

UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

AN EXAMINATION OF THE RELATIONSHIP BETWEEN DIGITAL LITERACY
AND STUDENT ACHIEVEMENT IN TEXAS ELEMENTARY SCHOOLS

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

Degree of

DOCTOR OF PHILOSOPHY

By

BRIAN C. BROWN
Norman, Oklahoma
2009

AN EXAMINATION OF THE RELATIONSHIP BETWEEN DIGITAL LITERACY
AND STUDENT ACHIEVEMENT IN TEXAS ELEMENTARY SCHOOLS

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF EDUCATIONAL LEADERSHIP AND POLICY STUDIES

BY

Dr. Jeffrey Maiden, Chair

Dr. Frank McQuarrie

Dr. Courtney Vaughn

Dr. Gregg Garn

Dr. Linda Atkinson

© Copyright by BRIAN C. BROWN 2009
All Rights Reserved.

ACKNOWLEDGEMENTS

I want to begin by thanking my committee for giving me advice and encouragement as I endeavored to pursue this degree. My chair, Dr. Jeffrey Maiden, provided me with guidance and assurance as he spent hours reading, editing, and commenting on my drafts. Thank you Dr. Maiden for the time you spent with my materials throughout the Skype calls, independent studies, and dissertation hours. Thank you to Dr. Gregg Garn and Dr. Linda Atkinson for providing insight into the research process. My thanks to Dr. Frank McQuarrie for his exceptional attention to detail that strengthened my writings and thank you to Dr. Courtney Vaughn for helping me find the “so what?” I could not have had a more supportive committee. Thank you all.

My love and gratitude go out to my strength and inspiration, my wife Casey. Without her many hours of investment in reading and editing my writings I would not ever have finished. I deeply appreciate everything she has done for me and allowed me to do these past few years. To our children, Caroline and Camilla, thank you for giving up time that could have been spent together so that I could finish my degree. There is no worth in this achievement without all three of you.

Thank you to my family for understanding when I stayed home to write instead of attending family events. Thank you to my mother, Linda, who instilled in me the value of an education. To my dad, Wally, I appreciate the encouragement you provided at the most crucial moments. Thank you to mother-in-law Sherry, Aunt Linda, and Pop for making me a part of the family.

Most of all, I want to thank God for the strength, wisdom, and love He has shown me through all of the people He has placed in my life.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION	1
Theoretical Framework	8
Statement of the Problem	11
Purpose of the Study	12
Research Questions	12
Significance of the Study	13
Overview of the Method	14
Limitations of the Study	15
Basic Assumptions	15
Definitions of Terms	15
Summary	16
 CHAPTER 2: REVIEW OF THE LITERATURE	 17
Administrative Technology	19
Infrastructure	19
Communication and Security	21
Assistive Technologies	24
Assessment Technology	25
Instructional Technology	26
Delineation of Instructional Technology	26
Differentiated Instruction	29
Constructivism and Games	29
Student Motivation	30
At-Risk Populations	32
Student Achievement	32
Barriers to Implementation of Instructional Technology	34
Accessibility	34
Inoperable Equipment	36
Loss of Authority	37
Teacher Beliefs	38
Technical and Instructional Support	38
Internet Content	40
Professional Development	40
Historical Review of Instructional Technology	46
Conclusion	48
 CHAPTER 3: DESIGN	 51
Purpose of the Study	51
Research Questions	52

Description of Data	53
Instrumentation	53
Participants	56
Methodology	57
Procedures for Data Analysis	61
Summary	62
CHAPTER 4: PRESENTATION OF DATA	63
Description of Data	64
Level of Digital Literacy by State Accountability Rating	68
Differences in Digital Literacy Levels	82
Changes in the Levels of Digital Literacy	95
Summary	98
CHAPTER 5: CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS FOR FURTHER RESEARCH	100
Summary of the Study	100
Discussion of Results	103
Level of Digital Literacy by State Accountability Rating	103
Differences in Digital Literacy Levels	108
Changes in the Levels of Digital Literacy	109
Recommendations for Practice	110
Recommendations for Further Research	112
Summary	113
References	114
Appendices	125
A. Institutional Review Board Approval	126
B. Permission to Reprint the Texas Campus School Technology and Readiness (STaR) Chart	128
C. Texas Campus School Technology and Readiness (STaR) Chart	131

LIST OF TABLES

Number

1. Descriptive Statistics for the 2004-2005 Academic Year	69
2. Descriptive Statistics for the 2005-2006 Academic Year	70
3. Descriptive Statistics for the 2006-2007 Academic Year	72
4. Descriptive Statistics for the 2007-2008 Academic Year	73
5. Percentages of Patterns of Classroom Use (TL1) by Accountability Rating	76
6. Percentages of Frequency/Design of Instructional Setting Using Digital Content (TL2) by Accountability Rating	77
7. Percentages of Content Area Connections (TL3) by Accountability Rating	79
8. Percentages of Online Learning (TL6) by Accountability Rating	81
9. Chi-Square Analysis of STaR Chart Reporting: Patterns of Classroom Use (TL1), 2007	84
10. Chi-Square Analysis of STaR Chart Reporting: Frequency/Design of Instructional Setting Using Digital Content (TL2), 2007	85
11. Chi-Square Analysis of STaR Chart Reporting: Content Area Connections (TL3), 2007	87
12. Chi-Square Analysis of STaR Chart Reporting: Online Learning (TL6), 2007	88
13. Chi-Square Analysis of STaR Chart Reporting: Patterns of Classroom Use (TL1), 2008	90

14. Chi-Square Analysis of STaR Chart Reporting: Frequency/Design of Instructional Setting Using Digital Content (TL2), 2008.....	91
15. Chi-Square Analysis of STaR Chart Reporting: Content Area Connections (TL3), 2008.....	93
16. Chi-Square Analysis of STaR Chart Reporting: Online Learning (TL6), 2008	94
17. Changes in the Levels of Digital Literacy.....	97

LIST OF FIGURES

Number

1. 2007/2008 Texas Elementary School Accountability Rating..... 66

ABSTRACT

The proponents of digital literacy have been advocating its use in our schools and classrooms for a number of years. However, the empirical evidence on the impact of digital literacy on teaching and learning is nearly nonexistent. Therefore, this study was conducted to provide evidence of the effects of digital literacy skills instruction on student achievement.

There were three research questions that were used to guide the organization of this study. The first question sought to determine the level of digital literacy present in schools based upon their state accountability rating. Statistically significant differences between digital literacy levels of students according to their state accountability rating were investigated in the second question. The third question examined the statistically significant changes in elementary students' levels of digital literacy over a period of time.

The Texas Campus School Technology and Readiness Chart (STaR) was utilized, in part, as an indicator of the levels of digital literacy taught within schools. This was achieved by identifying and isolating several variables within the chart that contained levels that exemplified the theory of digital literacy. The key areas utilized from the Texas STaR Chart were patterns of classroom use, frequency/design of instructional setting using digital content, content area connections, and on-line learning.

The STaR Chart data were compared with data taken from the Accountability Rating System for Texas Public Schools and Districts for state elementary schools. The Texas Accountability Rating System is calculated, for elementary schools, entirely on student achievement on standardized tests. This study reviewed the STaR Chart and state accountability data for 3,518 elementary schools in Texas. By utilizing data obtained

from these data sources, a relationship between digital literacy and student achievement was suggested.

Chapter 1

INTRODUCTION

Public education has experienced a tremendous influx of technological tools into classrooms since the 1980s. This avalanche of technology has sparked a fierce debate among those who support the technology, its promoters, and those detractors who seek to slow its expansion. Throughout this often vehement argument between promoters and detractors, teachers and students have had to make drastic adjustments in classroom management, teaching styles, and assessment (Prensky, 2001a, 2005).

While technology's supporters have touted its ability to motivate students, encourage creativity, and increase test scores (Butzin, 2000; Mann, Shakeshaft, Becker, & Kottkamp, 1999; Matthewman & Triggs, 2004), critics have noted that the costs of technology have seemed to outweigh its benefits and that other instructional methods and tools have appeared to be more cost-effective (Cuban, 2001; Oppenheimer, 2003). Other researchers have found that gains in student achievement through the use of technology have been modest, if present at all (Paige, Hickok, & Patrick, 2004).

In 1997, Oppenheimer described five main arguments often made in disputes pertaining to the decision to incorporate technology into schools:

1. Computers improve both teaching practices and student achievement.
2. Computer literacy should be taught as early as possible; otherwise students will be left behind.
3. To make tomorrow's work force competitive in an increasingly high-tech world, learning computer skills must be a priority.

4. Technology programs leverage support from the business community badly needed today because schools are increasingly starved for funds.
5. Work with computers—particularly using the Internet—brings students valuable connections with teachers, other schools and students, and a wide network of professionals around the globe. These connections spice the school day with a sense of real-world relevance, and broaden the educational community. (p. 3)

Many of these same arguments for the inclusion of technology in education continue to be utilized (EdTech Action Network, 2008). Despite the arguments, educational institutions have continued to accrue increased amounts of technological hardware and software since the early 1980s in an effort to increase the quantity of technology available to students and teachers (Ringstaff, Sandholtz, & Dwyer, 1991). The quantity of technology accumulated is reported by using terms such as *students-per-computer*, *percentage of Internet connected classrooms*, and *amount of available network bandwidth* (Texas Education Agency [TEA], 2006a). These types of data collection measure the basic infrastructure of the technology in a school and comprise the majority of technology expenditures (Moss & Townsend, 2000; Stover, 1999). Some states, for example Texas, have begun to collect data in other areas of technology outside of infrastructure like instructional practices and technology leadership (TEA).

Many educators see the incorporation of increased technology as a paradigm shift in educational reform, but as of the late 1990s and early 2000s, researchers and educators have begun to doubt the once-promised power of technology to reshape teaching and learning (Latham, 1999; Schacter, 1999). Schlechty (2006) proposed that the United

States's educational system is still caught in the early 1900s when students often dropped out of school before graduation and few received a complete high school education. The educational system still lingers in the realm of the past; however, we now expect all students to graduate from high school and attend college (Schlechty). Educational reform is shaped more through governmental action than research-based methodologies due to national focus on problems such as dropout rates that face the youth of our country (November, 2006). Major, wide-sweeping improvements need to be made to education but how those changes should occur is often debated (November; Schlechty).

Despite the needed educational reform and the proposal by some technological promoters that technology can provide that change, others are still cautious of implementing too much technology too quickly. Schmoker (2006) wrote, "there may be great possibilities for improving instruction through the judicious, experimental use of technology" (p. 142), but added "I have yet to see a single technology objective linked tightly to assessment or based on achieved results, in language that requires leaders or practitioners to gauge the actual impact of specific lessons that incorporate technology" (p. 142). Schmoker contended that the infusion of technology into schools has led us into a trap where the training of its use is non-sustaining and money is ill-spent. In other words, the deluge of technology into our schools has created a system where teaching and learning are being stifled by technology-related problems instead of technology being utilized to increase learning.

Despite opinions from those who oppose the inclusion of technology in schools, researchers have found that technology can impact student learning. It has been indicated that students with access to a variety of technologies show positive gains in achievement

on researcher-constructed tests, standardized tests, and national tests (Schacter, 1999). Students in technology-rich environments have also been shown to experience achievement gains in all major content areas (Sivin-Kachala, 1998).

Schmoker and others are supported in their discussion of some of the negative aspects of technology. Kulik and Kulik (1994) found that computers did not have positive effects in every area in which students were tested. Other researchers have evidenced that educational technology is less effective or even ineffective when the learning objectives are unclear (Schacter, 1999). The value of educational technology is directly influenced by students, software, educators, and level of student access (Dynarski et al., 2007; Sivin-Kachala, 1998). Research has also suggested that students learn more information in less time when they receive computer-based instruction (Kulik & Kulik).

Schmoker (2006) cited the cost of technology and posited that many schools have invested in technology merely for the presence of the equipment. In 1984, the student-to-computer ratio was 125:1 (Becker, 1994). Since that time, the Texas Education Agency, through the School Readiness and Technology (STaR) Chart, has made a one-to-one student to computer ratio the goal for every school district in Texas, despite the fact that significant changes are not being found among one-to-one initiatives (Garthwait & Weller, 2005; TEA, 2006a). Further compounding this issue is the lack of knowledge on how best to apply technology. When whiteboards were introduced into classrooms, teachers knew exactly how to employ them—as substitutes for chalkboards. However, the computer has so many possibilities that in-the-field educators cannot be expected to immediately understand how to best apply it to increase student achievement or supplement student learning (Williams & Kingham, 2003).

According to Schmoker (2006), some schools have made “misguided purchases of technology” (p. 142). Individual state legislatures and agencies have placed too much emphasis on lowering student-to-computer ratios without regard for proper utilization and upkeep of the equipment. More emphasis should be placed on the responsible application of technology and how to seamlessly integrate it into relevant assignments (Baylor & Ritchie, 2003). Educators should spend more time on learning how teachers and students can effectively incorporate technology into teaching and learning and less time worrying about how much equipment is currently present in individual schools.

Despite this concern, it is equally important to consider that too little technology within a school may have the same end result as the lack of training. Without sufficient access to technology, schools potentially hinder the ability of teachers and students to explore the possibilities made available through technology (Rogers, 2000). Placing a single desktop computer in every classroom might make less of an educational impact than utilizing the same money to create a more flexible computer arrangement, made available to all teachers and students. However, Mergendoller (1996) stated that “computer availability...is not the same as computer functionality” (p. 43). Some school districts have committed to heavy loads of technological equipment only to find that the technology fails within an unspecified amount of time, forcing unscheduled replacement. These schools are unprepared for the unforeseen costs of the technology and are often unable to afford the replacement. By providing less, but more accessible technology, schools reduce the potential impact on their operating budgets.

Educational technology can generally be divided into three areas: technology integration, instructional strategies, and technology tools (Driscoll, 2001). Technology

integration includes how and when technology is used in the educational setting while instructional strategies describe the methods for implementation and classroom use. Technology tools include the types of hardware and software available in the classroom (Driscoll). As inseparable as curriculum and instruction are, technology integration and instructional strategies are likewise nearly impossible to discuss independently from each other. Unfortunately, often the differences between technology integration and instructional strategies are lost in the application of administrative or instructional technology.

Classroom technology can be implemented with a focus on administrative functions or an emphasis on instructional purposes. Administrative tasks that might be completed by a teacher include taking attendance and utilizing grade book software and electronic mail (Hodas, 1993; Snoeyink & Ertmer, 2002). On the other hand, instructional technology was defined by Seels and Richey (1994) as “the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning with technology” (p. 1).

Even as instructional technology differs from administrative technology, instructional technology also contains segments of implementation styles that are rooted in pedagogy. Instructional technology can be applied in authentic or didactic learning styles (Dynarski et al., 2007). The authentic use of technology is essential for high-achieving schools (Newmann, Bryk, & Nagaoka, 2001). Proponents of didactic teaching methods, or instruction that occurs when the learning is often teacher-centered, have stated that students must first understand the basic concepts before moving on to a higher level of thought. In contrast, those who support interactive, or authentic, teaching have

asserted that these basic concepts can be learned, honed, and applied to new concepts in a high thinking level, student-centered learning environment (Newmann et al.).

Authentic learning contains three distinctive characteristics: construction of knowledge, disciplined inquiry, and value beyond school (Newmann et al., 2001). Construction of knowledge occurs when students use prior experiences and disciplined inquiry to analyze information or to investigate a possible solution to a problem or situation. The application of the learned knowledge provides relevance to the students' lives and the world outside of school thus contributing to the value beyond school (Newmann et al.). Authentic teaching and learning allows students to develop their knowledge and skills by motivating them to perform in the classroom (Newmann et al.).

Educators must commit to properly incorporating technology in education. School leaders must balance the accessibility of classroom technology with proper training in order to promote authentic teaching and learning. Additionally, careful consideration must be made when planning to implement new technologies to ensure that schools do not focus entirely on administrative types of technology, but instead strike a careful balance of providing assistive administrative tools that enable teachers to maximize instructional time while continuing to engage and intrinsically motivate students to strive to learn (Becker, 2007; Cohen, 1988; Ertmer & Snoeyink, 2002; Means et al., 1993; Mergendoller, 1996; Rogers, 2000).

Technology has not been the only force to impact schools during the late 1990s and early 2000s. The No Child Left Behind (NCLB) Act of 2001 was passed into federal law and created a system in which schools must be held accountable for the performance of students on standardized assessments. Additionally, the state of Texas has utilized a

state accountability system in some form since 1994 (TEA, 2008a). The Accountability Rating System for Texas Public Schools and Districts requires that schools meet a similar, yet separate, accountability system as set apart from the federal NCLB requirements (TEA). The state accountability rating system requires that students pass criterion-referenced tests in order for the school to receive a high rating. Similarly, lower numbers of students passing results in a lower rating for the school.

Theoretical Framework

Prensky coined the term *digital natives* to describe the students attending our schools (2001a, p. 1). He claimed that students readily adopt and master new technologies intuitively (Prensky, 2005). Specifically, Prensky (2001a) stated students “think and process information fundamentally differently from their predecessors” (p. 1). Because young people in the United States are surrounded by an environment that is saturated with media, changes must occur within the classroom to address students’ social, emotional, and mental differences (Prensky, 2001a; Roberts, Feohr, & Rideout, 2005). Teachers are being encouraged to *plug-in*, that is, to adopt new technologies, and begin utilizing technology within their classrooms to captivate and motivate their student audiences. These teachers are digital immigrants who are urged to embrace technology, learn it, and use it to address methods of instruction and the content being taught (Prensky, 2005).

While students may understand how to operate many of the technologies available today, they are often led astray by incorrect, inaccurate, or misleading information transmitted across the Internet (Armstrong & Warlick, 2006). This has resulted in the need to address students’ literacy of the technological tools available to them. Teachers

must assist students to not only becoming digitally literate, but also “use that literacy within their personal information environment in order to succeed now and in the future” (Armstrong & Warlick, p. 1). Warlick (2007) explained,

The containers that we once guarded —the libraries, book shelves, reference books, and file drawers—can no longer hold the information that most of us actually use. We can no longer be the gatekeepers. We must, instead, teach children how to be their own gatekeepers, and this is an ethical imperative. (p. 21)

In an effort for our teachers and students to obtain digital literacy, it is necessary to think beyond the ideas of technology integration and focus more on how to find and evaluate content and less on the content itself. Mann (2001) stated that, “instructional technology only works for some kids, with some topics, and under some conditions—but that is true of all pedagogy. There is nothing that works for every purpose, for every learner...all the time” (p. 241). If this statement implied that instructional technology should be integrated into the existing curriculum, it appears that these researchers did not capture the essence of true digital literacy. Digital literacy requires an upheaval within the thought processes of educators. The concentration moves away from teaching the same content with new instructional strategies; instead, the content focuses on the skills associated with finding, decoding, evaluating, and organizing information into personal learning networks (Armstrong & Warlick, 2006).

Digital literacy can be divided into network, Internet, hyper-, and multimedia literacy (Bawden, 2001). It can be described as the knowledge and skills needed for understanding meaning and context in an information age. Overall, digital literacy can be interpreted as sets of particular skills to be learned and competencies to be demonstrated

(Bawden). Unfortunately, these skills and competencies are not being used by many students nor are they being taught by many teachers (Armstrong & Warlick, 2006).

A presentation by Karl Fisch (2006) and subsequently released via numerous Internet media outlets including SlideShare (www.slideshare.com) and YouTube (www.youtube.com), indicated that educators are preparing students for jobs that do not yet exist. This statement provides support for the idea that we should be preparing students for a future that we cannot predict. Digital literacy seeks to provide students with the skills they need to operate in an information-rich society and allows them to evolve as technology continues to make drastic changes in the world (Armstrong & Warlick, 2006; Friedman, 2005).

Digital literacy provides students with opportunities to connect with other people through shared interests and goals. In an interview, Michael Wesch, a leader in the digital literacy discussion, stated,

For me, the ultimate promise of digital technology is that it might enable us to truly see one another once again and all the ways we are interconnected. It might help us create a truly global view that can spark the kind of empathy we need to create a better world for all of humankind. I'm not being overly utopian and naively saying that the Web will make this happen. In fact, if we don't understand our digital technology and its effects, it can actually make humans and human needs even more invisible than ever before. But the technology also creates a remarkable opportunity for us to make a profound difference in the world.

(Battelle, 2007, ¶ 7)

Wesch's statement seemed to infer that without understanding the power of digital technology, we may become less connected with other people and, in the most drastic cases, lose our humanity altogether. Instead, Wesch expressed a wish to focus understanding of digital technology, or digital literacy, into utilizing the power provided by technology to increase connections between people and cultures.

Fisch (2006) and Warlick (2007) stated that students will be increasingly overcome by the quantities of available information. Furthermore, Warlick suggested that "information must now compete for our attention in much the same way that products on a store shelf competed for attention during the industrial age" (p. 21). Proponents of digital literacy have contended that students must not only be able to collect, decode, and analyze information, but also be able to communicate with text, video, images, and sound (Warlick).

In light of this information, there are educational technology theorists who believe that students should be taught not just how to use technology, but how to use technology to find, collect, compile, and utilize information in a context that facilitates learning (Armstrong & Warlick, 2004; Prensky, 2001a, 2001b). Theorists have stated that students must understand the power of technology in order to be prepared for the problems of the future (Armstrong & Warlick; Battelle, 2007; Prensky 2001a, 2001b, 2005).

Statement of the Problem

Public education in the United States is intended to provide productive citizens for our democratic society (Apple & Beane, 1995). Fisch (2006) added the idea that "we are currently preparing students for jobs that don't yet exist using technologies that haven't yet been invented in order to solve problems we don't even know are problems yet" (p.

31). When these thoughts are intertwined, the resulting conclusion is that schools should develop students who can succeed in an innovative democratic society that leads along the edge of technological advancement.

Proponents of digital literacy claim that it can provide students with the skills necessary to succeed in a technologically advanced innovative democratic society (Armstrong & Warlick, 2004; Warlick, 2007). Additionally, the theory of digital literacy is being thrust forward as a method for ensuring that technology increases social interconnections instead of reducing them (Battelle, 2007). With the pressure placed on schools by the federal and state accountability systems to ensure that students succeed on criterion-referenced tests, are schools preparing students for a life beyond the educational setting? More specifically, do the ideals of digital literacy, which claim to provide the skills students will need to succeed in the future, also provide the skills needed for students to succeed on state and federally-mandated assessments?

Purpose of the Study

Proponents of digital literacy have suggested that the skills needed to succeed in the future are contained within their educational philosophy of using technology as a learning tool; however, the subject's scholarly knowledge base remains in a state of infancy. Therefore, this quantitative study sought to investigate the relationship between student achievement as measured by the state accountability system and the theory of digital literacy.

Research Questions

Historical data, drawn from multiple sources, were utilized to determine whether focused classroom attention on skills associated with the theory of digital literacy, as

measured by the Texas STAAR Chart, exhibits a relationship with the state accountability system. The following research questions were examined in an attempt to determine this relationship:

1. What is the administrator perceived level of digital literacy that is present in schools based upon their state accountability rating (e.g., exemplary, recognized, academically acceptable, and academically unacceptable)?
2. Are there statistically significant differences between the digital literacy levels of students according to their state accountability rating (e.g., exemplary, recognized, academically acceptable, or academically unacceptable)?
3. Is there a statistically significant change in elementary students' levels of digital literacy over the period studied?

Significance of the Study

This study was conducted to determine if a relationship exists between student achievement and digital literacy to provide research-based support for school leaders, community members, and law makers to utilize as proponents of digital literacy increasingly call for changes in curriculum and instruction. While the study focused on the state of Texas, it is reasonable to assume that the results of the study could be extrapolated to a larger population, therefore the study possesses significance for both proponents of digital literacy and technology detractors as the argument of technology's effectiveness continues.

The process of globalization, as presented in *The World is Flat*, has been driven by businesses utilizing technological tools to improve efficiency and increase profits (Friedman, 2005). Throughout the process, it would seem that people from around the

world become more interconnected because the power of the technology allows them to achieve things never before possible. However, there are some theorists who have proposed that despite the additional connections between people made possible by technology, we are in danger of losing our humanity (Battelle, 2007). If the process of globalization continues and expands as predicted, it becomes more important that the society of the future understands the limitations of technology and is able to responsibly apply it, in order to be prepared for the problems of tomorrow (Fisch, 2006; Friedman). Therefore, it was significant to study the impact of digital literacy on student achievement.

Overview of the Method

The study utilized quantitative methods to examine the relationship between the Texas STaR Chart and the state school accountability system. The STaR chart is an instrument that collects data on technology in schools measuring four areas: teaching and learning; educator preparation and development; leadership, administration and instructional support; and infrastructure for technology (TEA, 2006a). STaR Chart data were collected from the online data repository of Region 12 of the Texas Education Agency. The STaR chart was analyzed and categorized in terms of digital literacy for the purpose of isolating the relationship between digital literacy and student achievement. The state school accountability system data, being used as a tool of measuring student achievement, were collected from the Texas Education Agency's website and correlated with the data obtained from the STaR Chart. Data were aligned by school district over a four year period of time. Any data found to be missing from the four year time were

excluded from the study. The study included elementary schools from all 1031 Texas school districts.

Limitations of the Study

The research was limited to public school districts in a single southwestern state, therefore information produced by this study may not be applicable to other U.S. geographical regions or private schools regardless of location. Due to instances of natural disaster, data were not available for all public school districts in Texas. Several hurricanes (Katrina and Rita) produced an unusual strain on some eastern and coastal Texas school districts that resulted in the unavailability of data for those districts during those time periods. This study is limited to administrators' perceptions of the levels of digital literacy within their respective schools.

Basic Assumptions

The following were considered to be assumptions of the study:

1. The individual campuses selected for study were truthful in the completion of the Texas STaR Chart and were not influenced by outside entities.
2. The state of Texas accurately reported the Texas STaR Chart and state accountability rating data.

Definitions of Terms

The following terminology are used in this study.

Digital literacy has been defined as the ability to find, decode, evaluate, and organize information into personal learning networks (Armstrong & Warlick, 2006). This theoretical framework is being presented as a paradigm shift in classroom teaching and learning by several educational technology pundits.

Technology, for the purposes of this study, is defined as a personal computer. This includes hardware, local software, and software, text content, and audio-visual media on the Internet.

Summary

The youth of the early 21st century need to learn about the theory of globalization and work to understand the processes that drive it. The understanding of globalization and its potential impact on the United States in the future should be of great importance to educators so that they can help students develop skills that will allow them to be successful in a global marketplace (Friedman, 2005). As proposed by its proponents, digital literacy helps fill these skill gaps by providing students with the knowledge they will need to harness new technologies and apply them to solve problems (Armstrong & Warlick, 2004; Batelle, 2007; Prensky 2001a, 2001b, 2005). Globalization and the promises of digital literacy justified the need for a study to examine the relationship between digital literacy and academic achievement.

Chapter 2 focuses upon an exhaustive review of the research on the impact of technology in education. The third chapter details the methods of data collection, description of collection instruments, and statistical analyses that apply to the data.

Chapter 2

REVIEW OF THE LITERATURE

Technology in education has been applauded and attacked by promoters and detractors alike. Those who promote technology in education often cite gains in student achievement as the primary reason for implementation (Butzin, 2000; Chandra & Lloyd, 2008; Hsieh, Cho, Liu, & Schallert, 2008; Mann, Shakeshaft, Becker, & Kottkamp, 1999), while detractors point toward research that has suggested that the money spent on technology is wasted (Cuban, 2001; Cuban, Kirkpatrick, & Peck, 2001; Oppenheimer, 1997, 2003). A theme has become apparent in the literature surrounding the topic *technology in education*: technology can make positive increases in student achievement, but it must be applied in an appropriate manner (Hartnell-Young, 2006; Latham, 1999).

Detractors have argued that the cost of technology has not provided ample gains in student achievement and that other methods are more effective for increasing student learning (Cuban, 2001). According to No Child Left Behind of 2001, schools that utilize federal funds for instructional technology must use them for scholarly, research-based applications. Oppenheimer (2007) adds that many software companies use faulty research reports in order to sell software to schools, software that has no hope of increasing student achievement. A report produced by the National Center for Education Evaluation and Regional Assistance stated that many of the major direct-instruction software programs available were ineffective in increasing teaching and learning (Dynarski et al., 2007).

The arguments against educational technology tend to center on the cost effectiveness of its implementation, such as *bang for your buck*, while those that promote

technology use focus on the results of its use. Some promoters even go so far as to incite a moral panic that educational technology is an immediate need due to globalization or knowledge expansion (Bennet, Maton, & Kervin, 2008; Fisch, 2006; Friedman, 2005). The resulting discussion becomes a hazy cloud of overused terminology and misunderstanding, fueled by the passions of eager technophiles and technology defamers.

Ultimately, if student achievement can be affected by properly applied technology-utilizing instructional methods, then the cost effectiveness of the technology could increase. Instead, many studies that sought to inform this missing link in the knowledge base have focused on the digital divide (Hohlfeld, Ritzhaupt, Barron, & Kemker, 2008; Swain & Pearson, 2003), teacher concerns about technology (Atkins & Vasu, 2000; Donovan, Hartley, & Strudler, 2007; Fairman, 2004), or the quality of technology (Lei & Zhao, 2007). In order to address the concerns of the detractors, it is necessary to examine the school acquisition of technology during the 1980s, 1990s, and early 2000s, as well as the implementation of the technology obtained.

In light of the discrepancy within the discourse among technology promoters and detractors, it is necessary to review the complexities of the technologies that are infused into schools. Moreover, the argument needs be viewed within the ideals of the theoretical framework of digital literacy. In order to fully understand the intricacies of the argument between technology promoters and detractors, we must review what is deemed technology. Furthermore, the expansion of technology within schools along with associated processes, like professional development, must be reviewed in order to fully encompass the magnitude of what is being presented by digital literacy theorists.

As schools acquired technology, it became apparent that not all technology was being utilized within the classroom. Some technology purchased was strictly administrative in nature, intended to streamline bureaucratic processes or centralize data (Hodas, 1993). While these types of technology do not directly influence teaching and learning, they can perhaps explain some of the loss of cost efficiency as proclaimed by educational technology detractors.

Administrative Technology

Administrative technologies range from computer applications intended to maximize instructional time to hardware that enable faster communication or increased student safety. Many administrative technologies do not have a direct relationship to teaching and learning, but can affect it by providing teachers with avenues for parent contact or reduce time spent on administrative tasks such as averaging grades. Ideally, the time saved by these technologies translates into increased interaction between teachers, administrators, parents, and students (Hodas, 1993).

Infrastructure

In addition to wasting money on instructional programs and applications that may never work, schools have invested large amounts of money in information technology (IT) infrastructure. These investments in infrastructure may indirectly influence teaching and learning, but in terms of technology expenditures, the investments do not translate into money spent on technology-utilizing instructional practices (Dai, Kauffman, & March, 2007). Business literature has indicated that a well-constructed infrastructure is flexible, thus making it “feasible for a firm to create IT-based business innovations at a lower cost than its competition because the firm can adapt its systems and business

processes to accommodate changing conditions cost-effectively” (Dai et al., p. 2).

Because technology changes greatly with each passing year, a strong and flexible infrastructure provides a steady base for technological innovations in teaching and learning.

It is possible that early claims of the inefficiencies of technology in schools (Cuban, 2001; Oppenheimer, 1997) were skewed by the investment in technologies that do not have a direct impact on teaching and learning, for example, IT infrastructure. Schools had to secure an appropriate infrastructure before classroom technological innovations could be utilized to their full potential. However, there is not always enough money in a school district to install both a flexible IT infrastructure and provide other resources (Dai et al., 2007).

The relationship between IT infrastructure and instructional technology creates a problem to other entities besides schools. According to Alper (2003), the healthcare industry also needs to invest in appropriate IT infrastructure. The infrastructure provides the base for a flexible, organic computer network that will allow an organization to be ready for implementation of administrative technology that will ultimately result in financial savings on rising labor costs (Alper, 2003; Dai et al., 2007). Like the healthcare industry, schools must invest in IT infrastructure in order to be flexible enough to support current and future technology use within classrooms. However, unlike the healthcare industry, public schools are not-for-profit organizations and the overall costs of extensive infrastructure may outweigh potential benefits (Moss & Townsend, 2000; Stover, 1999).

Many schools have begun to balance this relationship by utilizing Total Cost of Ownership (TCO) calculations to determine when an investment is the most financially

profitable (Hurst, 2005; Willis, 2003). TCO data allow technology decision makers to squeeze every last ounce of effectiveness out of each technology dollar by weighing administrative and infrastructural needs against instructional benefits (Hurst). An example of using TCO in decision making is when an organization's officials decide to purchase more expensive laser printers because they cost less to operate than ink jet printers with a lower upfront cost, but more costly upkeep. Utilizing TCO to make decisions ultimately saves the school district money, allowing for more funds to be put into other areas. For schools, however, financial concerns are not always the driving factor in decision making, but instead often yield to the potential impact on teaching and learning. TCO calculations have drawn criticism from some because they do not include either real or perceived instructional benefits (Hurst).

Communication and Security

Technologies such as electronic attendance programs were intended to provide teachers with more time to devote to administrative tasks such as classroom management and student supervision (Hodas, 1993). Additionally, administrative functions of technology have allowed teachers to become more accessible to parents by providing electronic mail as an asynchronous layer of communication that is often more dependable than notes sent to and from school via a student. Electronic grade books are intended to improve academic recordkeeping and, in some more advanced systems, provide another layer of communication with parents since they can be used to facilitate an online avenue for parents to check their children's grades and assignments. The underlying benefits of administrative technologies include increased, reliable communication and a reduction of

the amount of time teachers must spend on administrative tasks which result in increased instructional time (Hodas).

In addition to electronic mail, technologies such as Voice-over-Internet Protocol (VoIP) have saved schools thousands of dollars in phone charges and improved communication across districts (Milner, 2005). VoIP allows districts to utilize the computer networks to place phone calls across the district (Milner), translating into fewer needed outside telephone lines because the outside lines are reserved for telephone traffic traveling to destinations beyond the school district. Fewer telephone lines lead to increased monetary savings for school districts (Milner).

VoIP technology also allows for increased safety and security for school districts. Educators at schools incorporating VoIP technology in classrooms can alert administrators, school resource officers, or other emergency response personnel of situations that might arise in and around schools. Some VoIP systems can be programmed to send text messages or electronic mail to specified personnel whenever 911 is called on a VoIP telephone. The message sent to the recipient displays the date, time, extension number, and physical location of the 911 call (Cisco Systems, 2008).

Another security-based technology that has an administrative benefit for education is Internet-Protocol (IP) surveillance cameras. IP cameras allow administrators and security personnel to monitor the activities within and around school buildings (Warnick, 2007). This is particularly useful when unknown adults attempt to enter a school or altercations erupt between students. Ethical issues sometimes arise when utilizing surveillance cameras. Student privacy is one such issue, but the idea of a safe school environment tends to prevail in the end (Warnick).

Other administrative technologies such as access control systems and visitor tracking applications provide schools with additional security. Access control systems restrict the movements of visitors in and out of a building (Taylor, 2008). There are many different types of access control systems, but the most common are Radio-Frequency-Identification (RFID) badges that use radio waves to signal a badge reader at the door, which then communicates with a computer server to determine whether the user has clearance to open the door. Some schools are also investing in systems that conduct on-the-spot background checks against a sex offender database across the Internet for each and every visitor who enters the school (Raptor Technologies, 2008).

The additions of access control systems, criminal background checks, and video surveillance often make school campuses begin to resemble strongholds like Fort Knox or even prisons. However, the technologies are being incorporated in ways that maximize safety without becoming overly inconvenient. In light of school violence events throughout the 1990s and early 2000s, the community sees a need for these types of technologies and is often willing to fund them with school bond issue dollars (Brooks, Schiraldi, & Zeidenberg, 2000; Wright, 2008).

When security and safety technologies are combined with electronic attendance and grade books, email, and VoIP phones, it becomes apparent how much schools rely on administrative technology. With justifications ranging from student safety to increased communication between staff and the community, the quantities of these technologies in our schools is only going to increase.

Alternately, these same administrative uses may negatively impact teaching and learning. Email, for example, is intended to increase communication, but some argue that

it actually hinders social relationships because of the loss of face-to-face interactions (Esperon, 2008). However, there are some educational technology theorists who believe that the use of technology will lead to the creation of digitally literate individuals who foster more inter-relational connections (Battelle, 2007).

Assistive Technologies

Disabled students often benefit from assistance provided through the use of technology. From software programs that convert text-to-speech to robotic legs for a paraplegic person, assistive technologies' benefits appear almost limitless. Unfortunately, these technologies are not as widespread as many other types of technologies in schools (Carlson, Ehrlich, Berland, & Bailey, 2001; Lahm, 2003). While some assistive technologies give the appearance of performing instructional tasks, they are actually augmentations that allow disabled individuals to perform daily responsibilities and activities (Carlson et al.; Lahm).

The exact benefits of assistive technologies are difficult to pinpoint (Derer, Polsgrove, & Rieth, 1996). There were six major themes that emerged from a study of the benefits of assistive technologies. The themes included instructional refinement, communication, independence, self-concept, skill improvement, and visionary (Derer et al.). Some of the items included as instructional refinement were assistive technologies' abilities to individualize instruction and provide immediate feedback. The visionary theme included responses related to the increased potential of students due to the presence of assistive technologies (Derer et al.).

Some schools implement assistive programs such as Kurzweil 3000 (Kurzweil Educational Systems, 2008). This computer program allows teachers to scan assessments

and other assignments into computers using an ordinary flatbed scanner. Once an assignment has been scanned, a student can sit down at a computer and have the computer read the assignment to him or her (Kurzweil Educational Systems, 2008). This type of assistive technology allows students to receive individualized instruction based upon their physical, mental, or emotional needs (Lahm, 2003).

Assistive technology has the potential to produce the greatest benefits for students and schools (Carlson et al., 2001). Unfortunately, it is expensive and the individuals who tend to need it most often cannot afford to purchase it (Carlson et al.). Additionally, schools' already cash-strapped budgets can hardly take on an additional burden, especially one as costly as the most high-tech assistive technologies. Due to these constraints, assistive technologies are assuredly going to remain the most elusive technological benefits afforded public education (Derer et al., 1996).

Assessment Technology

Assessment technology is a growing area in education. The state of Texas is currently in the midst of an ever-advancing pilot program involving online assessment (Texas Education Agency [TEA], 2008a). In 2006, the state entered into a long-term contract with Pearson Educational Measurement to create online versions of the Texas Assessment of Knowledge and Skills (TAKS), a test once administered only in paper format (TEA). Online assessment is a benefit for schools in a society intent on monitoring the accountability of education because the results of the online assessment are returned at a much faster rate than the paper format (TEA), allowing schools to adjust the curriculum to make up for areas in which students may be lacking certain skills.

Administrative technologies perform important tasks for teachers, administrators, students, and community members, but the overall impact on teaching and learning is minimal, at best (Hodas, 1993). These technologies are often based upon the demands and expectations of the community, especially in terms of school safety. However, the expense of the technology continues to be an obstacle for schools, with every dollar spent on administrative technology becoming one less dollar available for teaching and learning.

Instructional Technology

The implementation of instructional technology in the classroom has been shown to help increase student knowledge attainment, create unique constructivist events, and provide students with opportunities to experience learning in an innovative manner (Becker, 2007; Collins, 1991; Driscoll, 2001; Means & Olson, 1997; Snoeyink & Ertmer, 2002). Students in technology-rich environments have also been shown to experience achievement gains in all major content areas (Sivin-Kachala, 1998). Mann et al. (1999) observed increases in student achievement after implementing a technology integration program. Just as the previous studies confirmed the success of technology in education, there are many other studies that provide evidence of the opposite (Judson, 2006; Oppenheimer, 2007; Schmoker, 2006; Venezky, 2004).

Delineation of Instructional Technology

Instructional technology can be broken down into three distinct areas: hardware, synthesis software, and computer-assisted instruction software. Instructional technology hardware may include desktop, laptop or tablet computers, interactive whiteboards, wireless interactive pads, student response pads, and digital projectors. These

technologies are intended to provide teachers and students with methods for sharing information. Synthesis software is used by teachers and students to organize, evaluate, and create information. Examples include word processing, spreadsheets, organizational applications (for example, Inspiration, Time Liner), and online collaborative applications (for example, wikis, blogs, social bookmarking). Synthesis software facilitates the conscious sharing of teaching and learning roles by teachers and students (Hartnell-Young, 2006).

Computer-assisted instructional software packages are applications that are intended to provide direct instruction to students. Many software titles that are classified at this level of instructional technology have been criticized for not providing rich, meaningful learning experiences that produce results (Dynarski et al., 2007; Trotter, 2007). According to Oppenheimer (2007), software companies utilize faulty research to show that the software can establish incredible gains for students, especially in math and language. A district's failure to see beyond the software companies' skewed research has cost schools and students millions of dollars that could have been used for equipment and staff development (Oppenheimer).

Some research has suggested that not only does the computer-aided instructional software not affect learning, it might even harm students in the long term by resulting in decreased student achievement (Biggers, 2001; Dynarski et al., 2007; Krashen, 2003). According to a recent report from the U.S. Department of Education, many types of computer-aided instructional software failed to provide students with increased learning (Dynarski et al.). With the relative failure of the software companies to create software

that can replace a teacher, it becomes more apparent that “technology support[s] the learning, rather than driv[es] it” (Hartnell-Young, 2006, p. 473).

Most schools are not implementing the best research-based uses of technology (Roschelle, Penuel, & Abrahamsom, 2004). A technologically advanced classroom should provide immediate feedback for the teacher so that learning can be instantaneously measured, and then reinforced or extended (Roschelle et al.). Many states are requiring schools to pursue one-to-one initiatives within the next five years, leaving schools to determine the best methods for reaching that goal (TEA, 2006a). Numerous schools have invested large quantities of money to purchase handheld computers, only to find that they are technologically lacking in just a few months. Other schools have issued student laptop computers, while some have explored more cutting-edge technologies like ultra-mobile personal computers. Regardless of the implementation of these initiatives, schools need to use technology to take advantage of research-inspired implementation methods (Roschelle et al.).

There are several research-based methods of technology implementation highlighted throughout the literature. Technology can be used to differentiate instruction, increase student motivation, provide additional assistance to at-risk populations, develop constructivist learning opportunities, and increase student achievement (Becker, 2007; Kendal & Stacey, 2001; Mann et al., 1999; Milone, 2000; Mistler-Jackson & Songer, 2000; Ravitz, Becker, & Wong, 2000). Each of these implementations has shown success but, aside from the student achievement discussion, is not addressed by the critics of educational technology (Cuban, 2001; Oppenheimer, 2007).

Differentiated Instruction

A benefit of technology is that it can be used to differentiate instruction (Kendal & Stacey, 2001). Differentiated instruction can be used to reach more students in new and meaningful ways (Kendal & Stacey). Snoeyink and Ertmer (2002) reported that “literature overwhelmingly supports the idea that teaching with technology is not the same as teaching in the traditional classroom” (p. 87). Therefore, by differentiating the methods by which students learn content objectives, teaching itself changes. Technology creates another instructional tool for classroom teachers, allowing them to differentiate instruction in order to increase student achievement (Kendal & Stacey). As the educational tools at our disposal evolve, it has been suggested that the instructional strategies used to implement the tools into the curriculum should also change (Driscoll 2001; Snoeyink & Ertmer).

Constructivism and Games

Another aspect of instructional technology is that it can create constructivist-based classrooms (Jonassen, 1990). Collins (1991) concluded that teachers’ use of computers would naturally entail active learning, which would “foster a shift in society's beliefs toward a more constructivist view of education” (p. 32). This belief is supported by additional research that has indicated that computer use is related to more constructivist practices (Driscoll, 2001; Ravitz et al., 2000).

While Collins (1991) predicted that technology would create a shift toward more constructivist classrooms, Judsen (2006) found no significant correlation between teachers’ instructional beliefs and the actual practice of integrating technology. Furthermore, Judsen stated that “technology is not a mechanism that enables

constructivism” (p. 592). In contrast, Gregiore, Bracewell, and Laferriere (1996) concluded that,

If the new technologies are used in such a way as to exploit their potential, the teacher interacts with students much more than in a traditional classroom, as a facilitator, a mentor, a guide to the discovery and gradual mastery of knowledge, skills and attitudes. (p. 22)

This statement is further supported by Becker (2007), who reported that games have the potential to offer an inquiry-based, constructivist approach that allows learners to engage with the material in an authentic, yet safe, environment. Research has often supported the idea that constructivist applications of technology within the classroom provide authentic learning experiences for learners (Becker; Collins; Gregiore et al.). Additionally, Prensky (2002) stated,

In playing these games—sometimes on their own, often mediated by instructors—students face real issues, do real research, have discussions (both real and simulated), collect real data, uncover and solve real problems, collaborate, compete, test hypotheses, generate reports and recommendations, and design, build and test solutions. (p. 3)

Electronic gaming can be an avenue for learning. Electronic gaming should be explored as new methods of teaching and learning in our schools and classrooms (Prensky).

Student Motivation

Authenticity and collaboration have seemed to foster technology as a student motivator (Mistler-Jackson & Songer, 2000). Students have become motivated through the utilization of technology because they have found “a learning environment in which

their voices, and those of their peers, were valued and respected, thereby allowing them to view themselves as capable participants in this new learning situation” (Mistler-Jackson & Songer, p. 475). When students were asked about technology in schools, they “expressed a clear interest in having more technology in their classrooms—especially laptops” (Spires, Lee, Turner, & Johnson, 2008, p. 510).

By working cooperatively, students help each other develop increased understanding the uses of technology. Students with more knowledge about a particular software or hardware issue can share information with others. Often the students take over some of the leadership of the class as they teach each other. Students begin to collaborate more and compete less (Slavin, 1980).

New technologies often motivate students by sparking their interests, leading them to “devote more time and attention to those activities than in regular classes” (Gregoire et al., 1996, p. 8). Students working with technology are often motivated to further investigate subjects. The ease of retrieving information encourages students to interact more often with data. Many times students become so captivated by technology that they forget they are learning.

In one teacher’s classroom, students used computers and other technological equipment to measure carbon dioxide levels. Students enjoyed the activity so much that they often asked the teacher if they would be working on an experiment on a particular day, or just doing science. Students did not realize that their technological and scientific experiments were applied science. The innovative activity provided students with new knowledge and led to the discovery of dangerously high carbon dioxide levels in the school (Shinohara, Wenn, & Sussman, 1996).

At-Risk Populations

Instructional technology has also had positive impacts in low-income and special needs populations. Milone and Salpeter (1998) reported that instructional technology can help improve education for low-income and at-risk populations. From implementation of take-home computer programs to schools with business models utilizing technology, the low-income and at-risk populations seem to benefit from access to technology. Special education teachers are also able to utilize instructional technology to assist special needs students (Milone, 2000). The utilization of text-to-speech software, literature books on compact discs, and the development of electronic journals have led to special needs students' improvement on standardized tests (Milone).

Student Achievement

Perhaps the most fervently contested discussion about educational technology centers on the ability of technology to produce increases in student achievement (Cuban, 2001; Dugger & Johnson, 1992; Harter & Harter, 2004; Mann et al., 1999; Middleton & Murray, 1999; Oppenheimer, 2003). Despite prolific amounts of research to the contrary, some studies have suggested that technology seems to positively effect student achievement. For example, Mann et al. reported an 11% improvement in standardized test scores after the implementation of an instructional technology program. According to Bloomfield (1999), the study by Mann et al. echoed another study of 55 school districts that used similar computer-enriched teaching strategies.

Middleton and Murray (1999) examined how instructional technology impacted students' reading and math achievement. They found that student achievement was affected by how much technology a teacher implemented in the classroom. Lei and Zhao

(2007) found that achievement was not impacted by the amount of technology utilized with students, but instead by the tasks assigned to them when using the technology. This concept is further supported by the work of Dugger and Johnson (1992) who examined technology utilized to teach basic physics concepts. They found that the students in the applied technology courses had increased gains in basic physics knowledge when compared to physics students in traditional classes.

Educational technology allows students to evaluate their own learning (Gregoire et al., 1996). Roth (1999) stated that computer technology allows students to reach their full potential and meet their academic goals. Computers allow students to work at their own pace, provide individual instruction, and make integrating subjects easier. In one elementary school, students who spoke languages other than English received individualized computer assistance. For 90 minutes each day, students used computers to facilitate the improvement of their English proficiency. The students were allowed to take the computers home and to their other classes. As a result, the students developed computer skills while learning English (Gardner, 1997).

For technology to improve learning, students must be provided with opportunities to communicate, make decisions, and solve problems while interacting with the equipment (Newman, 2000). Computers and other technologies provide an innovative way to introduce new materials, supply instruction, and furnish students with new experiences (Matthewman & Triggs, 2004; Newman). Computers are not a solution to all educational problems, but can be used as improvement tools to assist students in gathering information and learning new skills (Newman).

The discussion surrounding student achievement and instructional technology has provided evidence that technology can positively impact student achievement when used in authentic ways (Earle, 2002; Hartnell-Young, 2006; Latham, 1999; Ravitz et al., 2000). Additionally, technology has not proved to be the catalyst for change within our classrooms, as was previously predicted (Earle; Matzen & Edmunds, 2007; Venezky, 2004). Unfortunately, schools struggle with creating environments where teachers can utilize technology effectively as they continue to deal with barriers to instructional technology.

Barriers to Implementation of Instructional Technology

In order for instructional technology to affect student achievement, schools must remove the barriers blocking the path to implementation. Surprisingly, the barriers have not changed drastically since they were first identified. However, strides have been made in remedying these barriers.

Accessibility

It is important to determine the level of student and teacher access to technology. Placing a single desktop computer in every classroom might make less of an educational impact than utilizing the same money to purchase several mobile computer labs. By utilizing laptop labs, teachers can choose to place students into small or large group settings. Teachers might even place the computers in the hallways. Then, instead of each classroom having access to three computers, 10 classrooms share 30 computers. While this model raises some issues involving school security since students would be using the hallways more frequently, therefore increasing the chance of contact with an

unauthorized person inside the school, the flexibility of the number of computers readily accessible to teachers and their students would increase.

Garthwait and Weller (2005) found that the initiation of a one-to-one, student-to-computer ratio program did not automatically shift the instructional style to a student-centered format. The shift needed to move toward a student-centered learning program is only possible through the discovery and exploration of individuals who collaborate with one another to develop authentic learning activities. Many programs focus only on the purchase and maintenance of the equipment when the curricular avenues are actually of greater importance. Garthwait and Weller wrote that it is not sensible to rely on one-to-one initiatives “as Trojan Horses for educational change” (p. 375).

Teachers often report that technology is not sufficiently accessible (Rogers, 2000). The ratio of students to computers that are connected to the Internet dropped from 12.1 in 1994 to only 3.8 in 2005 (Wells, Lewis, & Greene, 2006). Additionally, nearly 100% of schools were connected to the Internet in 2005 (Wells et al.). Access issues may not be completely resolved, but great strides have occurred in the attempt to place an Internet-connected computer in every classroom.

As of 2004, 84% of students in the nation lived in a home with a computer and 74% had an Internet service provider at home (Roberts, Feohr, & Rideout, 2005), resulting in an unlevel educational playing field for children without home access. In order to address the issue of access, schools across the nation are beginning to initiate ubiquitous computing, or one-to-one computer-to-student programs (Dunleavy, Dextert, & Heinecke, 2007). This type of program places a computer in the hands of each student,

but not all programs allow the students to take the laptops home, nor do all homes have high-speed Internet access (Roberts et al.).

Students in some schools may borrow laptops from the school in order to work on assignments. According to Wells et al. (2006), approximately 10% of schools have a laptop check-out program for students. This allows schools to at least marginally address the socioeconomic gaps in computer access (Roberts et al., 2005). While a laptop availability program might address some access issues, a one-to-one initiative ensures that students have access to a computer every day.

While ubiquitous computing works to solve the problem of electronic inequity, it does create several additional problems (Donovon et al. 2007; Fairman, 2004). Educators who teach in a one-to-one environment are forced to adjust their teaching methods. Perhaps the foremost challenge is classroom management. Student attention is often focused away from the teacher, and instead dominated by information and resources found on the Internet, such as games, social networking, and instant messaging. Educators who use teacher-centered learning environments will not be productive in a one-to-one program. Students with laptops would be better managed using student-centered learning. In such an environment, the students would have authentic learning activities on which to focus their attention.

Inoperable Equipment

Mergendoller (1996) stated that “computer availability...is not the same as computer functionality” (p. 43). Some school districts have committed to heavy loads of technological equipment, only to find that it fails within an unspecified amount of time. The schools are then frequently unprepared for the replacement costs of the technology

and unable to budget for the necessary funds to facilitate equipment replacement (Mergendoller).

Additionally, the technology could break or be otherwise unusable, outdated, or incompatible with other technologies being used (Mergendollar, 1996). Outdated or broken equipment is very common in education because of the high initial purchase costs and the lack of technology support personnel (Atkins & Vasu, 2000). If schools do not create efficient professional development programs to synthesize technology-based learning environments and let the computers sit unused, the expenses incurred in purchasing the equipment are wasted (Brown & Warhauser, 2006). By providing less, but more accessible technology, schools reduce the potential impact on their operating budgets.

Loss of Authority

Another inhibitor of instructional technology may be a loss of authority, as students commonly know more about technology than their teachers. In this event, students exercise *expert power* over their teachers, and doing so may undermine the teachers' power (French & Raven, 1968; Hodas, 1993). According to Fairman (2004), the students in one-to-one computing programs are often placed into the role of teacher, while the teacher is moved into the position of learner. When teachers implement a threat-free learning environment, such as that found in constructivist classrooms, the loss of authority is no longer an issue. Teachers must be expected to model learning to their students, instead of always attempting to be the single source of information. Since information is so readily available on the Internet, teachers should focus more on locating and evaluating information, rather than on being the information disseminator (Hodas).

Teacher Beliefs

Teachers' own beliefs about technology can also be a barrier to proper technology implementation. When teachers retain beliefs such as "as long as they can do the quizzes and the tests, we're good," then pedagogical change is less likely to occur (Li, 2007, p. 390). This statement is the result of outcome-based education, where the knowledge and comprehension abilities of students are more important than application and synthesis abilities. Other teachers have indicated feeling that if good learning is not already taking place, technology would serve no good (Li).

For some teachers, technology produces anxiety and hostile feelings more than educational gain for the students (Bly, 1993). In a society in which students must be taught to be digitally literate, it is unacceptable for teachers to harbor fear or contempt for technology, or for teachers to lack the knowledge and skills needed to effectively utilize technology within the classroom. Atkins and Vasu (2000) suggested that as teachers become more knowledgeable about technology integration, their concerns tend to move from lower levels (contextual, informational, personal) to higher levels (consequences on self and others). Professional development, even in its seemingly perpetual failure to change teacher uses of technology, appears to be the only method available to construct teacher knowledge about the need for digital literacy.

Technical and Instructional Support

If the previous barriers are not enough, another potential area for disappointment is the lack of appropriate technical support (Atkins & Vasu, 2000). Research has suggested that schools with appropriate technical support, including support staff with curricular knowledge, have more successful levels of technology integration (Atkins &

Vasu; Healy, 1999). This means that teachers with locally-based technology integrators are more likely to successfully use technology in the classroom. Additionally, teachers with exemplary levels of technology use are more likely to be found in schools that have a locally-based technology integrator (Becker, 1994).

Teachers who integrate technology tend to need support from administrators (Baylor & Ritchie, 2002; Hartnell-Young, 2006). Administrators can greatly influence the levels of technology integration by modeling uses of technology to teachers and students, providing acknowledgments and incentives for technology use, and utilizing formative or summative technology evaluations (Baylor & Ritchie). Building level funds could also be used to increase accessibility or provide professional development. Since these monies are often administered by the building level administrator, the funds could be used to support technology.

Snoeyink and Ertmer (2001) found two levels of barriers to learning and/or using technology. The first level, *extrinsic*, includes lack of access to equipment or software, insufficient time for planning, or lack of technological support. Teacher beliefs about technology, organizational culture, instructional models, and openness to change are examples of the second barrier level, *intrinsic* barriers to technology (Snoeyink & Ertmer). These barriers are not insurmountable; the overall outcome of defeating them benefits teachers and students as they progress toward digital literacy. If a school's technology program is to succeed, it will need a clear vision of a technology-mediated education, a technology plan, strong administrative support, an adequate budget, clear and consistent expectations, and an evaluation system that personifies the program (Atkins & Vasu, 2000).

Internet Content

A final barrier to utilizing instructional technology is content found on the Internet (Healy, 1999). The content of the Internet is as varied and wide-ranging as that found throughout the entire world, except that content can be brought into the confines of a home or school with tremendous amounts of privacy. Students using the Internet to conduct student-centered projects may come into contact with content that is incompatible with their personal beliefs or the beliefs of their teachers, parents, administrators, or school board members. Even sites that contain appropriate information may harbor advertisements that feature inappropriate messages (Healy). As a rule, administrators and other stakeholders do not have tolerance for student access of inappropriate materials using school equipment; therefore, this is a barrier that needs to be addressed through continued actualization toward digital literacy. By giving teachers and students the literacy skills they need to fully utilize the Internet, the problems associated with advertisements can be turned into learning activities.

Professional Development

Educators have improved the quantity and quality of technology in our schools, but teachers who are digital immigrants are ill-prepared to use technology for teaching and learning (Prensky, 2005; Sandholtz, 2001). According to Sandholtz, “the capacity of teachers to use technology in classroom instruction has not kept pace with the increased access to technology in school” (p. 349). School officials have worked very hard to improve instructional staff members’ computer literacy skills, but authentic technology integration goes far beyond basic concepts (Sandholtz). Often, the professional development surrounding technology initiatives is too short, not easily applicable, covers

too much material, or is too advanced to meet the needs of the learners (Sandholtz; Shackel, 2004).

Students have complained that teachers and schools are woefully unprepared to teach them in a digital age (Paige, Hickok, & Patrick, 2004; Prensky, 2001a). Students have even requested professional development activities for their teachers (Paige et al.). Unfortunately, technology-based professional development has fallen short in delivering sustainable change in classroom instruction (McCannon & Crews, 2000). However, despite the shortcomings of professional development, some teachers have become technology implementation innovators (Armstrong & Warlick, 2004; Jaber & Moore, 1999; Stetson & Bagwell, 1999).

Utilizing technology as a vehicle of school reform creates a discourse between those who seek the reform and those who debate the equity issues involved in technology initiatives (Warschauer, 2003). The issue of equity addresses the access levels of minority students and/or students from low income households when compared to students from middle and upper income households (Warschauer). DeBell and Chapman (2006) disclosed that the equity issue is improving. They stated that 85% of students in low-income households (less than \$20,000) used a computer and the Internet, compared to 95% of students in more wealthy households (more than \$75,000). This closing of the gap is apparently due to the increased amounts of technology within schools, since within the same report the discrepancy between the adults in the same households was nearly 60% (33% of adults in low-income households compared to 89% of adults in high-income households used computers and the Internet).

Sandholtz (2001) found that there were three major factors to technology implementation: access, training, and support. Authentic, motivational professional development is needed to move teachers to more appropriate classroom technology use (Sandholtz). Additionally, students should serve as collaborators in order for schools to better meet the needs of learners (Prensky, 2005). The utilization of students as developers of their own learning is a key practice in learner-centered educational programs (Owen & Demb, 2004).

Access to appropriate technology is important for teachers and students. If the technology is not easily accessible, then teachers will be less likely to utilize it in their instructional plans (Sandholtz, 2001). Technology needs to be readily accessible to teachers and students in order for proper implementation to occur. This may only be fully achieved through one-to-one, student-to-computer ratios.

When large amounts of technology are introduced at a school (for example, a one-to-one, student-to-computer program), professional development becomes an issue (Sandholtz, 2001). Many of the users do not understand the basic infrastructure behind much of the technology being placed into their classrooms. Without this basic understanding of the equipment, they cannot perform simple troubleshooting processes when a minor problem arises. Administrators lodged in this mindset often produce professional development that is focused on training teachers how to use the equipment. Instead, professional development should focus on how the equipment can be used as authentic learning tools. The infrastructure that allows the technology to be used should continue to be discussed, but only in relation to how the learning tools can be used to authentically instruct students.

After appropriate technology is in place and authentic professional development is implemented to encourage the use of technology, teachers and students are in need of appropriate technical support (Sandholtz, 2001). Many schools officials who face this issue hire certified teachers to be technology integrators. Other administrators feel that content area coordinators should ultimately be responsible for urging teachers to authentically integrate technology into teaching and learning. In both cases, school leaders should employ computer technicians who can understand the goals of teachers and present the teachers with solutions to the technical problems they face as they move to implement technology-based authentic learning.

In addition to appropriate technology, professional development, and ongoing support, schools should consider long range technology plans to ensure that goals are set. When school districts' technology plans were examined, the schools were rated highly in the category of development of long-range strategies (Bradshaw, 2002), in contrast to the single trainings so often found in typical technology implementation programs. Bradshaw suggested that technology plan developers should work to ensure that appropriate support for ongoing technology staff development was available and that it supplemented the teachers' and administrators' shared vision for technology. Bradshaw concluded that "there was evidence that some districts recognized the need to examine the impact on both teacher and student learning" (p. 144). When implementing a technology integration program, teacher learning is as important as student achievement. Rivero (2005) quoted a public school official as stating, "the goal of today's educational leaders ought to be having all teachers make good and consistent use of technology" (p. 36). Teachers should

work to understand and implement technology within their classrooms, with increased student learning and achievement as the end goals.

Teacher preparation programs have failed to prepare pre-service teachers and to provide them with the tools they need to utilize instructional technology in the classroom (McCannon & Crews, 2000; Stetson & Bagwell, 1999). A major focus of educational reforms in teacher preparation programs has been to develop curricula that prepare teachers to incorporate technology into classroom learning (Mayo, Kajs, & Tanguma, 2005). If teacher preparation faculty are unable to deliver individuals trained in instructional technology, educators cannot rely on a new generation of teachers to begin integrating instructional technology. Therefore, schools must commit to developing professional development programs that facilitate the transition from technology user to technology integrator.

Williams and Kingham (2003) sought to determine whether experienced and pre-service teachers differed in their perception of technology utilization, based upon teaching assignment. They found “a lack of infusion of technology into the curriculum” and that “the veteran teachers...showed very little use of technology in the subject areas,” suggesting that “school districts may not be providing adequate staff development experiences to prepare veteran teachers to use technology in their classrooms” (¶ 1).

Unfortunately, school personnel have fallen short in delivering quality in-service that emphasizes the uses of instructional technology (McCannon & Crews, 2000). Since increases in achievement can be linked to the uses of instructional technology, then it logically follows that staff development in the uses of instructional technology can lead to increases in student achievement (Latham, 1999; Schacter, 1999). But in most cases,

the in-service that teachers received was on how to use the computers, with little or no emphasis placed on how to incorporate computers into instruction (McCannon & Crews; Stetson & Bagwell, 1999).

Another problem with integrating staff development for technological integration into the curriculum is a lack of funding. Coley, Cradler, and Engel (1997) stated that at least 30% of educational technology budgets should be earmarked for staff development, a sentiment echoed by Carvin (2000). But in 1995, Mageau found that only 5% of technology budgets were being devoted to such causes. That percentage had dropped to only 3% by the year 2000 (Carvin). This is obviously a discrepancy, and one that, due to school finance issues, is not likely to be quickly remedied.

While it has been found that technology can increase student achievement, it has also been suggested that technology only affects achievement when properly utilized in a constructivist method where students pursue higher-order thinking skills (Baylor & Ritchie, 2002; Latham, 1999; Schacter, 1999). It has also been indicated that teachers are not prepared to use technology in this fashion despite their many years of access to it. Not even teacher preparation programs are adequately meeting the needs of pre-service teachers (McCannon & Crews, 2000; Stetson & Bagwell, 1999; Williams & Kingham, 2003).

In addition to staff development funding, teachers need time to learn how to use and apply technology (Hartnell-Young, 2006). The implementation of administrative technology was meant to lighten the burdens placed on teachers, but it has been questioned whether it has held true to its purpose (Snoeyink & Ertmer, 2001). It is possible that the time recovered by the use of electronic grade books and attendance

programs has been replaced with the review of student data for special education programs, standardized testing, and at-risk populations.

Historical Review of Educational Technology

A review of research of educational technology from the late 1980s showed the changes that have occurred as a result of application of knowledge gained. In the 1980s, Cawelti (1989) proposed several technology principles for public schools. Schools were urged to carefully consider the uses and purposes of technology and implement technology in areas where machines are more effective and efficient than humans (Cawelti). This coincided with the idea that schools have traditionally utilized computers to more efficiently take attendance and compute student grades (Cohen, 1988; Ertmer & Snoeyink, 2002).

Another of Cawelti's (1989) principles described how software should be equally balanced between didactic and authentic types of instruction. This demonstrated a transition from purely administrative uses of technology and hinted at the utilization of technology as an authentic learning tool. As presented by Cawelti, it would appear that many researchers were still promoting didactic methods of teaching as viable in the classroom. School clientele have changed with the technological improvements over the past decade (Battelle, 2007; Prensky, 2001a, 2001b, 2005).

A third technology principle presented by Cawelti (1989) was that schools should be prepared for the time and expense of staff training. In the past, training has often been more aligned with teaching computer literacy. Instead of teaching computer literacy, today's schools should utilize authentic professional development focused on technology

application (Sandholtz, 2001). The role of technology has changed from the concept of *it must be learned* to the idea of *it must be used to learn*.

The next technology principle presented by Cawelti (1989) was that “care is taken to provide equity of access to technology as a learning tool” (p. 35). The issues of a technology gap and equity in access are persistent themes in the implementation of technology in public schools. Warschauer (2003) presented equity as one of two central discourses involved in introducing technology into the classroom, but it was found that educators have worked very hard over time to shore up the technology gap (DeBell & Chapman, 2006).

Something not taken into account by DeBell and Chapman (2006) was the quality and quantity of computer access of the children within each household. Quality is a key factor in determining how successful technology will be in providing seamless integration into teaching and learning (Lei & Zhao, 2007).

Cawelti’s (1989) final principle of technology involved ensuring that students received training on how to access and utilize it as a learning tool. An interesting component of this principle was the insistence of involving students in the implementation of technology for learning and utilizing the students as models to enable the learning of other students. This principle has gone nearly unchanged since Cawelti’s review. In fact, we often find the inclusion of students as decision makers presented as a new idea. This principle, as presented by Cawelti, is almost in contrast to the computer literacy-based principles presented during the same time period.

Public education has experienced enormous changes in a short period of time. More administrators and teachers are educating students who have already integrated

technology into their lives and do not need computer literacy skills (Prensky, 2001a, 2001b, 2002, 2005). The resulting conclusion is that teachers should be using technology as a tool in their instructional tool belts that allows them to motivate and challenge students to make significant gains in learning.

Conclusion

Technology has not made the wide-sweeping educational change that so many people believed it could make, but that does not mean that we should abandon it for the next great revolution. Technology should be harnessed for its power to motivate students, provide collaborative experiences, and integrate authentic learning experiences.

Technology is a tool, albeit a very flexible one, that should be applied in such a way that students do not even notice its involvement (Warlick, 2007).

In the end, technology has not been shown to have an undeniably positive impact on the central core business of education: learning. From researchers who have demonstrated increased student achievement (Mann et al., 1999; Schacter, 1999), to those who have suggested that some types of technology might even decrease student learning (Biggers, 2001; Harter & Harter, 2004; Krashen, 2003), the results have portrayed an inconclusive report on the effects of technology in education. The overall concomitant benefits of technology do not synchronize with the millions of dollars spent by public education. However, in the light of the day-to-day technological changes in society, there are those who say it is still important for schools to continue to invest financially in technology (Armstrong & Warlick, 2004; Battelle, 2007; Fisch, 2006; Friedman, 2005; Prensky, 2001a, 2001b, 2002, 2005).

Every year, schools purchase technological hardware and software that do not live up to the seller's stated promises (Oppenheimer, 2007). Instead of relying on technology to make drastic changes in education by itself, educational leaders need to apply the lessons learned from the research: the implementation of authentic, constructivist teaching with technology that motivates students to utilize higher-order thinking skills to increase learning (Becker, 2007; Collins, 1991; Jonassen, 1990).

In 2001, Prensky wrote that "our students have changed radically...today's students are no longer the people our educational system was designed to teach" (p. 1). According to Fisch (2006), our schools are preparing students for jobs that do not yet exist. If these statements are true, educators are challenged to provide students with the best set of skills necessary to allow them the flexibility to compete for future employment. Within this realm of technology, innovative instructional methods such as digital literacy should be utilized.

According to several theorists, digital literacy could provide students with the skills they will need to work and live in a society that each day produces more information than it produced the week before (Armstrong & Warlick, 2004; Battelle, 2007; Fisch, 2006 ; Prensky 2001a, 2001b, 2005; Warlick, 2007). These theorists have proposed that students must be able to find, evaluate, organize, and synthesize information from multiple sources in order to be successful in such a world (Armstrong & Warlick; Warlick). Dede (2000) stated that the "innovative kinds of pedagogy enabled by [technology] empower moving instruction beyond synchronous, group, presentation-centered forms of education and enable preparing students for the complexities of a...knowledge-based global marketplace" (p. 301).

Digital literacy, as described by these theorists and presented as a framework for education in the future, has not been studied sufficiently. The lack of empirical evidence on the subject of digital literacy, as suggested by Warlick (2007) and Prensky (2001a, 2001b, 2002, 2005), has suggested that it is not a viable solution for creating educational change within schools. Therefore, in light of the strong theoretical argument based upon solid evidence gathered from multiple sources from around the globe (Friedman, 2005; Prensky, 2005; Warlick), it becomes evident that the theory of digital literacy should be compared to outcomes in student achievement. This study investigated the relationship between digital literacy and student achievement.

Chapter 3

DESIGN

Educating students is one of the most important responsibilities of parents, administrators, teachers, and community members. Teaching students to succeed in a global environment should be a central tenet of every school in America. Schools are under a great deal of pressure to ensure that students succeed on high-stakes accountability measures but must also prepare students for life after graduation. This study examined whether schools are facilitating student technological growth and whether the digital literacy levels being taught by teachers are reflected in the schools' state accountability ratings. This chapter describes the methods that were used to examine the relationship between level of digital literacy and Texas public school accountability rating. The chapter describes the steps of the study, including instrumentation, participants, and a description of data collection and data analysis procedures.

Purpose of the Study

This study attempted to determine whether focused classroom instruction on the skills associated with digital literacy exhibit a relationship with student achievement. The proponents of digital literacy claim that the skills learned within their educational philosophy are morally and ethically necessary in order for students to find success as adults in the future (Armstrong & Warlick, 2004; Battelle, 2007; Fisch, 2006; Prensky, 2001a, 2001b, 2005; Warlick, 2007). However, this educational philosophy lacks research-based evidence to support its cause. Therefore, it was necessary to examine the relationship between student achievement and the tenets of digital literacy in order to

establish a justifiable basis for inclusion or exclusion of the theory of digital literacy from education.

In order to provide insight on the theory of digital literacy, this study examined the relationship between student achievement, as measured by the state of Texas accountability system, and the digital literacy levels of campus students and teachers, as measured by the Texas School Technology and Readiness (STaR) Chart. A study that examined links between the accountability rating system for Texas public schools and districts and the theory of digital literacy had not been conducted. It is hoped that the results of this research will be utilized to prompt constructive conversations about digital literacy in the classroom. Therefore, it was significant to study the impact of digital literacy on student achievement.

Research Questions

A total of three research questions were investigated in this study. The following questions were examined to determine the relationship between Texas elementary schools' levels of technology implementation and utilization and their state accountability rating:

1. What is the administrator perceived level of digital literacy that is present in schools based upon their state accountability rating (e.g., exemplary, recognized, academically acceptable, and academically unacceptable)?
2. Are there statistically significant differences between the digital literacy levels of students according to their state accountability rating (e.g., exemplary, recognized, academically acceptable, or academically unacceptable)?

3. Is there a statistically significant change in elementary students' levels of digital literacy over the period studied?

Description of Data

Historical data were utilized to ascertain whether a relationship existed between focused classroom attention on the skills associated with the theory of digital literacy, as measured by the Texas STaR Chart, and the outcomes found in the state accountability system. Data were extracted from the Texas STaR Chart for every elementary school in the state of Texas for the academic years 2004-2005, 2005-2006, 2006-2007, and 2007-2008. The STaR chart is an instrument used to collect data on technology in schools. It facilitates the measurement of four focus areas: teaching and learning; educator preparation and development; leadership, administration, and instructional support; and infrastructure for technology (Texas Education Agency [TEA], 2006). The study sought to compare the areas of the Texas Campus STaR Chart specific to the theoretical framework of digital literacy and the results of the campuses' state accountability ratings to determine whether a relationship existed.

Instrumentation

The Texas STaR Chart is a state-mandated report of technology preparation for districts, campuses, and individual teachers. The STaR Chart consists of two different types of reports, one for campuses and one for individual teachers. The reports are required as part of the state technology plan submission process and as one eligibility factor for E-Rate funding (TEA, 2006a). According to TEA,

The Texas Campus STaR Chart has been developed around the four key areas of the *Long-Range Plan for Technology, 2006-2020*....the Texas Campus STaR

Chart is designed to help campuses and districts determine their progress toward meeting the goals of the Long-Range Plan for Technology, as well as meeting the goals of their district. The Texas Campus STaR Chart will also assist in the measurement of the impact of federal, state, and local efforts to improve student learning through the use of technology. (p. 2)

The Texas Teacher STaR Chart has been a mandated requirement for the past two academic years. Because the study was intended to examine a longer period of time, it focused only on the Texas Campus STaR Charts. The Campus STaR Chart had been a state mandated survey for the entire period of the study.

The Texas Campus STaR Chart is based upon the work of The CEO Forum on Education & Technology (Northeast and the Islands Regional Technology in Education Consortium, 2002). The CEO Forum on Education & Technology developed the original STaR Chart as a teacher preparation tool for colleges and universities to be used by preservice teachers (2000). The CEO Forum's (2001) original STaR Chart called for four levels, or indicators, of technology implementation: early tech, developing tech, advanced tech, and target tech. Each of these indicators was assigned a method of measurement within five categories: educational benefits, hardware and connectivity, professional development, digital content, and student achievement and assessment (CEO Forum, 2001).

The Texas STaR Chart's format was modified to include the same four levels, or indicators, but reduced the categories and modified them to include teaching and learning; educator preparation and development; leadership, administration, and instructional support; and infrastructure for technology (TEA, 2006a, 2008b).

Additionally, each of the four categories is broken down into six sub-categories of assessment.

The key area of teaching and learning is comprised of six focus areas: patterns of classroom use, frequency/design of instructional setting using digital content, content area connections, on-line learning, technology applications Texas Essential Knowledge and Skills (TEKS) implementation, and student mastery of technology applications TEKS. The key area of educator preparation and development addresses the focus areas of content of professional development, models of professional development, capabilities of educators, access to professional development, levels of understanding and patterns of use, and professional development for online learning.

The leadership, administration, and instructional support key area includes the focus areas of leadership and vision, planning, instructional support, communication and collaboration, budget, and leadership and support for online learning. The key area of infrastructure for technology is comprised of the focus area students per computers, internet access connectivity/speed, other classroom technology, technological support, local area network/wide area network (LAN/WAN), and distance learning capacity. The resulting chart is a matrix-style rubric with sections that list the qualifications for the subcategory and level indicators (TEA, 2006a).

Each Texas public school campus administrator is required to complete the STaR Chart on an annual basis (TEA, 2006a, 2008b). The STaR chart is accessed utilizing an online interactive website hosted on the TEA Region 12 Education Service Center's website. Each subcategory appears on its own screen and the administrator selects the level of indicator for the campus. Once an indicator is selected, the site automatically

forwards to the next subcategory. Once the chart is completed, the administrator can review the recorded information and make necessary changes before the report is submitted.

Each response is assigned a number based on the indicator selected by the administrator. Early tech responses earn a one, developing tech receive a two, advanced tech earn a three, and target tech receive a four. The total of each subcategory is then tabulated for a category total that ranges from a minimum of 6 to the target score of 24. Schools are then assessed on the four category totals. The goal of this process is to increase the category totals each year for each individual campus (TEA, 2006a).

Participants

The population of this study consisted of public elementary schools in the state of Texas whose district officials completed the Texas STaR Chart every year during the 2004-2008 time period that was studied. Officials from 3961 elementary schools whose officials completed the Texas STaR chart in the state of Texas in 2004-2005, 4099 in 2005-2006, 4176 in 2006-2007, and 4145 in 2007-2008.

The state accountability rating is based upon the test scores of the students, graduation rates of high school seniors, and dropout rates of 7th and 8th grade students (TEA, 2008a). These additional variables were eliminated by utilizing elementary schools for which graduation and dropout rates are not calculated (TEA, 2008c). Additionally, it is believed, based on the work of Prensky (2001a, 2001b, 2005), that younger students are better suited for the auspices of the theoretical framework of digital literacy and therefore elementary schools become the natural sites of study.

Only public elementary schools were studied. Commonly, technology in secondary schools is taught in separate classes while elementary school teachers are responsible for implementing the TEKS objectives. This makes secondary teachers less responsible for the technology-based TEKS, even if addressing the standards is theoretically a team effort. Since only elementary schools were studied, the results can only be extrapolated to other elementary schools.

Methodology

Texas STaR Chart data were collected from the online data repository of all Texas elementary schools that is hosted by the Region 12 Education Service Center. The data that were utilized were from those schools whose officials completed the chart during the 2004-2008 school years. Texas school accountability system rating data were collected from the TEA website. Data were compiled by school district for a four year period of time. School campuses with any data missing from the four year timeframe were excluded from the study.

The study utilized the Texas Campus STaR Chart because of the ability to separate data into the four categories and 24 sub-categories. The STaR chart data were analyzed and categorized in terms of digital literacy for the purpose of isolating the relationship between digital literacy and student achievement. The literature surrounding the theory of digital literacy was utilized to identify the focus areas from the key area of teaching and learning. Of the six focus areas of teaching and learning, four are most aligned with the theory of digital literacy (Armstrong & Warlick, 2004; Prensky, 2001a, 2001b; Warlick 2007) and were used as indicators to assess the level of presence of digital literacy in the elementary campuses studied. The four focus areas of the teaching

and learning area of the Texas STaR Chart that were examined were: patterns of classroom use, frequency/design of instructional setting using digital content, content area connections, and on-line learning.

Within the first focus area of patterns of classroom use, the early tech phase is described as when “teachers primarily use technology to supplement instruction, streamline management functions, and present teacher-centered lectures” and “students use software for skill reinforcement” (TEA, 2006a, p. 9). The developing tech phase is described as when “teachers primarily use technology to direct instruction, improve productivity, model technology skills, and direct student use of productivity applications for technology integration” and “students use technology to access, communicate, and present information” (TEA, p. 9). The third level, or advanced tech, is depicted when “teachers primarily use technology in teacher-led and some student-centered learning experiences to develop higher order thinking skills and provide opportunities for collaboration with content experts, peers, parents, and community” and “students evaluate and analyze data to solve problems” (TEA, p. 9). The fourth and final level, target tech, is illustrated with “teachers seamlessly integrate technology in student-centered learning environment where technology is used to solve real world problems in collaboration with business, industry, and higher education” and “learning is transformed as students propose, assess, and implement solutions to problems” (TEA, p. 9).

The second focus area, frequency/design of instructional setting using digital content, has an early tech level described as when “most teachers occasionally use technology to supplement or reinforce instruction in classroom, library, or lab” (TEA, 2006a, p. 9). The developing tech level is illustrated by stating that teachers have “regular

weekly access and use of technology and digital resources for curriculum activities in the classroom, library, or lab” (TEA, p. 9). As described in the advanced tech level, teachers not only have regular access to technology, they also apply it “in various instructional settings such as the classroom, library, lab, or through mobile technology” (TEA, p. 9). The target tech level of the focus area is depicted as teachers and students having “on-demand access to appropriate technology,” not just at school, but also at home and in the community (TEA, p. 9).

The third focus area selected as an indicator of digital literacy is content area connections. The early tech level is described as teachers using technology for “basic skills with little or no connections with content objectives” (TEA, 2006a, p. 9). In the developing tech level, teachers “use technology to support content objectives” (TEA, p. 9). Within the advanced tech level, teachers not only incorporate technology to support content objectives, but also use technology to support subject specific objectives in order to encourage the “development of higher-order thinking skills” (TEA, p. 9). The top level, target tech, is exemplified as when teachers use technology to “seamlessly apply technology across all subject areas” and provide for learning opportunities beyond the classroom (TEA, p. 9).

The fourth and final focus area selected as an indicator of digital literacy on the Texas STaR chart is online learning. In the early tech level, “most teachers use a few web-based learning activities” (TEA, 2006a, p. 9). The developing tech level increases in complexity to include customization of web-based learning activities in order to support learning objectives (TEA). In advanced tech, teachers “create web-based lessons” firmly rooted in content and learning objectives (TEA, p. 9). Finally, in target tech, “most

teachers create and integrate web-based lessons...that support learning objectives throughout the curriculum” (TEA, p. 9).

Texas state accountability ratings served as an additional data source. As of the 2004-2005 academic year, schools in Texas earn one of four accountability scores: exemplary, recognized, academically acceptable, or academically unacceptable (TEA, 2008c). For elementary schools, the accountability rating is assigned based on student performance on the Texas Assessment of Essential Knowledge and Skills (TAKS) exam (TEA).

To earn an exemplary rating during the 2005-2008 assessment years, schools were required to have 90% of students pass all five academic tests in the areas of reading, writing, social studies, mathematics, and science (TEA, 2005, 2006b, 2007, 2008d). In order to obtain the recognized rating, schools during the 2005-2006 assessment periods had to have 70% of students pass all five academic tests. In the 2007-2008 assessment period, 75% of students were required to pass for the school to reach the same goal.

The academically acceptable rating has experienced the most change during the four year period of study. During the 2005 assessment year, only 50% of students needed to pass the reading, writing, and social studies test to receive the rating of academically acceptable. Additionally, 35% of students needed to pass the mathematics portion, while only 25% of students needed to pass the science test in order to be rated as academically acceptable (TEA, 2005). This standard changed during the 2006 assessment year to require 60% of students to pass the reading, writing, and social studies tests while only 30% and 25% needed to pass the respective mathematics and science assessments (TEA, 2006b). In 2007, the passing percentage was raised to 65% for reading, writing, and

social studies, while mathematics required 45% and science required 40% of students to pass in order for the campus to receive the recognized rating (TEA, 2007). During the final year included in the study, expectations were increased to require the passing percentages to 70% for reading, 65% for writing and social studies, 50% for mathematics, and 45% for science (TEA, 2008d). Schools with students who failed to meet this standard received the academically unacceptable rating (TEA, 2005, 2006b, 2007, 2008d).

Procedures for Data Analysis

The study examined the relationship between campus STaR Chart indicators and state accountability ratings. The first research question was examined utilizing descriptive statistics. Each of the four years of data was independently analyzed for trends utilizing reported mean scores. Then the trends of each individual academic year were compared to determine if a relationship existed between levels of digital literacy and student achievement. As an extension to the first research question, the examination of the level of digital literacy that is present in schools based upon their state accountability rating, the data of reported mean scores was converted into a percentage for easy comparison.

The second research question, an examination of the existence of statistically significant differences between the digital literacy levels of students according to their state accountability ratings, was analyzed using a nonparametric test, chi square, followed by a post hoc test, Kendall's tau_b. The data utilized to investigate the second research question was determined to be categorical and ordinal, therefore the nonparametric statistical test, chi square, was appropriate. The chi square assisted in the analysis of the

expected number of schools at various levels of technology implementation versus the observed number of schools actually at that level of technology implementation. After significant relationships were established, the Kendall's tau_b was used to determine the strength and direction of the relationship.

The nonparametric statistic Wilcoxon signed-rank test was used for the third research question investigating a statistically significant change in elementary students' levels of digital literacy over the period studied. Nonparametric tests were necessary due to the categorical and ordinal nature of the data. The Wilcoxon signed-rank test is a nonparametric alternative to the paired-samples *t*-test and is used when the assumptions of the *t*-test are not met (Hinton, Brownlow, McMurray, & Cozons, 2004). This statistical test compares two paired samples by taking the value of a participant's score from one sample and subtracting it from the same participant's score in the second sample, producing a *difference score* (Hinton et al.). The output scores of the Wilcoxon signed-rank test can be based on either positive or negative ranks with positive ranks indicating that the second sample had a higher mean rank than the first and negative ranks indicating that the first sample had a higher mean rank than the second sample (Hinton et al.).

Summary

This study sought to determine the level of relationship between technology implementation indicators, as derived from the Texas Campus STaR Chart, and student achievement, as measured by the state accountability rating. Chapter 3 described the methods of data collection, instrumentation, participants, and data analysis. The findings of the study are reported in Chapter 4.

Chapter 4

PRESENTATION OF DATA

The theory of digital literacy presents promises of increased student learning through the use of technology in order to provide students with the skills they will need to survive in a global marketplace (Dede, 2000; Prensky, 2001a, 2001b, 2002, 2005; Warlick, 2007). Despite the theorists' urgings, little or no empirical evidence supports the idea that providing information-related technology skills will improve student performance. However, multiple sources of information have begun to emerge that suggest a relationship between digital literacy and student achievement (Fisch, 2006; Prensky, 2001a, 2001b, 2002, 2005). This study investigated that relationship by seeking information pertaining to three specific research questions.

The following research questions were used to determine the relationship between Texas elementary schools' levels of digital literacy and their state accountability ratings:

1. What is the administrator perceived level of digital literacy that is present in schools based upon their state accountability rating (e.g., exemplary, recognized, academically acceptable, and academically unacceptable)?
2. Are there statistically significant differences between the digital literacy levels of students according to their state accountability rating (e.g., exemplary, recognized, academically acceptable, or academically unacceptable)?
3. Is there a statistically significant change in elementary students' levels of digital literacy over the period studied?

This chapter describes the data, as retrieved from the two sources of information (Texas School Technology and Readiness [STaR] Chart and state accountability ratings)

utilized in this study. Also included in this chapter are analyses and presentation of the data. The data are presented in a variety of formats including narrative, graph, and table. The Statistical Package for the Social Sciences (SPSS 17.0) was utilized to analyze the data.

Description of Data

There were two data sets used to investigate the relationship between digital literacy and student achievement, as proposed by the research questions. The first data set was obtained from the Texas STaR Chart. Information from the Accountability Rating System for Texas Public Schools and Districts served as the second data set.

The Texas STaR chart is composed of two similar state-mandated surveys, one completed by individual teachers and another completed by the principal to describe the campus as a whole. For the purposes of this study, the campus chart was utilized. It was selected in order to be congruent with the second data set, which only reports campus level performance.

In order for the chart to be utilized as an indicator of digital literacy, it was necessary for it to be reviewed and validated by a panel of digital literacy experts. The experts ascertained that four of the six focus areas within the key area of Teaching and Learning were acceptable to use as indicators of digital literacy. The focus areas approved by the expert panel as indicators of digital literacy were Patterns of Classroom Use (TL1), Frequency/Design of Instructional Setting Using Digital Content (TL2), Content Area Connections (TL3), and Online Learning (TL6). The expert panel consisted of six current researchers holding terminal degrees in the areas of educational leadership and educational technology.

The STaR chart data were obtained from the Region 12 Educational Service Center (ESC), which acts as the state agent for collection and dissemination of STaR chart data. The data were downloaded as four separate files from the Region 12 ESC website; each file covered an academic year ranging from 2004-2005 through 2007-2008. The 2004-2005 data set contained 3,962 schools. The 2005-2006 school year contained 4,100 schools. The next academic year, 2006-2007, included 4,177 schools, and the last year within the scope of this study, 2007-2008, included 4,146 schools.

During the course of the study, it was discovered that the selection criteria for the campus level STaR chart shifted slightly between the 2005-2006 and 2006-2007 school years. The change occurred in the subarea information collected between the first two years and last two years of the data examined. It was determined that the changes in the STaR Chart were significant enough to warrant limiting the second and third research questions to two school years of study, 2006-2007 and 2007-2008. However, findings from the trends in the first two school years of the study, 2004-2005 and 2005-2006, allowed for the investigation of the levels of digital literacy that are present in the schools, based upon state accountability rating.

Specifically, the variable TL1 was changed from Impact of Technology on Teacher Role and Collaborative Learning on the 2005-2006 chart, to Patterns of Classroom Use on the 2006-2007 chart. Additionally, the variables Frequency/Design of Instructional Setting Using Digital Content (TL2), Content Area Connections (TL3), and Online Learning (TL6) had either name or location changes on the STaR Chart. The indicators for the levels of the chart also changed for this subarea. All four years of data

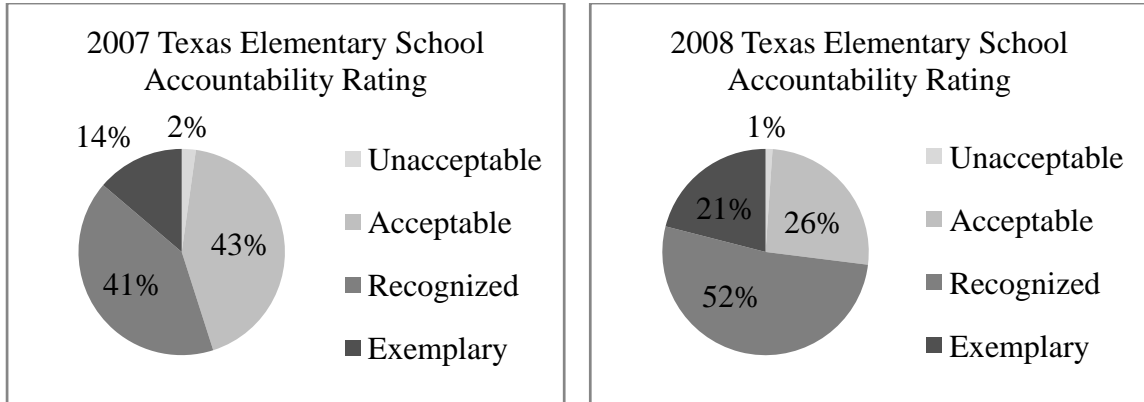
were used to describe the first research question, but only the most recent two years of data were utilized to examine the second and third research questions.

The second data set was obtained from the Accountability Rating System for Texas Public Schools and Districts. The accountability system assigns ratings to schools and districts according to several sources of information including performance on state achievement tests, eighth grade completion rate, and high school dropout rate. Texas elementary schools were selected for inclusion in this study. Secondary schools were not included in order to control for completion and dropout rates which only affect the accountability ratings of middle and high schools. The Texas elementary schools' accountability rating system is based entirely upon student performance on the Texas Assessment of Knowledge and Skills (TAKS) exams.

The second data set was downloaded directly from the Texas Education Agency's Accountability and Reporting website. Both years included in the study were downloaded as comma-separated-values (CSV) files. The files were combined into a single spreadsheet using Microsoft Excel. Schools that did not possess the elementary designation were removed from the data set, as were elementary schools whose leaders did not report accountability data for the years studied. The final file contained campuses that were classified as elementary schools by the state of Texas and received an accountability rating for the years studied. The composition of this data set, according to state accountability rating and disaggregated by academic year, is shown in Figure 1.

Figure 1

2007/2008 Texas Elementary School Accountability Rating



Each Texas school is assigned a unique 9-digit county-district-campus number (TEA, 2004). For the purposes of this study, both data sets were combined into a single Excel spreadsheet and arranged by campus identification number. The rows were aligned so that each contained the 10 data points that were unique for each school. The Texas STaR Chart was amended in 2006, thus causing a shift in the data set and forcing the data from the first two years studied to be excluded during the examination of the second and third research questions. Schools that did not possess data for the academic years 2005-2008 were removed from the data set in order to report on the status of school campuses that had been open continuously and that had been consistent in reporting. This data cleaning procedure was conducted utilizing the unique campus identification number which allowed the entire data set to be sorted in numerical order and then cross-checked to verify that the state accountability and STaR chart data were present for the years included in the range of the study.

There are several possible reasons that some school leaders did not report accountability or STaR chart data. The school may have opened or closed during the

years examined. Additionally, large natural disasters, such as Hurricane Katrina and Hurricane Rita, resulted in TEA providing some school districts with waivers that exempted them from reporting required information in the immediate aftermath of those events. There were 3,518 schools included in the study (N= 3,518). The data were transferred from Microsoft Excel into SPSS and initial descriptive statistics were calculated.

Level of Digital Literacy by State Accountability Rating

The first research question sought to determine if a relationship existed between the level of digital literacy present within a school and the state accountability rating. Descriptive statistics were calculated for each of the four areas of the STaR Chart utilized for the study. The four areas included Patterns of Classroom Use (TL1), Frequency/Design of Instructional Setting Using Digital Content (TL2), Content Area Connections (TL3), and Online Learning (TL6). The descriptive statistics for the variables are listed in Tables 1 through 4.

In 2004-2005 (see Table 1), a pattern developed that indicates that recognized schools reported higher levels of digital literacy ($X_{TL1} = 2.03$, $X_{TL2} = 2.28$, $X_{TL3} = 2.18$, $X_{TL6} = 2.03$) than acceptable schools ($X_{TL1} = 1.98$, $X_{TL2} = 2.19$, $X_{TL3} = 2.11$, $X_{TL6} = 1.97$). Exemplary schools reported higher levels ($X_{TL1} = 2.16$, $X_{TL2} = 2.41$, $X_{TL3} = 2.38$, $X_{TL6} = 2.19$) than did recognized schools ($X_{TL1} = 2.03$, $X_{TL2} = 2.28$, $X_{TL3} = 2.18$, $X_{TL6} = 2.03$). However, the trend was not demonstrated in the relationship between acceptable ($X_{TL1} = 1.98$, $X_{TL2} = 2.19$, $X_{TL3} = 2.11$, $X_{TL6} = 1.97$) and unacceptable schools ($X_{TL1} = 2.08$, $X_{TL2} = 2.19$, $X_{TL3} = 2.06$, $X_{TL6} = 1.98$).

Table 1

Descriptive Statistics for the 2004-2005 Academic Year

School Accountability Rating		Variable			
		TL1	TL2	TL3	TL6
Unacceptable	N	63	63	63	63
	Mean	2.08	2.19	2.06	1.98
	Std. Deviation	0.604	0.564	0.592	0.66
Acceptable	N	1911	1911	1911	1911
	Mean	1.98	2.19	2.11	1.97
	Std. Deviation	0.544	0.564	0.63	0.554
Recognized	N	1292	1292	1292	1292
	Mean	2.03	2.28	2.18	2.03
	Std. Deviation	0.526	0.619	0.686	0.564
Exemplary	N	252	252	252	252
	Mean	2.16	2.41	2.38	2.19
	Std. Deviation	0.6	0.622	0.724	0.588

A similar pattern is displayed in the 2005-2006 school year (see Table 2). Across all four variables, exemplary schools had the highest STaR Chart mean scores ($X_{TL1} = 2.23$, $X_{TL2} = 2.41$, $X_{TL3} = 2.37$, $X_{TL6} = 2.25$). Additionally, recognized schools reported higher mean scores ($X_{TL1} = 2.17$, $X_{TL2} = 2.30$, $X_{TL3} = 2.21$, $X_{TL6} = 2.14$) than did acceptable schools ($X_{TL1} = 2.08$, $X_{TL2} = 2.23$, $X_{TL3} = 2.13$, $X_{TL6} = 2.05$). However, mimicking the trend that developed in the analysis of the 2004-2005 school year data,

acceptable schools did not always report higher mean scores of digital literacy ($X_{TL1} = 2.08$, $X_{TL2} = 2.23$, $X_{TL3} = 2.13$, $X_{TL6} = 2.05$) than unacceptable schools ($X_{TL1} = 2.15$, $X_{TL2} = 2.20$, $X_{TL3} = 2.07$, $X_{TL6} = 2.15$).

Table 2

Descriptive Statistics for the 2005-2006 Academic Year

School Accountability Rating		Variable			
		TL1	TL2	TL3	TL6
Unacceptable	N	46	46	46	46
	Mean	2.15	2.20	2.07	2.15
	Std. Deviation	.631	.582	.574	.595
Acceptable	N	1203	1203	1203	1203
	Mean	2.08	2.23	2.13	2.05
	Std. Deviation	.528	.535	.555	.523
Recognized	N	1825	1825	1825	1825
	Mean	2.17	2.30	2.21	2.14
	Std. Deviation	.540	.561	.564	.524
Exemplary	N	444	444	444	444
	Mean	2.23	2.41	2.37	2.25
	Std. Deviation	.573	.608	.713	.567

During the 2006-2007 academic year, exemplary schools tended to report higher mean scores across the technology implementation categories than did recognized schools (see Table 3). In turn, recognized schools reported higher mean scores than did

schools that received acceptable academic ratings. However, the trend did not continue because acceptable schools only reported higher mean scores than unacceptable schools in two of the four variables.

The area Patterns of Classroom Use (TL1) focused upon teachers' use of technology in the classroom. In this area, acceptable and unacceptable schools reported identical mean scores ($X = 1.96$). In the Frequency/Design of Instructional Setting Using Digital Content (TL2) area, unacceptable schools reported higher mean scores ($X = 2.37$) than did acceptable schools ($X = 2.36$). Frequency/Design of Instructional Setting Using Digital Content (TL2) is described as how often teachers utilize technology or have access to technology within various instructional settings (TEA, 2006a).

Table 3

Descriptive Statistics for the 2006-2007 Academic Year

School Accountability Rating		Variable			
		TL1	TL2	TL3	TL6
Unacceptable	N	78	78	78	78
	Mean	1.96	2.37	2.15	1.55
	Std. Deviation	.612	.705	.512	.573
Acceptable	N	1507	1507	1507	1507
	Mean	1.96	2.36	2.24	1.69
	Std. Deviation	.534	.616	.527	.621
Recognized	N	1449	1449	1449	1449
	Mean	2.02	2.41	2.29	1.70
	Std. Deviation	.519	.613	.546	.567
Exemplary	N	484	484	484	484
	Mean	2.19	2.63	2.48	1.86
	Std. Deviation	.585	.688	.608	.586

The scores reported during the second year of the study, 2007-2008, repeat the established trend as indicated by the data in Table 4. However, in 2007-2008, the unacceptable schools ($X = 2.45$) reported means greater than or equal to acceptable schools ($X = 2.43$) only once, in the Patterns of Classroom Use (TL1) area. Upholding the trend set during the previous year, recognized schools ($X = 2.50$) surpassed the scores of acceptable schools ($X = 2.43$) and exemplary schools ($X = 2.68$) surpassed the scores

of recognized schools. The descriptive data revealed an increasing trend in STaR chart scores as schools received higher accountability ratings.

Table 4

Descriptive Statistics for the 2007-2008 Academic Year

School Accountability Rating		Variable			
		TL1	TL2	TL3	TL6
Unacceptable	N	38	38	38	38
	Mean	2.45	2.21	2.00	1.58
	Std. Deviation	.555	.528	.569	.500
Acceptable	N	911	911	911	911
	Mean	2.43	2.32	2.01	1.75
	Std. Deviation	.643	.574	.543	.565
Recognized	N	1830	1830	1830	1830
	Mean	2.50	2.37	2.08	1.83
	Std. Deviation	.618	.563	.537	.559
Exemplary	N	738	738	738	738
	Mean	2.68	2.56	2.18	1.88
	Std. Deviation	.658	.616	.549	.530

The fourth and final focus area selected as an indicator of digital literacy on the Texas STaR chart was online learning. Online Learning (TL6) is “a highly interactive form of distance learning that is primarily delivered via the Internet” (TEA, 2006a, p. 7). In the academic year 2007-2008, the Online Learning (TL6) area progressively increased

in arithmetic mean as the accountability levels increased from unacceptable ($X = 1.58$) to exemplary schools ($X = 1.88$) (see Table 4). While there are several examples of anomalies that do not seem to exemplify the trend, it is important to note that often the sample size of unacceptable schools was considerably lower than the sample size of acceptable schools.

Perhaps the most important observation that can be made from the descriptive statistics reported in Tables 1 through 4 is that, in every case, the reported mean scores of recognized and exemplary schools surpassed the scores of unacceptable and acceptable schools. This indicates a relationship between teaching digital literacy skills and increased student achievement. However, since there are such drastic changes in sample size within each variable, percentages were calculated for the last two years of the study to compare values in order to limit the effect of small sample sizes. Because the data collection instrument, the Texas Campus STaR Chart, changed between the 2005-2006 and 2006-2007 school years, it was impossible to compare data across all four years of the study. Therefore, percentages were calculated for the 2006-2007 and 2007-2008 school years. In order for the trend set by the means reported in Tables 3 and 4 to remain accurate, it would require that early and developing tech levels be persistent at the unacceptable and acceptable accountability levels, while the levels would gradually slide toward advanced and target tech levels as the recognized and exemplary rating levels were observed.

Analysis of the percentages of the Patterns of Classroom Use (TL1) area by accountability rating initially indicated that the relationship suggested during the examination of the reported mean values is perhaps not as strong as previously indicated

(see Tables 3 and 4). However, when examined closer, a relationship began to emerge in Patterns of Classroom Use (TL1). In the 2007-2008 academic year, 8.8% of exemplary schools reported target technology implementation, while on the other end of the spectrum, no unacceptable schools reported a target technology level (see Table 5). However, a larger percentage of acceptable schools reported target technology levels for 2006-2007 and 2007-2008 (0.7% and 4.3%, respectively) than recognized schools (0.4% and 4.1%, respectively). Despite the inverse order, the percentages for each year are very close. While the relationship is not as pronounced when examining the percentages as compared to the arithmetic means, it is still apparent that, according to the STaR chart data, a relationship exists between school accountability rating and level of technology implementation.

Table 5

Percentages of Patterns of Classroom Use (TLI) by Accountability Rating

Accountability Rating	2007	2008
Unacceptable		
Early	19.2	2.6
Developing	66.7	50.0
Advanced	12.8	47.4
Target	1.3	0.0
Acceptable		
Early	15.5	4.1
Developing	73.4	52.7
Advanced	10.4	39.0
Target	0.7	4.3
Recognized		
Early	12.3	2.5
Developing	74.3	49.0
Advanced	13.0	44.4
Target	0.4	4.1
Exemplary		
Early	8.1	1.9
Developing	66.7	37.3
Advanced	23.8	52.0
Target	1.4	8.8

In 2006-2007, the variable Frequency/Design of Instructional Setting Using Digital Content (TL2) showed much higher percentages of unacceptable schools reporting early technology implementation levels than any other level (see Table 6). While the percentage for unacceptable schools dropped by almost 4% moving from 2006-2007 to 2007-2008 for early level technology implementers, it was still the highest among the four academic ratings. Additionally, exemplary schools exhibited the highest levels of technology implementation, target tech, for both 2006-2007 and 2007-2008 (10.7% and 4.7%, respectively).

Table 6

Percentages of Frequency/Design of Instructional Setting Using Digital Content (TL2) by Accountability Rating

Accountability Rating	2007	2008
Unacceptable		
Early	9.0	5.3
Developing	48.7	68.4
Advanced	38.5	26.3
Target	3.8	0.0
Acceptable		
Early	3.9	3.7
Developing	59.5	62.7
Advanced	33.1	31.7
Target	3.5	1.9

Accountability Rating	2007	2008
Recognized		
Early	3.0	2.5
Developing	57.1	59.5
Advanced	36.2	36.4
Target	3.7	1.7
Exemplary		
Early	1.2	1.9
Developing	45.0	45.1
Advanced	43.0	48.2
Target	10.7	4.7

The Content Area Connections (TL3) area reflects how teachers incorporate technology into core content curricula (TEA, 2006a). The results of the examination of Content Area Connections (TL3), listed in Table 7, support the trends found in the previous two variables, Patterns of Classroom Use (TL1) and Design/Frequency of Instructional Setting Using Digital Content (TL2). As reported in both 2006-2007 and 2007-2008, no unacceptable schools reported reaching target technology levels in Content Area Connections (TL3). In 2006-2007, exemplary schools reported over three times the percentage of schools reporting target technology levels than recognized schools (1.2% as compared to 4.1%). Interestingly, when only the target tech and early levels of technology implementation were reviewed, unacceptable schools reported the highest percentages of early technology levels while exemplary schools reported the highest percentages of target technology levels.

Table 7

Percentages of Content Area Connections (TL3) by Accountability Rating

Accountability Rating	2007	2008
Unacceptable		
Early	6.4	15.8
Developing	71.8	68.4
Advanced	21.8	15.8
Target	0.0	0.0
Acceptable		
Early	3.9	13.8
Developing	69.4	72.2
Advanced	25.7	13.4
Target	0.9	0.5
Recognized		
Early	3.4	9.8
Developing	65.6	73.7
Advanced	29.7	15.5
Target	1.2	1.0
Exemplary		
Early	1.9	6.5
Developing	52.3	70.3
Advanced	41.7	22.0
Target	4.1	1.2

The fourth variable, Online Learning (TL6), is defined as “a highly interactive form of distance learning that is primarily delivered via the Internet” (TEA, 2006a, p. 7). In 2006-2007, 98.7% of schools that were assigned unacceptable academic ratings reported either an early or developing Online Learning (TL6) technology implementation level with no unacceptable schools reaching the target tech level (see Table 8). During the follow year, 2007-2008, this trend increased as 100% of unacceptable schools reported an early or developing technology implementation level. Leaders of 92.1% of the 2006-2007 exemplary schools and 93.3% of the 2007-2008 exemplary schools indicated early or developing technology implementation levels.

Table 8

Percentages of Online Learning (TL6) by Accountability Rating

Accountability Rating	2007	2008
Unacceptable		
Early	47.4	42.1
Developing	51.3	57.9
Advanced	1.3	0.0
Target	0.0	0.0
Acceptable		
Early	38.0	31.2
Developing	56.3	62.9
Advanced	4.2	5.6
Target	1.5	0.3
Recognized		
Early	34.8	24.6
Developing	60.4	68.5
Advanced	4.4	6.0
Target	0.4	0.9
Exemplary		
Early	23.3	19.5
Developing	68.8	73.8
Advanced	6.2	5.6
Target	1.7	1.1

The first research question sought to determine the level of technology implementation based upon the state accountability rating. The data indicate that a relationship exists between higher rated schools and more advanced levels of technology. This could indicate a relationship between student achievement and the teaching of digital literacy skills because elementary schools with higher accountability ratings had students who performed better on state-mandated tests than did schools with lower accountability ratings. Additionally, the higher levels of technology implementation are congruent with the teaching of digital literacy skills.

Differences in Digital Literacy Levels

Jones-Kavalier and Flannigan (2006) stated that, “adults who did not grow up with technology continue to adapt from iteration to iteration. The senior population approaches the new literacy like a foreign language that is complex and perhaps of questionable use” (p. 8). Like differences in age and experience influence the use of technology, the second research question sought to determine whether students’ digital literacy levels differed based on the state accountability rating of their schools. In the case of both data sets, the information was categorical and ordinal in nature. Therefore, in order to express a relationship between the data sets, a Pearson’s chi-square was chosen as the initial statistical test. A chi-square is used to determine whether the expected values vary from the obtained values and answers the question of whether these discrepancies are bigger than might be expected by chance or if there is a statistically significant relationship between the variables (Hinton, Brownlow, McMurray, & Cozens, 2004). A chi-square does not indicate the strength of the relationship, therefore Kendall’s tau_b was added as a post hoc test to express the effect size. The large sample size (N =

3,518) provides more than adequate variation to account for the required average expected count frequency.

Kendall's tau is a nonparametric correlation coefficient that can be used with scaled ordinal variables (Hinton et al., 2004). While it is considered to be equivalent to Spearman's rho, Kendall's tau represents probability. There are three derivatives of the Kendall's tau; the appropriateness of each is determined by the type of data and size of the cross tabulation tables being used (Hinton et al.). For the purposes of this study, Kendall's tau_b was used because both variables being measured were at an ordinal level. A null hypothesis (tau_b = 0) represents no correlation between two variables while the alternate hypothesis (tau_b = < > 0) suggests the variables are correlated (Hinton et al.)

The Patterns of Classroom Use (TL1) area, reported in Table 9, expressed significance and a small effect size ($\chi^2 = 77.277$, $df = 9$, $N = 3,518$, $p < 0.001$, $\tau = 0.109$, $p < 0.001$). The next variable, Frequency/Design of Instructional Setting Using Digital Content (TL2), was also significant (see Table 10) with a small effect size ($\chi^2 = 86.941$, $df = 9$, $N = 3,518$, $p < 0.001$, $\tau = 0.096$, $p < 0.001$). The third variable, Content Area Connections (TL3), indicated a significant relationship (see Table 11) with a smaller than typical effect size ($\chi^2 = 84.556$, $df = 9$, $N = 3,518$, $p < 0.001$, $\tau = 0.116$, $p < 0.001$) (Cohen, 1988). The fourth and final variable for 2007, Online Learning (TL6), was also found to be significant (see Table 12) with a small effect size ($\chi^2 = 53.272$, $df = 9$, $N = 3,518$, $p < 0.001$, $\tau = 0.083$, $p < 0.001$).

Table 9

Chi-Square Analysis of STaR Chart Reporting: Patterns of Classroom Use (TLI), 2007

Variable	Level of Tech Implementation					χ^2	p	τ	p
	N	Early	Developing	Advanced	Target				
Academic Rating						77.277	< 0.001	0.109	< 0.001
Unacceptable	78	15	52	10	1				
Acceptable	1507	234	1106	157	10				
Recognized	1449	178	1076	189	6				
Exemplary	484	39	323	115	7				
Totals	3518	466	2557	471	24				

Table 10

Chi-Square Analysis of STaR Chart Reporting: Frequency/Design of Instructional Setting Using Digital Content (TL2), 2007

Variable	N	Level of Tech Implementation					χ^2	p	τ	p
		Early	Developing	Advanced	Target					
Academic Rating							86.941	< 0.001	0.096	< 0.001
Unacceptable	78	7	38	30	3					
Acceptable	1507	59	896	499	53					
Recognized	1449	43	828	524	54					
Exemplary	484	6	218	208	52					
Totals	3518	115	1980	1261	162					

During the 2006-2007 academic year, the relationship between levels of technology implementation and schools' accountability ratings was significant. The Content Area Connections (TL3) area had the largest effect size ($\tau = 0.116$) of all four variables, but it was considered to be smaller than typical (Cohen, 1988). The smallest effect size was found in the Online Learning (TL6) area ($\tau = 0.083$).

Table 11

Chi-Square Analysis of STaR Chart Reporting: Content Area Connections (TL3), 2007

Variable	N	Level of Tech Implementation					χ^2	p	τ	p
		Early	Developing	Advanced	Target	0				
Academic Rating							84.556	<0.001	0.116	<0.001
Unacceptable	78	5	56	17	0					
Acceptable	1507	59	1046	388	14					
Recognized	1449	49	951	431	18					
Exemplary	484	9	253	202	20					
Totals	3518	122	2306	1038	52					

Table 12

Chi-Square Analysis of STaR Chart Reporting: Online Learning (TL6), 2007

Variable	N	Level of Tech Implementation				Target	χ^2	p	τ	p
		Early	Developing	Advanced						
Academic Rating						53.272	<0.001	0.083	<0.001	
Unacceptable	78	37	40	0	1					
Acceptable	1507	572	849	64	22					
Recognized	1449	504	875	64	6					
Exemplary	484	113	333	30	8					
Totals	3518	1226	2097	158	37					

The results did not vary greatly in 2007-2008 when compared to the 2006-2007 results, however, the variables in 2007-2008 expressed slightly larger effect sizes. For the area Patterns of Classroom Use (TL1), the levels of technology implementation were significant (see Table 11), with a less than typical effect size ($\chi^2 = 72.94$, $df = 9$, $N = 3,518$, $p < 0.001$, $\tau = 0.115$, $p < 0.001$). The results of the second variable, Frequency/Design of Instructional Setting Using Digital Content (TL2), are reported in Table 12. This variable was also found to have a significant relationship between level of technology implementation and academic rating ($\chi^2 = 88.761$, $df = 9$, $N = 3,518$, $p < 0.001$, $\tau = 0.129$, $p < 0.001$). Despite having the largest effect size ($\tau = 0.129$) of all of the variables between the years studied, it is still considered to be smaller than typical (Cohen, 1988).

Table 13

Chi-Square Analysis of STaR Chart Reporting: Patterns of Classroom Use (TL1), 2008

Variable	N	Level of Tech Implementation					χ^2	p	τ	p
		Early	Developing	Advanced	Target	Target				
Academic Rating							72.94	<0.001	0.115	<0.001
Unacceptable	38	1	19	18	0					
Acceptable	911	37	480	355	39					
Recognized	1830	36	897	812	75					
Exemplary	739	14	275	385	65					
Totals	3518	98	1671	1570	179					

Table 14

Chi-Square Analysis of STaR Chart Reporting: Frequency/Design of Instructional Setting Using Digital Content (TL2), 2008

Variable	N	Level of Tech Implementation				Target	χ^2	p	τ	p
		Early	Developing	Advanced	0					
Academic Rating						88.761	<0.001	0.129	<0.001	
Unacceptable	38	2	26	10	0					
Acceptable	911	34	571	289	17					
Recognized	1830	45	1088	666	31					
Exemplary	739	14	333	357	35					
Totals	3518	95	2018	1322	83					

For the year 2007-2008, the variable Content Area Connections (TL3) was found to be significant (see Table 13) with an effect size of 0.100 ($\chi^2 = 47.471$, $df = 9$, $N = 3,518$, $p < 0.001$, $\tau = 0.100$, $p < 0.001$). Similarly, the fourth variable in 2008, Online Learning (TL6), was significant (see Table 14), but had an effect size that was nearly non-existent ($\chi^2 = 40.774$, $df = 9$, $N = 3,518$, $p < 0.001$, $\tau = 0.015$, $p < 0.001$). Online Learning (TL6), in 2007-2008, was found to have the smallest effect size ($\tau = 0.015$) for the years studied. However, the 2006-2007 Online Learning (TL6) variable also had the lowest effect size ($\tau = 0.083$) for that year of reporting and the second lowest in the years studied. This indicates that of all of the variables studied, Online Learning (TL6) has the weakest relationship to accountability. The other three variables, Patterns of Classroom Use (TL1), Design/Frequency of Instructional Setting Using Digital Content (TL2), and Content Area Connections (TL3), all had small, but similar, effect sizes which indicate that they are correlated, although slightly, with the school academic accountability rating.

Table 15

Chi-Square Analysis of STaR Chart Reporting: Content Area Connections (TL3), 2008

Variable	N	Level of Tech Implementation					χ^2	p	τ	p
		Early	Developing	Advanced	Target					
Academic Rating							47.171	< 0.001	0.100	< 0.001
Unacceptable	38	6	26	6	0					
Acceptable	911	126	658	122	5					
Recognized	1830	179	1348	284	19					
Exemplary	739	48	519	163	9					
Totals	3518	359	2551	585	33					

Table 16

Chi-Square Analysis of STaR Chart Reporting: Online Learning (TL6), 2008

Variable	N	Level of Tech Implementation					χ^2	p	τ	p
		Early	Developing	Advanced	Target					
Academic Rating						40.774	< 0.001	0.015	< 0.001	
Unacceptable	38	16	22	0	0					
Acceptable	911	284	573	51	3					
Recognized	1830	451	1254	109	16					
Exemplary	739	144	546	41	8					
Totals	3518	895	2395	201	27					

Changes in the Levels of Digital Literacy

The last research question sought to determine whether there was a statistically significant change in elementary students' levels of digital literacy over the period studied. The purpose of investigating the question was to see if significant changes occurred from year to year in the STaR chart areas that exemplified digital literacy.

The third question was examined through the use of a Wilcoxon signed-rank test. The Wilcoxon signed-rank test is a nonparametric alternative to the paired-samples t test and is used when the assumptions of the t test are not met (Hinton et al., 2004). This statistical test matches two paired samples and produces a *difference score* for each participant, taking the value of the participant's score from one sample and subtracting it from the same participant's score in the second sample (Hinton et al.). The output scores of the Wilcoxon can be based on either positive or negative ranks. Positive ranks indicate that the second sample had a higher mean rank than the first sample and negative ranks indicate that the first sample had a higher mean rank than the second sample (Hinton et al.).

There was a significant difference in a positive direction for the changes in Patterns of Classroom Use (TL1) key area between 2006-2007 and 2007-2008 ($Z = 34.069$, $N = 3,518$, $p < 0.001$). This indicates that the level of digital literacy skills being taught increased between 2006-2007 and 2007-2008. However, as indicated in Table 17, the Design/Frequency of Instructional Setting Using Digital Content (TL2) area exhibited a drop in digital literacy skills during the same time period ($Z = -1.859$, $N = 3,518$, $p = 0.063$). The drop in the second variable (TL2) was not significant, therefore it was not an

effective measure for determining the change in digital literacy skills being taught during the period studied.

The Content Area Connections (TL3) area, like the Design/Frequency of Instructional Setting Using Digital Content (TL2) area, experienced a decrease in the teaching of digital literacy skills over the period studied. This decrease was significant ($Z = -1.859$, $N = 3,518$, $p < 0.063$). The fourth variable, Online Learning (TL6), indicated a significant increase in the teaching of digital literacy skills ($Z = -8.923$, $N = 3,518$, $p < 0.001$). The outcome of the statistical test resulted in three significant results, with two results that indicate increases in the teaching of digital literacy skills. The third result suggests a decrease in these skills. The fourth variable was not found to experience a significant change.

Patterns of Classroom Use (TL1) is an indicator of teachers' use of technology within the classroom. Teachers were becoming more aware of digital literacy skills and are utilizing them more frequently in teaching and learning. The second significant variable, Content Area Connections (TL3), suggests that despite teachers' awareness of digital literacy skills, they were becoming less adept at incorporating these skills into daily classroom activities. The results of the analysis of the Online Learning (TL6) area also indicated that the amount of virtual or e-learning opportunities provided to students was increasing.

Table 17

Changes in the Levels of Digital Literacy

Digital Literacy Variable		Design/Freq. of Inst. Setting	Content Area Connections (TL3)	Online Learning (TL6)
Patterns of Classroom Use (TL1)	Using Digital Content (TL2)			
Z	-34.069 ^a	-1.859 ^b	-18.353 ^b	-8.923 ^a
p	<0.001	0.063	<0.001	<0.001

Note: Z scores marked with ‘a’ indicate positive ranked data, ‘b’ indicate negative ranked data

Summary

The purpose of school-based digital literacy is “to develop a cross-curricular attention so that students have the chance to learn in a digital environment and teachers to adopt media and communication as a teaching style” (Rivoltella, 2008, p. xii). This study examined the relationship between digital literacy and student achievement and was guided by three research questions. The first question sought to determine if a relationship existed between the level of digital literacy and the state accountability rating. An examination of statistical differences between the levels of digital literacy and state accountability rating was the basis for the second question. The third question sought to determine if statistically significant changes in digital literacy occurred during the period studied.

An investigation of the first question determined that in most cases, a positive relationship occurred between digital literacy levels and student achievement. This was determined by comparing descriptive statistics for four different indicators of digital literacy over the period studied. The data were presented in mean scores and percentages to provide a more in-depth investigation of the relationship. In both cases, a positive relationship was expressed.

The research method of the second question utilized nonparametric statistical tests to account for the categorical and ordinal information within the data sets. The statistical measure Kendall’s tau_b was utilized as a post hoc test to measure effect size. In all eight cases measured, a significant relationship was found with a small to moderately small effect size.

The statistical analysis of the third question required the use of another nonparametric measure, the Wilcoxon signed-rank test. The Wilcoxon test was used to determine whether the distribution of two paired variables in two related samples were the same. The existence of positive as well as negative significant changes in digital literacy levels over time was present between the years reported. The following chapter will include a summary, conclusions, suggestions for public school administrators, and implications for further research on the relationship between digital literacy and student achievement.

Chapter 5

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS FOR FURTHER RESEARCH

The proponents of digital literacy have been advocating its use in schools and classrooms for a number of years (Armstrong & Warlick, 2004; Battelle, 2007; Fisch, 2006; Warlick, 2007). However, the empirical evidence on the impact of digital literacy on teaching and learning has been nearly nonexistent. Therefore, this study was conducted to provide evidence of the effects of digital literacy skills instruction on student achievement. By utilizing data obtained from the Texas School Technology and Readiness (STaR) chart, validated as an indicator of digital literacy, and the Accountability Rating System for Texas Public Schools and Districts for state elementary schools, a relationship between digital literacy and student achievement was evidenced.

The theoretical framework presented in Chapter 1 provided the foundation for the conclusions discussed in this chapter, which presents an examination of the findings as well as implications for researchers and practitioners. Also presented in this chapter is a discussion of the impact of the study upon the theoretical framework of digital literacy, recommendations for future study, and conclusions.

Summary of the Study

Chapter 1 of this study included a description of the study's theoretical framework, problem statement, purpose of the study, and significance. The foundation of the study was built upon the theoretical framework of digital literacy. Proponents of digital literacy believe that students should be taught not just how to use technology, but how to use technology to find, collect, compile, and utilize information in a context that

facilitates learning (Armstrong & Warlick, 2004). According to digital literacy theorists, students must also be able to communicate with text, video, images, and sound without allowing the technology to strip them of their humanity (Battelle, 2007; Warlick, 2007).

Also presented in Chapter 1 were three research questions that guided the investigation:

1. What is the administrator perceived level of digital literacy that is present in schools based upon their state accountability rating (e.g., exemplary, recognized, academically acceptable, and academically unacceptable)?
2. Are there statistically significant differences between the digital literacy levels of students according to their state accountability rating (e.g., exemplary, recognized, academically acceptable, or academically unacceptable)?
3. Is there a statistically significant change in elementary students' levels of digital literacy over the period studied?

Included in Chapter 1 were a description of the methods utilized in the study, assumptions and limitations, and key terminology.

The next chapter provided a review of the literature concerning the implementation of technology in education, the barriers to using technology effectively, and the history of instructional technology. Chapter 2 was divided into several sections: administrative technology, instructional technology, barriers to instructional technology, professional development, and a historical review of instructional technology. The literature supported the idea that technology can be employed using many different methods, but not all approaches are capable of assisting or enhancing teaching and learning. A central theme centered upon the argument that technology has not lived up to

the expectations of the past and the counter-argument that technology must be applied in an appropriate manner for it to enhance teaching and learning (Cuban, 2001; Hartnell-Young, 2006; Latham, 1999; Oppenheimer, 2003, 2007). The chapter concluded with the notion that technology is a tool, albeit a very flexible one, that should be applied in such a way that students do not even notice its involvement (Warlick, 2007).

The third chapter detailed the method of study used to investigate the research questions. The population of the study was described as elementary schools in Texas that had consistently reported technology implementation levels and received state accountability ratings. The two data sources, the Texas STaR Chart and state accountability system ratings, were described and the processes for statistically testing the data were explained.

Chapter 4 described the analysis of the data conducted under the auspices of the research questions. The research questions were investigated using statistical procedures including descriptive analysis, chi-square, Kendall's tau_b, and the Wilcoxon signed-rank test. The data were presented utilizing narrative descriptions, figures, and tables. The first question, an investigation of the level of digital literacy that is present in schools based upon their state accountability ratings, was investigated using descriptive statistics. The data were presented first as mean scores and then again using the percentages of each academic rating disaggregated by technology implementation levels.

The second question, an examination of the existence of statistically significant differences between the digital literacy levels of students according to their state accountability ratings, was analyzed using a nonparametric test, chi square, followed by a post hoc test, Kendall's tau_b. The chi square assisted in the analysis of the expected

number of schools at various levels of technology implementation versus the observed number of schools actually at that level of technology implementation. After significant relationships were established, Kendall's tau_b was used to determine the strength and direction of the relationship.

The third research question, an examination of whether there was a statistically significant change in elementary students' levels of digital literacy over the period studied, was conducted to determine if growth occurred. A Wilcoxon signed-rank test was utilized to determine a mean rank comparison as a way to investigate individual campus trends.

Discussion of Results

The results of the study indicated that a relationship between digital literacy and student achievement exists. The findings of the study were found to be significant in almost all cases. This is highly indicative of a strong relationship between digital literacy and student achievement, however since nonparametric tests were applied to the categorical data sets, the direction of the relationship becomes more difficult to predict. The discussion of the findings for each research question is presented in the following sections.

Level of Digital Literacy by State Accountability Rating

The first research question addressed the levels of digital literacy within each rating of the state accountability system and was investigated utilizing descriptive statistics. Digital literacy has been described as representing,

a person's ability to perform tasks effectively in a digital environment, with "digital" meaning information represented in numeric form and primarily for use

by a computer. Literacy includes the ability to read and interpret media (text, sound, images), to reproduce data and images through digital manipulation, and to evaluate and apply new knowledge gained from digital environments. (Jones-Kavalier & Flannigan, 2006, p. 9)

In both 2007 and 2008, schools that earned exemplary and recognized ratings obtained higher mean scores than the next lower campus rating on all four tested variables: Patterns of Classroom Use (TL1), Frequency/Design of Instruction Using Digital Content (TL2), Content Area Connections (TL3), and Online Learning (TL6). This indicates that across all four variables, schools that earned a recognized accountability rating reported teaching digital literacy skills at a higher rate than those schools that obtained an acceptable rating. Likewise, exemplary schools reported teaching digital literacy skills at a higher rate than did recognized schools.

While the exemplary and recognized schools consistently reported higher mean scores than acceptable and unacceptable schools, acceptable schools did not always report higher mean scores than schools earning an unacceptable rating. There are multiple cases, for example the Frequency/Design of Instructional Setting Using Digital Content (TL2) area in 2007, and the Patterns of Classroom Use (TL1) area in 2008, in which unacceptable schools reported higher mean scores than did acceptable schools. This could be used as an argument against the relationship of digital literacy to student achievement, but it could also be evidence of a technological or socioeconomic gap.

The data suggest that schools that earned recognized and exemplary academic ratings tended to report higher levels of technology implementation. When the percentages of the technology implementation levels were segregated by academic

accountability rating, exemplary schools continued to dominate the highest technology implementation levels. The findings suggest that schools that earned exemplary and recognized accountability ratings had more access to technology than did schools that received acceptable and unacceptable ratings. This gap could be technological or socioeconomic in nature. A technological professional development gap infers that teachers are not learning new ways to utilize technology effectively in the classroom. A socioeconomic gap suggests the continued lack of access to computers and Internet technologies (Roberts, Feohr, & Rideout, 2005; Sandholtz, 2001; Shackel, 2004). Secretary of Education Rod Paige stated that “we need to address the limited access to technology the many students have outside of school...closing the digital divide will also help close the achievement gap that exists within our schools” (U.S. Department of Education, 2001, ¶ 17).

The findings indicate that exemplary schools appear to be more effectively utilizing technology to “seamlessly integrate technology in student-centered learning environment where technology is used to solve real world problems in collaboration with business, industry, and higher education” and that learning is “transformed as students propose, assess, and implement solutions to problems” (TEA, 2006a, p. 9). The results of the high level technology implementation are translated into improved student achievement, as evidenced by the accountability ratings of the exemplary schools.

The overall trend found throughout the levels of technology implementation suggests that exemplary schools report higher levels of technology use. However, the inconsistencies over time are in need of explanation. First, fewer schools received the unacceptable accountability rating than any other academic accountability rating.

Therefore, a smaller number of schools whose leaders reported high levels of technology implementation can greatly affect the overall percentages. This problem could be connected to the fact that the completion of the STaR chart is linked to the state-mandated school district technology plan. The technology plan must be filed with the state of Texas by the first day of April. This is during the same time that schools begin to gear-up for state-mandated testing, a major focus of most elementary schools (TEA, 2008a). In many districts, the technology plan is prepared at the district's central administration office. At the same time, campus-level administrators are focusing on impending state-mandated tests and thus may not spend a tremendous amount of effort or time reviewing and completing the STaR Chart. There are no repercussions at the campus level for administrators' noncompliance. The STaR chart is also self-administered; therefore there is no verification to ensure that answers are accurate. It is plausible that some administrators in low-performing schools spend limited time completing or thinking about the STaR chart, as they are focused on testing due to the stringent repercussions for low performance.

Another issue that could cause the variations among unacceptable and acceptable rated schools are barriers to technology implementation. Common barriers to technology implementation include lack of accessibility, inoperable equipment, teachers' loss of authority, lack of funding, teacher beliefs, and the absence of instructional and technical support (Atkins & Vasu, 2000; Baylor & Ritchie, 2002; Becker, 1994; Brown & Warhauser, 2006; Garthwait & Weller, 2005; Hartnell-Young, 2006; Hodas, 1993; Li, 2007; Rogers, 2000). The presence of these barriers could influence the reporting of STaR chart scores.

Principals, superintendents, and other school leaders should be aware that proper support for technology must be established through professional development, appropriate technological implementation methods, and funding for adequate accessibility to technology for teachers and students (Atkins & Vasu, 2000; Brown & Warhauser, 2006; Mergendoller, 1996). Professional development should focus on implementing digital literacy skills across the curriculum in order to close teachers' skill gaps (Prensky, 2005; Sandholtz, 2001). According to Jones-Kavalier and Flannigan (2006),

The greatest challenge is moving beyond the glitz and pizzazz of the flashy technology to teach true literacy in this new milieu. Using the same skills used for centuries—analysis, synthesis, and evaluation—we must look at digital literacy as another realm within which to apply elements of critical thinking. (p. 9)

Jones-Kavalier and Flannigan's warning is meant to alert educators about the traps set by educational software manufacturers to sell computer programs, hardware, and teacher training that do not employ the elements of critical thinking (Oppenheimer, 2007).

Administrators should be aware of digital literacy skills and promote their use within their respective schools. Digital literacy can be supported by administrators by providing teachers with time and opportunities to experience collaborative investigations into utilizing technology to motivate and captivate students (Brown & Warhauser, 2006). Teachers should be provided with the resources they need to create vibrant, interactive learning experiences for students (Armstrong & Warlick, 2006).

As campus level administrators are at the core of the leadership within a school, it is important that they model the traits of digitally literacy to their faculty, students, and

community stakeholders. Administrators should work to cultivate an environment where “students and teachers become partners in the exploration of this new universe” (Paige, Hickok, & Patrick, 2005, p. 11).

Differences in Digital Literacy Levels

The second research question, an examination of whether differences exist between the digital literacy levels of students according to their schools’ state accountability ratings (e.g., exemplary, recognized, academically acceptable, or academically unacceptable), sought to determine if the levels of technology implementation were significantly different. When utilizing nonparametric statistical tests, it is impossible to determine for certain to which variable the correlation can be attributed. By utilizing the Kendall’s tau_b post hoc correlation coefficient, an effect size was established.

The findings revealed that only one variable, Online Learning (TL6) in 2007-2008, was not found to be significant. The other variables, Patterns of Classroom Use (TL1) in 2006-2007 and 2007-2008, Design/Frequency of Instructional Setting Using Digital Content (TL2) in 2006-2007 and 2007-2008, Content Area Connections (TL3) in 2006-2007 and 2007-2008, and Online Learning (TL6) in 2006-2007, were found to be significant, but all had small effect sizes. This indicates that while the differences between the technology implementation levels are significant, the relationship is not very strong.

A practitioner implication resulting from the analysis of this research question is that digital literacy skills seem to impact school accountability ratings. The areas that seem to have the most effect are 1) teaching seamlessly with technology in order to

invoke higher order thinking skills and 2) cultivating cross-curricular use of technology (TEA, 2006a). Administrators need to understand that our classrooms are filled with digitally literate students who are being led by *digital immigrants* (Jones-Kavalier & Flannigan, 2006; Prensky, 2001a, 2001b). Therefore, simply purchasing technological equipment does not suffice. It becomes necessary to develop “comprehensive technology plans that specify technical learning objectives or ensure successful integration of technology to enhance students’ digital and visual literacy” (Jones-Kavalier & Flannigan, p. 8). All too often, successful implementation of technology occurs not campus-wide, but within single classrooms of school campuses, facilitated by teachers who are motivated to individually master “the skills needed to merge the digital world with [education]” (Jones-Kavalier & Flannigan, p. 9).

Changes in the Levels of Digital Literacy

The last research question, an examination of elementary students’ levels of digital literacy over the period of the study, found that out of four digital literacy indicators only two, Patterns of Classroom Use (TL1) and Online Learning (TL6), showed positive gains in classroom use. The Design/Frequency of Instructional Setting Using Digital Content (TL2) area did not show a significant change while the Content Area Connections (TL3) area actually decreased during the course of the study.

With the rise in availability of online learning for elementary students it is not surprising to find an escalation in the use of these resources, therefore causing an increase in Online Learning (TL6). However, it seems unusual for Patterns of Classroom Use (TL1), which focuses on how teachers utilize technology in their classrooms, and Content Area Connections (TL3), which focuses on using technology across all subject areas, to

indicate inverse results. Based upon these findings, it would appear that teachers use technology more often in their classrooms, but limit the use of the technology to just a few subjects. Perhaps the growth of the digital literacy movement is so slow that a study of changes in technology implementation over two years is not able to fully to measure the differences.

To address changes in digital literacy, public school administrators should closely monitor the cross-curricular use of technology in schools to ensure that digital literacy skills are being addressed by all teachers in all subjects and classrooms. Administrators can seek funding for additional technology in order to increase teacher and student access to information technologies, leaving time and funding to increase support within classrooms (Atkins & Vasu, 2000). Teachers who integrate technology need more than just equipment and training. They do need support from school administrators (Baylor & Ritchie, 2002; Hartnell-Young, 2006). It is important to note that the statistical reporting for question three was limited to only two years of data, therefore conclusions derived from the information should be concerned with validity.

Recommendations for Practice

Administrators can provide leadership and support to teachers by modeling the skills associated with digital literacy (Baylor & Ritchie, 2002). Rivero (2005) quoted a public school official who stated, “the goal of today’s educational leaders ought to be having all teachers make good and consistent use of technology” (p. 36). Findings from this study indicate that higher levels of student achievement are supported by high levels of digital literacy. District and campus level administrators should consider factors that impact student achievement as they provide leadership in public schools.

Campus and district administrators can incorporate the relationship between digital literacy and student achievement as they plan and facilitate professional development and provide ongoing classroom support. Students can benefit when their teachers have an increased capacity to utilize technology in a way that facilitates the learning process. Thus, technology becomes a tool to gather, organize, and assimilate information (Hartnell-Young, 2006; Paige, Hickok, & Patrick, 2004; Warlick, 2007).

Teachers require authentic, motivational professional development in order to create changes in instructional behavior (Sandholtz, 2001). Campus administrators can work with campus leadership teams to facilitate the understanding of digital literacy concepts to facilitate changes in teaching and learning. Prensky (2001) stated that students “think and process information fundamentally differently from their predecessors” (p. 1). It is the responsibility of campus leaders to ensure that teachers adjust to changes in student behaviors in order to improve teaching and learning.

Although affecting school district eligibility to receive E-Rate funds (TEA, 2004, 2006a), not completing the STaR Chart carries no consequences for school leaders individually. It is possible for a school district that does not receive or wish to receive federal E-Rate funds to refuse to complete the STaR Chart, despite the indication that the chart is mandatory (TEA, 2006a). It is recommended that TEA enact a policy to enforce the reporting of STaR Chart data by linking it to the state accountability rating for each campus. The policy could require campuses to complete STaR Charts in order to receive academic accountability ratings.

Recommendations for Further Research

Research in the area of the effect of digital literacy on student achievement is limited. The area is in need of continued study so that the relationship can be further explored. Digital literacy is likely to be an ever-expanding theory of teaching and learning in the future and thus should be fully investigated. In order for school personnel to continue to address the future needs of students, administrators and teachers must adopt a mindset of teaching and learning that reflects the needs of society and anticipates future technological advances.

Additional research is needed to explore the gap in student test scores between unacceptable and acceptable rated schools and recognized and exemplary rated schools. While the digital divide and lack of professional development are well documented in the literature (Hoffman & Novak, 1998; Hohlfeld, Ritzhaupt, Barron, & Kemker, 2008), research should be conducted to investigate the effects of digital literacy between low-achieving schools and high-achieving schools. A direct response survey could be administered to determine the characteristics of the individual schools. This type of study could include a qualitative approach to shed light on the practices of individual schools and school leaders.

Another recommendation would be to study changes in digital literacy over a prolonged period of time. Changes from one year to the next can provide beneficial information about technology implementation, but it may be useful to examine the results of research conducted over increased time periods. Additionally, it may prove beneficial to study the Texas Teacher STaR Chart.

Finally, another area in need of study is students' actual knowledge and understanding of digital literacy skills. A study that measures critical thinking skills as they relate to digital literacy could shed light on the *plugged-in brain* discussed by several researchers and theorists (Armstrong & Warlick, 2006; Jones-Kavalier & Flannigan, 2006; Prensky, 2001a, 2001b, 2002, 2005; Warlick, 2007). Furthermore, a study that determined the source of digital literacy skills for students might be beneficial.

Summary

Administrators and teachers must adjust to the rapid changes occurring in our world by ensuring that students are prepared for those changes (Battelle, 2007; Fisch, 2006; Friedman, 2005). Digital literacy is a vehicle for creating teaching and learning environments that foster the skills needed to succeed in the world of our future (Fisch; Warlick, 2007). Fostering these skills in schools is expected to facilitate increased student achievement and motivation and encourage creativity (Butzin, 2000; Mann, Shakeshaft, Becker, & Kottkamp, 1999; Matthewman & Triggs, 2004).

Blackall (2006) wrote that,

educational organisations need to be able to respond to current and future literacy needs in their communities, and be in a position to both recognise and take advantage of the new opportunities for learning. (¶ 56)

School leaders in Texas, the United States, and throughout the world must facilitate the rise of schools to meet that level of expectation.

REFERENCES

- Alper, M. (2003). Mission possible: Creating technology infrastructure to help reduce administrative costs. *Managed Care Quarterly*, 11(3), 11-14.
- Apple, M. W., & Beane, J. A. (1995). *Democratic schools*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Armstrong, S., & Warlick, D. (2004, September). The new literacy. *Tech-learning: The Resource or Technology Education*. Retrieved September 2, 2007, from <http://www.techlearning.com/showArticle.jhtml?articleID=47102021>
- Atkins, N. E., & Vasu, E. S. (2000). Measuring knowledge of technology usage and stages of concern about computing: A study of middle school teachers. *Journal of Technology and Teacher Education*, 8(4), 279-302.
- Battelle, J. (2007, February). A brief interview with Micheal Wesch (the creator of that wonderful video...). *John Battelle's Searchblog*. Retrieved September 28, 2008, from <http://battellemedia.com/archives/003386.php>
- Bawden, D. (2001) Information and digital literacies: A review of concepts. *Journal of Documentation*, 57(2), 218-259.
- Baylor, R., & Ritchie, D. (2002). What factors facilitate teacher skill, teacher morale, and perceived student learning in technology-using classrooms? *Computers & Education*, 39(4), 395-414.
- Becker, H. J. (1994). How exemplary computer-using teachers differ from other teachers: Implications. *Journal of Research on Computing in Education*, 26(3), 291-322.
- Becker, K. (2007). Digital game-based learning once removed: Teaching teachers. *British Journal of Educational Technology*, 38(3), 478-488.
- Bennet, S., Maton, K., & Kervin, L. (2008). The 'digital natives' debate: A critical review of the evidence. *British Journal of Educational Technology*, 39(5), 775-786.
- Biggers, D. (2001). The argument against Accelerated Reader. *Journal of Adolescent & Adult Literacy*, 45(1), 72-75.
- Blackall, L. (2005). Digital literacy: How it affects teaching practices and networked learning futures: A proposal for action research. *International Journal of Instructional Technology & Distance Learning*, 2(12), 3-20. Retrieved February 1, 2009, from www.itdl.org/journal/dec_05/dec_05.pdf
- Bloomfield, D. (1999). Life imitates Pokemon: The virtues and necessities of technology-based peer education in today's schools. *Social Policy*, 30(1), 13-19.

- Bly, C. S. (1993). *Technology-related staff development: Teacher concerns and perceptions*. Ed.D. dissertation, University of La Verne, United States-California. Retrieved November 9, 2008, from Dissertations & Theses: Full Text database. (Publication No. AAT 9407207).
- Bradshaw, L. K. (2002). Technology for teaching and learning: Strategies for staff development and follow-up support. *Journal of Technology and Teacher Education, 10*(1), 131-150.
- Brooks, K., Schiraldi, V., & Zeidenberg, J. (2000). *School house hype: Two years later*. San Francisco: Center on Juvenile and Criminal Justice.
- Brown, D., & Warschauer, M. (2006). From the university to the elementary classroom: Students' experiences in learning to integrate technology in instruction. *Journal of Technology and Teacher Education, 14*(3), 599-621.
- Butzin, S. M. (2000). Project CHILD: A decade of success for young children. *Technology Horizons in Education Journal, 27*(11). Retrieved August 4, 2008, from <http://www.thejournal.com/articles/14835>
- Carlson, D., Ehrlich, N., Berland, B. J., & Bailey, N. (2001). *Assistive technology survey results: Continued benefits and needs reported by Americans with disabilities*. Washington, DC: U.S. Department of Education.
- Carvin, A. (2000). Mind the gap: The digital divide as the civil rights issue of the new millennium. *MultiMedia Schools, 7*(1), 56-58.
- Cawelti, G. (1989). Designing high schools for the future. *Educational Leadership, 7*(1), 30-35.
- CEO Forum on Education & Technology. (2001). *The CEO forum STaR chart: A tool for accessing school technology and readiness*. Washington, DC: Author.
- CEO Forum on Education & Technology. (2000). *Teacher preparation STaR chart: A self-assessment tool for colleges of education*. Washington, DC: Author.
- Chandra, V., & Lloyd, M. (2008). The methodological nettle: ICT and student achievement. *British Journal of Educational Technology, 39*(6), 1087-1098.
- Cisco Systems. (2008). *Voice and unified communications*. Retrieved November 7, 2008, from <http://www.cisco.com/en/US/products/sw/voicesw/index.html>
- Cohen, D. (1988). Educational technology and school organization. In R. S. Nickerson & P. P. Zoghbiates (Eds.), *Technology in education: Looking toward 2020*. (pp. 231-264). Hillsdale, NJ: Erlbaum.

- Coley, R., Cradler, J., & Engel, P. K. (1997). *Computers and classrooms: The status of technology in U.S. schools*. Princeton, NJ: Educational Testing Service.
- Collins, A. (1991). The role of computer technology in restructuring schools. *Phi Delta Kappan*, 73(1), 28-36.
- Cuban, L. (2001). *Oversold and underused: Reforming schools through technology, 1980-2000*. Cambridge, MA: Harvard University Press.
- Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Education Research Journal*, 38(4), 813-834.
- Dai, Q., Kauffman, R. J., & March, S. T. (2007). Valuing information technology infrastructures: a growth options approach. *Information Technology and Management*, 8(1), 1-17.
- DeBell, M., & Chapman, C. (2006, September). *Computer and internet use by students in 2003: A statistical report*. Washington, DC: U.S. Department of Education, Institute of Education Sciences.
- Dede, C. (2000). Emerging influences of information technology on school curriculum. *Journal of Curriculum Studies*, 32(2), 281-303
- Derer, K., Polsgrove, L., & Rieth, H. (1996). A survey of assistive technology applications in schools and recommendations for practice. *Journal of Special Education Technology*, 13(2), 62-80.
- Donovon, L., Hartley, K., & Strudler, N. (2007). Teacher concerns during initial implementation of a one-to-one laptop initiative at the middle school level. *Journal of Research on Technology in Education*, 39(3), 263-286.
- Driscoll, M. (2001). Computers for what? Examining the roles of technology in teaching and learning. *Educational Research and Evaluation*, 7(2/3), 335-349.
- Dugger, J., & Johnson, D. (1992). A comparison of principles of technology and high school physics student achievement using a principles of technology achievement test. *Journal of Technology Education*, 4(1), 18-25.
- Dunleavy, M., Dextert, S., & Heinecke, W. F. (2007). What added value does a 1:1 student to laptop ratio bring to technology-supported teaching and learning? *Journal of Computer Assisted Learning*, 23(5), 440-452.

- Dynarski, M., Agodini, R., Heaviside, S., Novak, T., Carey, N., Campuzano, L., et al. (2007). *Effectiveness of reading and mathematics software products: Findings from the first student cohort*. Washington, DC: U.S. Department of Education, Institute of Education Sciences.
- Earle, R. S. (2002). The Integration of instructional technology into public education: Promises and challenges. *Educational Technology*, 42(1), 5-13.
- EdTech Action Network. (2008). *Why technology in schools?* Retrieved October 14, 2008, from http://www.edtechactionnetwork.org/technology_schools.html
- Esperon, C. (2005, November 14). Using email for successful business communication. *Associated Content*. Retrieved November 7, 2008, from http://www.associatedcontent.com/article/11428/using_email_for_successful_business.html
- Fairman, J. (2004). *Trading roles: Teachers and students learn with technology*. The University of Maine: Maine Education Policy Research Institute. Retrieved September 2, 2007, from <http://www.state.me.us/mlte/resources/research.htm>
- Fisch, K. (2006, August 15). *Did you know?* [PowerPoint]. Retrieved August 1, 2008, from <http://www.lps.k12.co.us/schools/arapahoe/fisch/didyouknow/didyouknow.ppt>
- French, J. R. P., & Raven, B. H. (1968). Bases of social power. In D. Cartwright and Zander (Eds.), *Group dynamics: Research and theory* (pp. 259-270). New York: Harper & Row.
- Friedman, T. (2005). *The world is flat*. New York: Farrar, Straus, and Giroux.
- Gardner, B. (1997). Students click with learning. *NEA Today*, 16(3), 19.
- Garthwait, A., & Weller, H. G. (2005). A year in the life: Two seventh grade teachers implement one-to-one computing. *Journal of Research on Technology in Education*, 37(4), 361-377.
- Gregoire, R., Bracewell, R., & Laferriere, T. (1996). *The contribution of new technologies to learning and teaching in elementary and secondary schools*. Retrieved September 20, 2005, from <http://www.tact.fse.ca>
- Harter, C. L., & Harter, J. F. (2004). Teaching with technology: Does access to computer technology increase student achievement? *Eastern Economic Journal*, 40(4), 507-514.

- Hartnell-Young, E. (2006). Teachers' roles and professional learning in communities of practice supported by technology in schools. *Journal of Technology and Teacher Education, 14*(3), 461-480.
- Healy, J. (1999). Why slow down the rush toward school computers? *Education Digest, 65*(3), 32-37.
- Hinton, P. R., Brownlow, C., McMurray, I., & Cozens, B. (2004). *SPSS explained*. London: Psychology Press.
- Hodas, S. (1993). Technology refusal and the organizational culture of schools. *Education Policy Analysis Archives, 1*(10). Retrieved September 25, 2005, from <http://epaa.asu.edu/epaa/v1n10.html>
- Hoffman, D. L., & Novak, T. P. (1998). Bridging the digital divide: The impact of race on computer access and internet use. *Science, 280*(5362), 390-391.
- Hohlfeld, T. N., Ritzhaupt, A. D., Barron, A. E., & Kemker, K. (2008). Examining the digital divide in K-12 public schools: Four-year trends for supporting ICT literacy in Florida. *Computer & Education*, Retrieved August 1, 2008, from <http://dx.doi.org/10.1016/j.compedu.2008.04.002>
- Hsieh, P., Cho, Y., Liu, M., & Schallert, D. L. (2008). Examining the interplay between middle school students achievement goals and self-efficacy in a technology-enhanced learning environment. *American Secondary Education, 36*(3), 33-50.
- Hurst, M. (2005). Schools eye future costs. *Education Week, 24*(35), 34-39.
- Jaber, W., & Moore, D. (1999). A survey of factors which influence teachers' use of computer-based technology. *International Journal of Instructional Media, 26*(3), 253-267.
- Jonassen, D. H. (1990). Thinking technology: Toward a constructivist view of instructional design. *Educational Technology, 30*(9), 32-34.
- Jones-Kavalier, B. R., & Flannigan, S. L. (2006). Connecting the digital dots: Literacy of the 21st century. *EDUCAUSE Quarterly, 29*(2), 8-10.
- Judson, E. (2006). How teachers integrate technology and their beliefs about learning: Is there a connection? *Journal of Technology and Teacher Education, 14*(3), 581-597.
- Kendal, M., & Stacey, K. (2001). The impact of teacher privileging on learning differentiation in technology. *International Journal of Computers for Mathematical Learning, 6*(2), 143-165.

- Krashen, S. (2003). The (lack of) experimental evidence supporting the use of Accelerated Reader. *Journal of Children's Literature*, 29(2), 16-30.
- Kulik, C., & Kulik, J. (1994). Meta-analytic studies of findings on computer-based instruction. In Baker, E. L. and O'Neill, H. F. (Eds.) *Technology Assessment in Education and Training*. Hillsdale, NJ: Lea Publishers.
- Kurzweil Educational Systems. (2008). *Kurzweil educational systems*. Bedford, MA: Author. Retrieved August 11, 2008, from <http://www.kurzweilededu.com>
- Lahm, E. A. (2003). Assistive technology specialists: Bringing knowledge of assistive technology to school districts. *Remedial and Special Education*, 24(3), 141-154.
- Latham, A. (1999). Computers and achievement. *Educational Leadership*, 56(5), 87-88.
- Lei, J., & Zhao, Y. (2007). Technology uses and student achievement: A longitudinal study. *Computers & Education*, 49(2), 284-296.
- Li, Q. (2007). Student and teachers views about technology: A tale of two cities? *Journal of Research on Technology in Education*, 39(4), 377-397.
- Mageau, T. (1995). Counting toward 2000. *Electronic Learning*, 15(3), 12-13.
- Mann, D. (2001). Documenting the effects of instructional technology, a fly-over of policy questions. In W. F. Heineke & L. Blasi (Eds), *Research methods for educational technology; methods of evaluating educational technology, Vol. 1* (pp. 239–249). Greenwich, CT: Information Age.
- Mann, D., Shakeshaft, C., Becker, J., & Kottkamp, R. (1999). *Achievement gains from a statewide comprehensive instructional technology program*. Santa Monica, CA: Milken Family Foundation.
- Matthewman, S., & Triggs, P. (2004). 'Obsessive compulsive font disorder': the challenge of supporting pupils writing with the computer. *Computers & Education*, 43(1-2), 125-135.
- Matzen, N. J., & Edmunds, J. A. (2007). Technology as a catalyst for change: The role of professional development. *Journal of Research on Technology in Education*, 39(4), 417-430.
- Mayo, N., Kajs, L., & Tanguma, J. (2005). Longitudinal study of technology training to prepare future teachers. *Educational Research Quarterly*, 29(1), 3-15.
- McCannon, M., & Crews, T. (2000). Assessing the technology needs of elementary school teachers. *Journal of Technology and Teacher Education*, 8(2), 111-121.

- Means, B., Blando, J., Olson, K., Middleton, T., Morocco, C. C., Remz, A. R., & Zorfass, J. (1993). *Using technology to support education reform*. Washington, DC: U.S. Government Printing Office.
- Means, B., & Olson, K. (1997). *Technology and education reform*. Washington, DC: U.S. Department of Education.
- Mergendoller, J. (1996). Moving from technological possibility to richer student learning: Revitalized infrastructure and reconstructed pedagogy. *Educational Researcher*, 25(8), 43-46.
- Middleton, B. M., & Murray, R. K. (1999). The impact of instructional technology on student academic achievement in reading and mathematics. *International Journal of Instructional Media*, 26(1), 109-117.
- Milner, J. (2005). VoIP to the rescue. *Technology Horizons in Education Journal*, 33(5), 30-35.
- Milone, M. (2000). Special teachers for special needs. *Technology & Learning*, 20(9), 40.
- Milone, M., & Salpeter, J. (1998). Aiming high. *Technology & Learning*, 18(8), 46-52.
- Mistler-Jackson, M., & Songer, N. B. (2000). Student motivation and internet technology: Are students empowered to learn science? *Journal of Research in Science Teaching*, 37(5), 459-479.
- Moss, M. L., & Townsend, A. M. (2000). The Internet backbone and the American metropolis. *The Information Society*, 16, 35-47.
- Newmann, F. M., Bryk, A. S., & Nagaoka, J. K. (2001, January). *Authentic intellectual work and standardized tests: Conflict or coexistence?* Chicago: Consortium on Chicago School Research.
- Newman, J. (2000). Following the yellow brick road. *Phi Delta Kappan*, 81(10), 774.
- No Child Left Behind Act of 2001, Pub. Law No. 107-110.
- Northeast and the Islands Regional Technology in Education Consortium. (2002). *Steps to increase accessibility*. Retrieved August 4, 2008, from <http://www.neirtec.org/products/techbriefs/3.htm>
- Oppenheimer, T. (2007). Selling software. *Education Next*, 7(2), 23-29.
- Oppenheimer, T. (2003). *The flickering mind: The false promise of technology in the classroom and how learning can be saved*. New York: Random House.

- Oppenheimer, T. (1997, July). The computer delusion. *The Atlantic Monthly*, 280(1), 45-62.
- Owen, P. S., & Demb, A. (2004). Change dynamics and leadership in technology implementation. *The Journal of Higher Education* 75(6), 636-665.
- Prensky, M. (2005). Listen to the natives. *Educational Leadership*, 63(4), 8-13.
- Prensky, M. (2002). Open collaboration: Finding and polishing “hidden gems.” *On the Horizon*, 10(3), 1-7.
- Prensky, M. (2001a). Digital natives, digital immigrants. *On the Horizon*, 9(5), 1-2.
- Prensky, M. (2001b). Do they really think differently? *On the Horizon*, 9(6), 1-7.
- Raptor Technologies. (2008). *V-soft*. Houston, TX: Author. Retrieved November 7, 2008, from <http://www.raptorware.com>
- Ravitz, J. L., Becker, H. J., & Wong, Y. (2000). *Constructivist-compatible beliefs and practices among U.S. teachers*. Irvine, CA: Center for Research on Information Technology and Organizations, University of California, Irvine, and the University of Minnesota.
- Ringstaff, C., Sandholtz, J., & Dwyer, D. (1991). *Trading places: When teachers utilize student expertise in technology-intensive classrooms*. Paper presented at the Annual Conference of the American Educational Research Association, Chicago.
- Rivero, V. (2005). Teaching in transition: Teachers need training – And tech tools that work. *American School Board Journal*, 192(9), 36-38.
- Rivoltella, P. C. (2008). *Digital literacy: Tools and methodologies for information society*. Hershey, PA: Idea Group.
- Roberts, D. F., Foehr, U. G., & Rideout, V. (2005). *Generation M: Media in the lives of 8-18 year-olds*. Washington, DC: Kaiser Family Foundation.
- Rogers, P. L. (2000). Barriers to adopting emerging technologies in education. *Journal of Educational Computing Research*, 22(4), 455-472.
- Roschelle, J., Penuel, W. R., & Abrahamsom, L. (2004). The networked classroom. *Educational Leadership*, 61(5), 50-54.
- Roth, W. (1999). Computers can individualize learning and raise group-interaction skills. *Education Digest*, 65(3), 27-32.

- Schacter, J. (1999). *The impact of education technology on student achievement: What the most current research has to say*. Santa Monica: Milken Exchange on Education Technology.
- Schmoker, M. (2006). *Results now: How we can achieve unprecedented improvements in teaching and learning*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Seels, B. B., & Richey, R. C. (1994). *Instructional technology: The definition and domains of the field*. Washington, DC: Association for Educational Communications and Technology.
- Shackel, B. (2004). A user's experience. *British Journal of Educational Technology*, 35(5), 645-656.
- Shinohara, M., Wenn, R., & Sussman, A. (Eds.). (1996). *Tales from the electronic frontier: First-hand experiences of teachers and students using the internet in k-12 math and science*. San Francisco: WestEd.
- Sivin-Kachala, J. (1998). *Report on the effectiveness of technology in schools, 1990-1997*. Washington, DC: Software Publisher's Association.
- Slavin, R. (1980). Cooperative learning. *Review of Educational Research*, 50(2), 315-342.
- Snoeyink, R., & Ertmer, P. (2002). Thrust into technology: How veteran teachers respond. *Journal of Educational Technology System*, 30(1), 85-111.
- Spires, H. A., Lee, J. K., Turner, K. A., & Johnson, J. (2008). Having our say: Middle grade student perspectives on school, technologies, and academic engagement. *Journal of Research on Technology in Education*, 40(4), 497-515.
- Stetson, R., & Bagwell, T. (1999). Technology and teacher preparation: An oxymoron? *Journal of Technology and Teacher Education*, 7(2), 145-152.
- Stover, D. (1999, May). No hiding technology's hidden costs. *The Education Digest*, 64(9), 36-38.
- Swain, C., & Pearson, T. (2003). Educators and technology standards: Influencing the digital divide. *Journal on Research on Technology in Education*, 34(3), 326-335.
- Taylor, A. (2008, November 6). Sheriff's office award 'secure our schools' grant. *Greene County Record*. Retrieved November 7, 2008, from http://www.greene-news.com/gcn/news/local/article/sheriffs_office_awarded_secure_our_schools_grant/30882/

- Texas Education Agency. (2008a). *Assessment and testing*. Retrieved August 12, 2008, from <http://www.tea.state.tx.us/assessment.html>
- Texas Education Agency. (2008b). *Instructional materials and educational technology*. Retrieved August 4, 2008, from <http://www.tea.state.tx.us/imet/>
- Texas Education Agency. (2008c). *Performance reporting*. Retrieved August 4, 2008, from <http://www.tea.state.tx.us/perfreport/>
- Texas Education Agency. (2008d, May). The basics: Base indicators. In *Accountability Manual* (pp. 11-22). Austin, TX: Author. Retrieved November 20, 2008, from <http://www.tea.state.tx.us/perfreport/account/2008/manual/ch02.pdf>
- Texas Education Agency. (2007, May). The basics: Base indicators. In *Accountability Manual* (pp. 11-22). Austin, TX: Author. Retrieved November 20, 2008, from <http://www.tea.state.tx.us/perfreport/account/2007/manual/ch02.pdf>
- Texas Education Agency. (2006a). *Texas campus STaR chart: A tool for planning and assessing school technology and readiness*. Austin, TX: Author.
- Texas Education Agency. (2006b, May). The basics: Base indicators. In *Accountability Manual* (pp. 11-22). Austin, TX: Author. Retrieved November 20, 2008, from <http://www.tea.state.tx.us/perfreport/account/2006/manual/ch2.pdf>
- Texas Education Agency. (2005, June). The basics: Base indicators. In *Accountability Manual* (pp. 11-22). Austin, TX: Texas Education Agency. Retrieved November 20, 2008, from <http://www.tea.state.tx.us/perfreport/account/2005/manual/chapter2.pdf>
- Texas Education Agency. (2004). *Section V: Responsibilities and Consequences*. Austin, TX: Author. Retrieved March 1, 2009, from <http://ritter.tea.state.tx.us/perfreport/account/2004/manual/sec05.html>
- Trotter, A. (2007). Major study on software stirs debate. *Education Week*, 26(32), 1-18.
- U.S. Department of Education. (2003). *Internet access soars in schools, but "digital divide" still exists at home for minority and poor students*. Washington, DC: Author.
- Venezky, R. L. (2004). Technology in the classroom: Steps toward a new vision. *Education, Communication & Information*, 4(1), 3-21.
- Warlick, D. (2007). Literacy in the new information landscape. *Library Media Connection*, 26(1), 20-21.

- Warnick, B. R. (2007). Surveillance cameras in school: An ethical analysis. *Harvard Educational Review, 77*(3), 317-393.
- Warschauer, M. (2003). *Technology and equity: A comparative study*. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.
- Wells, J., Lewis, L., & Greene, B. (2006). *Internet access in U.S. public school and classrooms: 1994-2005*. U.S. Department of Education. Washington, DC: National Center for Education Statistics.
- Williams, S., & Kingham, M. (2003). Infusion of technology into the curriculum. *Journal of Instructional Psychology, 30*(3), 178-184.
- Willis, D. (2003). Where do your IT dollars go? *Network computing, 14*(17), 12.
- Wright, M. (2008, September 18). School officials press for security, safety bond. *Anchorage Daily News*. Retrieved November 6, 2008, from <http://www.adn.com/news/alaska/matsu/story/530512.html>

APPENDICES

APPENDIX A

Internal Review Board Approval



The University of Oklahoma
OFFICE FOR HUMAN RESEARCH PARTICIPANT PROTECTION

IRB Number: 12421
Category: 4
Approval Date: January 30, 2009

February 03, 2009

Brian Brown
Educational Leadership and Policy Studies
820 Van Fleet Oval, ECH 227
Norman, OK 73019

Dear Mr. Brown:

RE: An Examination of the Relationship Between Digital Literacy and Student Achievement in Texas Elementary Schools.

On behalf of the Institutional Review Board (IRB), I have reviewed the above-referenced research project and determined that it meets the criteria in 45 CFR 46, as amended, for exemption from IRB review. You may proceed with the research as proposed. Please note that any changes in the protocol will need to be submitted to the IRB for review as changes could affect this determination of exempt status. Also note that you should notify the IRB office when this project is completed, so we can remove it from our files.

If you have any questions or need additional information, please do not hesitate to call the IRB office at (405) 325-8110 or send an email to irb@ou.edu.

Cordially,



Donald Baker, Ph.D.

Vice Chair, Institutional Review Board

Ltr_Prot_Fappv_X

660 Parrington Oval, Suite 316, Norman, Oklahoma 73019-3085 PHONE: (405) 325-8110 FAX:(405) 325-2373



APPENDIX B

Permission to Reprint the Texas Campus
School Technology and Readiness (STaR) Chart

Subject: Request to use Texas STAAR Chart Permission-Brian Brown, Doctoral Candidate
From: "Copyrights" <Copyrights@tea.state.tx.us>
Date: Tue, 24 Feb 2009 13:37:55 -0600
To: "Brian B." <edtecher@gmail.com>

This email and any attachments are intended only for the confidential use of the designated recipients, and may constitute a privileged communication. If you have received this message in error, please notify me immediately by telephone at the below phone number or by return email. Thank you.

LICENSE AGREEMENT AND PERMISSION:

To: Brian Brown
2100 Independence Drive
Melissa, TX 75454
972-837-4747
469-576-3418
edtecher@gmail.com
Univ. of Oklahoma
College of Education, Department of
Education Leadership & Policy Studies
Under the direction of Dr. Jeffery Maiden (maiden@ou.edu)

You requested to use TEA Copyrighted Material (hereafter called "Materials") identified by you in the below ----original message---- " included below. This Material is owned by TEA. TEA Copyrighted Materials may not be modified in any way in the requested use.

Service to Be Performed Description:

Exactly as described in the "original messages" and described in this document and made a part of this Permission Granted. You are restricted to the use of this Material as identified above and below. The use of the appropriate Copyright Notice shall appear with the use of and or printing of any use of Materials by you. Use " Copyright ©, Texas Education Agency. All rights reserved."

Your use as described immediately above and in the "original message" below is covered by TEA's Copyright and Terms of Service Policy discussed and reprinted below; and, you are granted the right to utilize the Materials with the further terms and conditions, stated within this document. You may not market or sell or give away TEA Material without a license from TEA. You are not allowed to use any of the questions or passages contained within the Grades 9-12 English Language Arts portion of the TAKS due to Permission restrictions.

Performance of the Service to Be Performed Description indicates "Acceptance" of this License's terms and conditions: If you perform your activity as described in this License/Permission, then you have agreed to the terms and conditions listed within this License. Any future replication of this activity described in the Service to Be Performed Description section above and below does require further communication with TEA. Any future changes that modify the terms and conditions or Service to Be Performed Description above and below stated will require you to contact TEA at Copyrights@tea.state.tx.us .

Royalty Payment: None.

License Period:

Expires on August 31, 2010; however, any future changes that modify the terms and conditions or Service to Be Performed Description above stated will require you to contact TEA at Copyrights@tea.state.tx.us for continuance. Please contact TEA ninety (90) days prior to the expiration of this License/Permission if you choose to request a renewal.

Limitation on Number of Copies Produced:

Limited to a circulation count reasonable for the distribution activity/availability for dissertations as described in below and incorporated email.

TEA Copyright and Terms of Service:

"Copyright © Texas Education Agency. All rights reserved" ". "The materials found on this website are copyrighted © and trademarked ™ as the property of the Texas Education Agency and may not be reproduced without the express written permission of the Texas Education Agency, except under the following conditions:

- 1) Texas public school districts, charter schools, and Education Service Centers may reproduce and use copies of the Materials and Related Materials for the districts' and schools' educational use without obtaining permission from the Texas Education Agency;
- 2) Residents of the state of Texas may reproduce and use copies of the Materials and Related Materials for individual personal use only without obtaining written permission of the Texas Education Agency;
- 3) Any portion reproduced must be reproduced in its entirety and remain unedited, unaltered and unchanged in any way except as allowed in the Permission discussed above;
- 4) No monetary charge can be made for the reproduced materials or any document containing them; however, a reasonable charge to cover only the cost of reproduction and distribution may be charged.

Private entities or persons located in Texas that are not Texas public school districts or Texas charter schools or any entity, whether public or private, educational or non-educational, located outside the state of Texas MUST obtain written approval from the Texas Education Agency and will be required to enter into a license agreement that may involve the payment of a licensing fee or a royalty fee." Please contact Copyrights@tea.state.tx.us with questions."

Please contact TEA with any further questions **and acknowledge receipt of this License Agreement/Permission by return email** at Copyrights@tea.state.tx.us . Thanks,

Richard "Dick" Jarrell
Office of Intellectual Property
Texas Education Agency
512-463-9270
Copyrights@tea.state.tx.us
Richard.Jarrell@tea.state.tx.us

> -----Original Message-----
> From: Brian B. [<mailto:edtecher@gmail.com>]
> Sent: Monday, February 16, 2009 10:48 PM
> To: Jarrell, Dick
> Subject: Reproduction of Texas STaR Chart Permission
>
> Mr. Jarrell,
>
> I am a doctoral candidate at the University of Oklahoma conducting a
> study under the direction of Dr. Jeffery Maiden (maiden@ou.edu)
> utilizing data obtained from the Texas School Readiness and Technology
> (STaR) Chart. I am seeking permission to reproduce the Campus STaR Chart
> instrument within an appendix of my dissertation. Can you assist me with
> contacting the appropriate office or person for obtaining that
> permission?
>
>
> Thank you,
> Brian Brown
> edtecher@gmail.com
> 469-576-3418
>
>

APPENDIX C

Texas Campus School Technology and Readiness (STaR) Chart



C
A
M
P
U
S

C
H
A
R
T

School Technology and Readiness
A Teacher Tool for Planning and Self-Assessing
aligned with the
Long-Range Plan for Technology, 2006-2020

**Instructional Materials and Educational Technology
Division
Texas Education Agency**



Texas Campus STaR Chart

Table of Contents

Letter to All Texas Administrators.....	1
A Tool for Planning and Assessing.....	2
Completing a Texas Campus STaR Chart Profile.....	3
SBEC Technology Applications Standards.....	3
The Texas Challenge	4
Texas Campus STaR Chart: A Tool for Planning and Assessing School Technology and Readiness aligned with the Long-Range Plan for Technology	
Glossary	6
Related Websites	8
Texas Campus STaR Chart Summary	9

www.tea.state.tx.us/starchart

Researchers, technology planning teams, and interested citizens may now review Texas STaR Chart summary data at

www.tea.state.tx.us/starchart/search

To: Administrator Addressed
 From: Anita Givens, Senior Director of Instructional Materials and Educational Technology
 Subject: The Texas Campus STaR Chart
 Date: Fall 2006

The Texas Education Agency Educational Technology Advisory Committee (ETAC) developed the Texas **School Technology and Readiness (STaR) Chart**, an online resource tool for self-assessment of your campus' and district's efforts to effectively integrate technology across the curriculum. This rubric serves as the standard for assessing technology preparedness in Texas K-12 schools. This chart has been updated to align with the new *Long-Range Plan for Technology, 2006-2020*.

The *No Child Left Behind Act of 2001*, emphasizes student achievement and assessment of fundamental knowledge and skills. In addition, *No Child Left Behind* requires that students be technology literate by the end of the eighth grade. The required Texas Technology Applications curriculum supports these requirements by focusing on teaching, learning, and integration of digital technology skills across the curriculum at all grade levels. In order to assess progress toward meeting these standards, teachers must complete the Texas Teacher STaR Chart. Campuses and districts must complete the Texas Campus STaR Chart online each year and use the profiles to gauge their progress annually in order to comply with federal and state requirements.

The **Texas Campus STaR Chart** is a tool designed for use in technology planning, budgeting for resources, and evaluation of progress in local technology projects. All applications for state funded technology grants require a completed campus or district Texas STaR Chart profile to be filed with the application as an indicator of current status and progress and as a formative and/or summative evaluation tool. Campuses must retain documentation of supporting data used to complete the chart. The online assessment may be used as a basis for dialogue with staff, administrators, technology directors, school board members and community leaders to plan for future growth. Statewide reports are used to report on progress toward fulfilling the requirements in *No Child Left Behind, Title II, Part D* that all teachers should be technology literate and integrate technology across the curriculum. The legislation also requires that all students should be technology literate by the time they leave the eighth grade.

The **Texas Campus STaR Chart** produces a profile of your campus' status toward reaching the goals of the Long Range Plan for Technology (LRPT) and *No Child Left Behind*. The profile indicators place your campus at one of four levels of progress in each key area of the LRPT: Early Tech, Developing Tech, Advanced Tech, or Target Tech.

The **Texas Public STaR Chart** is an online tool to allow all stakeholders to view the technology readiness of all campuses across the state. The search features enable a variety of reports such as all campuses that are Early or Target Tech in one or more focus areas. Reports may be organized by district, ESC region, legislative district, or campus type. Data is currently available from the Texas Campus STaR Charts completed in 2004, 2005 and 2006. The public site is available at <http://www.tea.state.tx.us/starchart/search>.

The **Texas Teacher STaR Chart** to be completed by individual teachers models and correlates with the Texas Campus STaR Chart and draws measures from a variety of national and state technology guidelines. It establishes a clear framework for measuring how well teachers are prepared to equip students with the knowledge and skills they need to thrive in today's information and communication technologies (ICT) economy. The Teacher STaR Chart has been voluntary since its introduction and over 172,000 teachers completed it in the 2004-2005 school year and more than 175,000 in the 2005-2006 school year. Beginning with the 2006-2007 school year, all Texas teachers are required to complete the online version of the Texas Teacher STaR Chart annually due to new federal reporting requirements in the Annual Mandatory Collection of Elementary and Secondary Education Data for the Education Data Exchange Network.

Please use the data entered by teachers in the Teacher STaR Chart to complete the Campus STaR Chart survey located at <http://www.tea.state.tx.us/starchart>. Use the printed charts, graphs and information as well as reports from the public site to compare your campus' progress to like-sized campuses and to the statewide profile. Your data will be compiled with those of other Texas campuses to provide an overall picture of the state of technology preparedness and implementation in Texas and reported to federal and state policymakers.

The printed version of the Texas Campus STaR Chart materials is provided for your reference.

Texas Campus STaR Chart: A Tool for Planning and Assessing School Technology and Readiness

The Texas Campus STaR Chart has been developed around the four key areas of the *Long-Range Plan for Technology, 2006-2020*: Teaching and Learning; Educator Preparation and Development; Leadership, Administration and Instructional Support; and Infrastructure for Technology. The Texas Campus STaR Chart is designed to help campuses and districts determine their progress toward meeting the goals of the Long-Range Plan for Technology, as well as meeting the goals of their district. The Texas Campus STaR Chart will also assist in the measurement of the impact of federal, state, and local efforts to improve student learning through the use of technology. Data from the chart is used to report progress toward the requirements in *No Child Left Behind, Title II, Part D*.

The Texas Campus STaR Chart Will Help Campuses and Districts Answer Critical Questions

- 1) What are your campus' and district's current educational technology profiles?
- 2) What evidence can be provided to demonstrate their progress is meeting the goals of the Long Range Plan for Technology?
- 3) What areas should your campus and district focus on to improve the level of technology integration to ensure the best possible teaching and learning for all students?

The Texas Campus STaR Chart Can Be Used:

- ★ To create and/or update the district's technology plan.
- ★ To help conceptualize your campus or district vision of technology.
- ★ To set benchmarks and goals. Campuses and districts may use the chart to identify current education technology profiles, establish goals, and monitor progress.
- ★ To measure student and teacher proficiencies with regard to the integration of technology into all content areas.
- ★ By the campus and district to document progress toward meeting *No Child Left Behind, Title II, Part D* requirements for technology literacy for students and teachers as well as technology integration across the curriculum. Our state's definition of technology literate is proficiency in the Technology Applications TEKS for students and the SBEC Technology Applications Standards for teachers.
- ★ To apply for grants. The Texas Campus STaR Chart will help schools identify their educational technology needs as they apply for grants.
- ★ To determine funding priorities. Education administrators and policymakers can use the Texas Campus STaR Chart to determine where to allocate funds.
- ★ To track progress on use of *No Child Left Behind Title II, Part D* formula and discretionary funds.

Texas campuses must complete the survey online and use the profile annually to gauge their progress in integrating technology into the school and aligning with national and state standards. The progress data can be reported to school boards, community groups, campus and district planning committees. Statewide summary data is reported to state and federal policymakers.

Instructions for Completing the Texas Campus STaR Chart Profile

The printed Texas Campus STaR Chart may be used for discussion and collection of data. This chart should be completed online by each campus in the district. The online Texas Campus STaR Chart provides campus and district reports that include charts and graphs. Use the instructions below and those online at the Web site <http://www.tea.state.tx.us/starchart> to develop Campus STaR Chart profiles.

1. Coordinate the completion of your Texas Campus STaR Chart with your district's director of technology and technology leadership team. The campus principal should be identified as the contact person and should enter the campus data and ensure that campus teachers complete the Teacher STaR Chart.
2. The Teacher STaR Chart and Campus STaR Chart are both divided into the four Key Areas of the Long-Range Plan for Technology: Teaching and Learning; Educator Preparation and Development; Leadership, Administration and Instructional Support; and Infrastructure for Technology.
3. Each Key Area is divided into six Focus Areas. Within each Focus Area, indicators are provided for assessing the campus' Level of Progress. It is possible that the campus may have indicators in more than one Level of Progress. Select the one Level of Progress that best describes your campus readiness.
4. The Texas Teacher STaR Chart provides supporting data for the campus chart. The first two areas automatically feed the electronic version of the campus chart. This feature provides valuable information to the campus principal when completing the campus chart. The summary data from the last two areas will also be available to campus administrators and aggregated at the state level but reported separately.
5. After you have filled out the Campus STaR Chart Summary on page 9, register to enter the scores on this summary online at <http://www.tea.state.tx.us/starchart>. Once you have completed the online form you will be able to view and generate summary charts and graphs.

State Board for Educator Certification (SBEC)

Technology Applications Standards for All Teachers

Standard I. All teachers use technology-related terms, concepts, data input strategies, and ethical practices to make informed decisions about current technologies and their applications.

Standard II. All teachers identify task requirements, apply search strategies, and use current technology to efficiently acquire, analyze, and evaluate a variety of electronic information.

Standard III. All teachers use task-appropriate tools to synthesize knowledge, create and modify solutions, and evaluate results in a way that supports the work of individuals and groups in problem-solving situations.

Standard IV. All teachers communicate information in different formats and for diverse audiences.

Standard V. All teachers know how to plan, organize, deliver, and evaluate instruction for all students that incorporates the effective use of current technology for teaching and integrating the Technology Applications Texas Essential Knowledge and Skills (TEKS) into the curriculum.

THE TEXAS CHALLENGE



In order to continue improvements in teaching and learning in Texas, educators must assure that the knowledge and skills students learn match the knowledge and skills needed to live and work in the 21st Century. Accelerating technological change, rapidly accumulating knowledge, increasing global competition, and rising workforce capabilities around the world make the integration of relevant knowledge and skills essential to our students.

The world is different, and never in our history has success of the State and its citizens been so tightly linked to ongoing learning. If the economic, technological, informational, demographic, and political opportunities are to be shared by all Texans, our citizens—and especially our young citizens—must be guaranteed an excellent 21st Century education.

Texas' Long-Range Plan for Technology organizes recommendations for effective integration of technology in schools within four key areas with clear challenges in each area. The areas include: Teaching and Learning, Educator Preparation and Development, Leadership, Administration and Instructional Support, and Infrastructure for Technology.

Challenges in Teaching and Learning

The traditional model of schooling with the teacher choosing what is to be learned and then serving as the source of knowledge as the student acts as the receiver of that knowledge is not adequate for 21st Century, world-class education. Roles of teacher and learner must continue to change. In the Digital Age the sheer volume of information means that Texas students cannot be passive recipients of instruction; rather, Texas students must become active participants in the learning process. It is vitally important that students know how to be sure their sources are credible. It is important that students gain skills for collaboratively constructing, using, and communicating the knowledge they need for a chosen task, project, or other learning pursuit. Learning and teaching must focus on connecting to students' lives and reflect what research reveals about how people learn.

Information and communications technologies (ICT) empower learners to undertake authentic projects for learning and productivity even in early grades. These technologies make possible collaboration of diverse work and learning groups and provide access to rich resources and expertise previously unavailable. Indeed, these technologies enable us to envision learning and student productivity that extend far beyond the walls of the classroom and far beyond the rigidity of traditional school schedules. Our challenge in teaching and learning is to move from the traditional teacher-led learning model to a student-centered collaborative model in order to empower our young citizens to succeed in a global and digital world of information. This transformation is not a simple undertaking, but it is one that must occur if we are to prepare young Texans for their future lives.

"...we must also prepare teachers far differently for significantly different roles, different students, and different tools..."

The landmark *No Child Left Behind, Title II, Part D (NCLB)* Education Technology Program addresses these challenges by setting national goals to improve student academic achievement through the use of technology, ensure that all students become technologically literate by the end of the eighth grade, promote the effective integration of technology into on-going professional development and advance research-based instruction through technology integrated curriculum development.

Challenges in Preparation and Development of Educators

Preparing teachers and administrators to effectively facilitate and manage 21st Century learning in technology and information-rich settings involves radical retooling of the existing professional core of the educational system. Securing time, resources, and effective models for educator professional development presents a tremendous challenge to our state and to the entire nation. Professional development carries the urgent charge of supporting—indeed of catalyzing—the move from traditional schooling to 21st Century education.

As the "baby boom" educators move into retirement, it will be our systems of teacher and administrator preparation that fuel the education of young Texans with qualified and skilled personnel. The number of new teachers and administrators needed within the next decade based on student growth and projected retirement rates is alarming. We must also prepare teachers for significantly different roles, different students, different tools and resources, and different methods of instructing students beyond the face-to-face classroom. This realization presents the PK-12 community and teacher preparation institutions with the greatest challenges in their history.



“Providing essential leadership and instructional support is critical.”

Challenges in Leadership, Administration and Instructional Support

The process of integrating technology in schools, in itself, promotes school reform. It is complex school-wide innovation, and, as such, vision-building, administrator commitment, and skilled leadership play pivotal roles in success. Texas faces a significant challenge in providing visionary school leadership with the necessary background requisite skills to lead and nurture the changes technology brings.

Rapid changes on many fronts make it virtually impossible for any individual within a school system to maintain the necessary knowledge to represent all facets of planning for and implementing technology. For this reason, collaborative and on-going planning consistent with the Long-Range Plan for Technology and articulated with campus and district plans is necessary if schools are to see improved student learning based on data-driven decisions. Fulfilling the vision of technology requires district, campus, and teacher leaders who articulate and advocate a vision of what technology can do for teaching and learning as well as school operations.

Providing the essential leadership and instructional support is critical. Leaders must model the effective use of technologies as well as articulate clear expectations for their faculty and staff. Time for ongoing, sustained professional development must be provided in order to maximize educational benefits from our investment in technology. School decision makers are challenged to budget real costs of technology, both initial and ongoing, and to secure funding to support that budget.

No Child Left Behind, Title II, Part D (NCLB) supports local challenges with a focus on strategic national, state, and local technology planning. Only through data-driven strategic planning process may key success elements such as intensive, sustained, high quality professional development, enhancement of existing technologies and comprehensive data analysis, and communication through technology become reality for each Texas campus.

Challenges in Infrastructure for Technology

Texas has made tremendous strides during the last decade in connecting schools to each other, to external resources, and to the Internet. Texas schools have been fortunate to have the support of the Texas legislature and the federal government in building the technology infrastructure that will allow students and teachers to make use of technology tools that are basic and necessary for education today and

in the future. Challenges clearly remain. Not all districts, campuses, and classrooms have the robust connectivity and tools needed to integrate technology into the teaching and learning process or to deliver online learning experiences to meet individual student needs. Work remains to ensure that connectivity reaches all instructional and professional work areas. Infrastructure capacity must support promising practices in teaching and learning, professional development, school leadership, instructional management, and operations. School infrastructure is aging and requires regular refresh cycles and incorporation of new and emerging technologies to increase effectiveness and efficiency.

Issues of support and maintenance for existing and evolving technologies will test our true commitment to connect schools. Maintaining appropriate funding levels, securing and retaining qualified staff, maintaining the infrastructure, providing upgrades, and greater bandwidth all provide significant challenges for schools.

The infrastructure of a school is the critical element of support for all areas: teaching and learning, educator preparation and development, leadership, administration and instructional support and infrastructure for technology. While school connectivity presents tremendous challenges, implementing that connectivity offers new and exciting opportunities for transforming the institution of schooling.

Summary

Learning for the 21st Century requires new skills, new tools, new online assessments, new knowledge, and new opportunities for when, where, and how learning takes place. Students today must learn different ways to work with tools, different ways to work with information and different ways to work with people. Our students will function in ever-changing and richly workgroups that often cross national boundaries. One of the greatest challenges our schools face is ensuring that each student is equipped to flourish within a wide array of learning and work communities. Today's world demands this environment, and technology facilitates it. Schools must also foster flexibility; for the 21st Century demands that its citizens are able to deal with continuous and significant change. Finally, precisely because of on-going change, Texas students must learn to learn. They must develop skills and habits of learning that will serve them for a lifetime.

“Learning and teaching must be different.”

Glossary

AEIS

Academic Excellence Indicator System; this state data collection system pulls together a wide range of information on the performance of students at each Texas school and district.

Anytime, Anywhere Learning

When learning can occur independent of location or time of day.

Applets

An applet is a small program that extends the capability of an application, particularly a web browser. An applet cannot run by itself, it needs to run within the application program like a browser. Examples include a popup calculator or a popup instant messenger program.

Assistive Technology Device

Any item, piece of equipment or product system, whether acquired commercially off the shelf, modified or customized, that is used to increase, maintain or improve the functional capabilities of children with disabilities.

Bandwidth

The capacity of a network or data connection to transmit data.

Blended Technologies

The combination of two or more different technologies (i.e. Internet, satellite, videoconferencing, and emerging technologies) for effective, interactive communications.

Collaborative Learning

Instructional strategy in which several students and/or teachers work together on an assignment with individuals sharing responsibility for various tasks in an interactive process of ongoing dialogue.

Community of Inquiry

All terms are used interchangeably to identify a group of persons engaged in ongoing dialogue about questions of shared interest or mutual concern for the purpose of generating workable, productive solutions to meaningful problems or adding enhancement to an existing knowledge base related to common interests.

Complex Thinking Strategies

Includes problem solving, decision-making, investigation, and reflective thinking.

Computer

A device that runs programs to display and manipulate text, graphics, symbols, audio, video, and numbers.

Dial-up Connectivity

Computers cabled to a telephone port for Internet connectivity; somewhat slower than a direct connection to the Internet.

Digital Content

Digitized multimedia materials requiring students to manipulate information creatively; may include video, software, websites, simulations, streamed discussion, databases, and audio files.

Direct Connection to the Internet

Computers are connected to the Internet via a telephone line usually leased from the telephone company. At many Texas schools, the connection goes to the Education Service Center and then out to the Internet.

Distance Learning

An educational process delivered and supported by technology in which the teacher and student are in different locations. (Internet, satellite, videoconferencing, and emerging technologies, etc.)

District Information System

A database of district-wide information, which may include student, financial, or other administrative information necessary for local, state, and federal reporting requirements.

Diverse Learning Needs

Learners are unique and learn in different ways; all students must have opportunities to learn in their distinctive styles.

Easy Internet Access

Ready access to a computer connected to the Internet for educator or students' use.

Educator

Professional employee who holds a valid certificate or permit in order to deliver instruction to students; these employees may include classroom teachers, librarians, principals, counselors, or paraprofessionals delivering instruction under the direction of a certified teacher.

Emerging Technologies

Newer, developing technologies; ever changing digital equipment, convergence of technologies.

Higher Level Thinking

Thinking that takes place in the higher levels of the hierarchy of cognitive processing on a continuum from knowledge level to evaluation level (e.g., Bloom's Taxonomy); may include problem solving, decision making, investigation, and reflective thinking.

Inquiry-based Learning

Children learn by generating new hypotheses, by taking risks and by reflecting on their accomplishments and miscues. Children engage in inquiry when they investigate questions or issues they find compelling. These questions or issues may be related to a class theme or concept.

Instructional Setting

Location where teaching and learning takes place.

Integrated/Integration

Use of technology by students and teachers to enhance teaching and learning and to support curricular objectives.

Interactive Communications

Two-way communications that may be synchronous or asynchronous and that are distinguished by mutually active responses. In online learning, interactive communications refers to a learning environment that includes a significant amount of discussion and other forms of communications between teachers and students that are enabled by technology. Examples include an Internet-based listserv, class newsgroups, discussion boards, or chat features.

Internet

Global network of networks that connects worldwide computers through digital systems.

Internet Connected, Multimedia Computer

A computer capable of presenting combinations of text, graphics, animation and streaming audio or video; the computer also should be connected to the Internet.

LAN (Local Area Network)

A network that connects computers in the same building.

Learning Communities

Schools, parents, and community collaborate to meet needs by pooling resources.

Librarians

Campus librarians are included in the term "teacher" used throughout the Texas Teacher STaR Chart.

Local Funding

Funds derived from local budgets, district fees, bond issues, and other local initiatives.

LRPT (Long Range Plan for Technology)

Texas plan for integrating technology into the school system. Four key areas are: Teaching and Learning, Educator Preparation and Development, Leadership, Administration and Instructional Support, and Infrastructure for Technology.

Multimedia

Combining text, graphics, full-motion video, sound and/or combining movies, music, lighting, CD-ROMs, DVDs, and the Internet and/or combining television, radio, print, and the Internet.

Networked Connectivity

Computers are cabled to a data port for sharing files, storing files, printing, and Internet connectivity.

On-Demand Access

Immediate access to technology tools as needed in all campus instructional settings.

Online Databases

Internet accessible databases providing resources such as encyclopedias, periodicals, biographies, timelines, maps and atlases, almanacs, audio clips, video clips, and student and teacher resources.

Online Learning

Sometimes referred to as web-based learning, virtual learning or e-learning. Online learning is a highly interactive form of distance learning that is primarily delivered via the Internet. Content and resources are accessed via the web. Communication, learning activities, and instruction from a teacher take place in a virtual (web-based) environment.

Portable Technologies

Technologies that are lightweight and small enough to carry such as laptop computers, hand-held devices, and PDAs (Personal Digital Assistant).

Print/File Sharing Access

Both files and printers are available from the school or district network.

Problem-Solving Strategies

Process by which learners identify goals and obstacles, identify/research alternative ways to solve the problem, select an alternative based on evaluation criteria, test the alternative, and finally evaluate results.

Professional Development

Also referred to as staff development or in-service training. Includes the National Staff Development Council's major models of professional development: training, observation/assessment, involvement in a development/improvement process, study groups, inquiry/action research, individually guided activities, and mentoring.

Replacement Cycle

School policy for purchase, replacement and upgrade cycle of technology equipment and software.

Rich media

Digital information that includes advanced capabilities such as streaming video, applets, and animation which require more bandwidth and storage than normal text.

SBEC

State Board for Educator Certification.

Seamless Technology Integration

Using technology as a natural tool; used routinely becomes the way work is done.

Software

The programs, routines and symbolic language that control the functioning of a hardware system and especially a computer system, sometimes referred to as a computer program.

State and Federal Funds

State funds such as, but not limited to, the Technology Allotment; federal funds such as, but not limited to, No Child Left Behind and E-Rate.

Streaming Video

Moving images that are sent in a continuous stream and played as it arrives; the web user does not have to wait to download a large file before seeing the video or hearing the sound.

Supplement not Supplant

Additional funds used to provide activities, but not used to replace local, state or federal funds already in place.

Supplemental Applications

Software that adds to or enhances instruction, but may not be required.

Technology Applications / Technology Applications TEKS

Technology Applications is the curriculum area that defines what all students should know and be able to do with technology K-12. Technology Applications Texas Essential Knowledge and Skills are available for Grades K-12.

Technology

Examples: computer workstations, laptop computers, wireless computers, handheld computers, digital cameras, probes, scanners, digital video cameras, analog video cameras, televisions, telephones, VCRs, digital projectors, programmable calculators, interactive white boards.

Technology Accommodation

Ergonomic, accessible office furniture and computer workstation accessories such as keyboards, Braille readers, pointing devices, screen readers, and speech recognition for all learners.

Technology Allotment

State funds provided to Texas school districts to support the goals of the Long Range Plan for Technology. The current level of funding is \$30 per student per year.

Technology Literacy

The ability to responsibly use appropriate technology to communicate, solve problems, and access, manage, integrate, evaluate, and create information to improve learning in all subject areas and to acquire lifelong knowledge and skills in the 21st century. The Technology Applications curriculum defines the technology literacy requirements for students and teachers specified in NCLB Title II, Part D.

Videoconferencing

One method by which distance learning may be delivered. Entails real time (synchronous) instruction via telecommunication lines which enable two-way audio and video interaction between two or more sites, using specialized equipment in a videoconference room or portable videoconference unit.

Video Streaming

Video delivered to the computer desktop; video that can be viewed from the Web in real time.

WAN (Wide Area Network)

A network in which two or more buildings are connected, such as campuses in a district or districts in a region.

Web-based Learning

See Online learning.

Wireless Connectivity

Computers with wireless capabilities to connect to the Internet when located near access points which are connected to the data ports. The computers are not cabled to the data port.

Related Websites

<p>http://www.cosn.org</p>	<p>The Consortium for School Networking promotes the use of telecommunications to improve K-12 Learning. Taking Total Cost of Ownership to the Classroom is one of the many resources available for schools at this site.</p>
<p>http://www.ed.gov</p>	<p>The U. S. Department of Education provides information selected especially for parents, teachers, students and administrators as well as press releases, photos, audio clips and video all in one place—Press Room.</p>
<p>http://www.ed.gov/nclb</p>	<p>The <i>No Child Left Behind Act of 2001</i> is a landmark in education reform designed to improve student achievement and change the culture of America's schools. With passage of No Child Left Behind, Congress reauthorized the <i>Elementary and Secondary Education Act (ESEA)</i>—the principal federal law affecting education from kindergarten through high school. In amending <i>ESEA</i>, the new law represents a sweeping overhaul of federal efforts to support elementary and secondary education in the United States.</p>
<p>http://gief.org</p>	<p>The George Lucas Education Foundation documents and disseminates the stories of exemplary practices in K-12 public education. Over 70 online documentaries showcase imagination and innovation in public schools. Free teaching modules created by professional development experts and education faculty are available at the website.</p>
<p>http://www.iste.org</p>	<p>The International Society for Technology in Education provides major resources for educators who strive to integrate technology with teaching and learning. Standards are available for both students and teachers at this site. The ISITE professional journals detail excellent examples of the integration of technology into the curriculum. Both individual and district memberships are available.</p>
<p>http://www.sbec.state.tx.us</p>	<p>The State Board of Educator Certification site assists educators in planning for quality technology applications professional development programs as well as providing information on certifications for all professional educators.</p>
<p>http://www.nacol.org</p>	<p>The North American Council for Online Learning (NACOL) is dedicated to fostering a learning landscape that promotes student success and lifelong learning. NACOL increases educational opportunities and enhances collegial expertise and leadership in K-12 online teaching and learning.</p>
<p>http://www.21stcenturyskills.org/Route21</p>	<p>A collection of web-based tools designed to support and promote achievement of Information and Communication Technologies (ICT) literacy and 21st century skills. It presents a dynamic look at highlighted examples, resources, recommendations, tools and recommended goals in each of nine key areas that support a coherent framework for 21st century education.</p>
<p>http://www.sbec.state.tx.us</p>	<p>The State Board of Educator Certification site assists educators in planning for quality technology applications professional development programs as well as providing information on certifications for all professional educators.</p>
<p>http://www.sedl.org</p>	<p>The Southwest Educational Development Laboratory (SEDL) solves significant problems facing educational systems and communities to ensure a quality education for all learners. The SEDL work focuses on an integrated program of applied research and development, professional development, assistance and services. SEDL refines work based on new finding from on-going research.</p>
<p>http://www.setda.org</p>	<p>Founded in the fall of 2001, the State Educational Technology Directors Association (SETDA) is the principal association representing the state directors for educational technology. SETDA's goal is to improve student achievement through technology.</p>
<p>http://www.sreb.org/program/EdTech/edtechindex.asp</p>	<p>The Southern Regional Education Board (SREB) Educational Technology Cooperative, comprised of state higher education and K-12 coordinating and governing boards, represents more than 3,300 school districts and nearly 800 colleges and universities in the 13 SREB states, including Texas. It monitors and reports on a wide array of educational technology topics and works with states to use technology wisely.</p>
<p>http://www.tasanet.org</p>	<p>The mission of the Texas Association of School Administrators is to promote, provide, and develop leadership that champions educational excellence.</p>
<p>http://www.tcea.org</p>	<p>The Texas Computer Education Association supports educators in learning about technology and using it in the classroom. As the sponsor of the largest Texas conference focusing on educational technology, the organization's website provides online registration, program information and student and teacher contest information.</p>
<p>http://www.tea.state.tx.us</p>	<p>The Texas Education Agency website provides immediate information needed daily in schools related to a variety of topics, including assessment, curriculum, teacher resources and grant information. Quick links to Education Service Centers and the State Board for Educator Certification are also provided.</p>
<p>http://www.techappsnetwork.org</p>	<p>The Technology Applications Teacher Network is a collaborative project between the 20 Texas Education Service Centers and the Texas Education Agency and is designed to provide Texas teachers with resources to implement the Technology Applications Texas Essential Knowledge and Skills in the K-12 classroom and meet <i>No Child Left Behind, Title II, Part D</i> requirements.</p>
<p>http://tpesc.esc12.net</p>	<p>The Technology Planning & E-Rate Support Center (TPESC) provides assistance and support to Texas public and charter schools in meeting the requirements for participation in the federal Schools and Libraries Universal Service Support Program, better known as E-Rate and in meeting <i>No Child Left Behind, Title II, Part D</i> requirements. TPESC also provides assistance in submission of the online Texas ePlan and the Texas Campus STaR Chart.</p>

The Texas Campus School Technology and Readiness (STaR) Chart

KEY AREA:		TEACHING & LEARNING				
Focus Area:	TL 1	TL 2	TL 3	TL 4	TL 5	TL 6
Levels of Progress:	Patterns of Classroom Use	Frequency/ Design of Instructional Setting Using Digital Content	Content Area Connections	Technology Applications (TA) TEKS Implementation (TAC Chapter 126)	Student Mastery of Technology Applications (TA) TEKS	Online Learning
Early Tech	Teachers primarily use technology to supplement instruction, streamline management functions, and present teacher-centered lectures Students use software for skill reinforcement	Most teachers occasionally use technology to supplement or reinforce instruction in classroom, library, or lab	Most teachers use technology for basic skills with little or no connections with content objectives	K-8 Campuses: Teachers are aware of the TA TEKS and the adopted TA instructional materials 9-12 Campuses: At least 4 high school TA courses are offered	K-8 Campuses: Within each grade level cluster (K-2, 3-5, 6-8), TA TEKS are mastered by up to 25% of the students 9-12 Campuses: TA TEKS are mastered by up to 25% of the students as measured by integration in core classrooms and TA courses	Most teachers use a few web-based learning activities
Developing Tech	Teachers primarily use technology to direct instruction, improve productivity, model technology skills, and direct students in the use of productivity applications for technology integration Students use technology to access, communicate and present information	Most teachers have regular weekly access and use of technology and digital resources for curriculum activities in the classroom, library, or lab	Most teachers use technology to support content objectives	K-8 Campuses: Teachers are aware of the TA TEKS appropriate to content areas and regularly include technology skills in planning and implementing instruction; use adopted TA materials 9-12 Campuses: At least 4 high school TA courses offered and at least 2 taught	K-8 Campuses: Within each grade level cluster (K-2, 3-5, 6-8), TA TEKS are mastered by 26 to 50% of the students 9-12 Campuses: TA TEKS are mastered by 26 to 50% of the students as measured by integration in core classrooms and TA courses	Most teachers customize several web-based lessons which include online TEKS-based content, resources, learning activities and interactive communication that support learning objectives
Advanced Tech	Teachers primarily use technology in teacher-led and some student-centered learning experiences to develop higher-order thinking skills and provide opportunities for collaboration with content experts, peers, parents, and community Students evaluate and analyze data to solve problems	Most teachers have regular weekly access and use of technology and digital resources in various instructional settings such as in classroom, library, lab, or through mobile technology	Most teachers incorporate technology in their subject area TEKS, and classroom applications of technology support the development of higher-order thinking skills and encourage collaboration	K-8 Campuses: Teachers are knowledgeable and consistently use the TA TEKS as appropriate for content area and grade level 9-12 Campuses: At least 4 high school TA courses offered and at least 4 taught	K-8 Campuses: Within each grade level cluster (K-2, 3-5, 6-8), TA TEKS are mastered by 51 to 85% of the students 9-12 Campuses: TA TEKS are mastered by 51 to 85% of the students as measured by integration in core classrooms and TA courses	Most teachers create web-based lessons which include online TEKS-based content, resources, learning activities, and interactive communications that support learning objectives
Target Tech	Teachers seamlessly integrate technology in a student-centered learning environment where technology is used to solve real world problems in collaboration with business, industry, and higher education Learning is transformed as students propose, assess, and implement solutions to problems	Most teachers and students have on-demand access to appropriate technology and digital resources anytime/anywhere for technology integrated curriculum activities on the campus, in the district, at home, or key locations in the community	Most teachers and students seamlessly apply technology across all subject areas to provide learning opportunities beyond the classroom that are not possible without the technology	K-8 Campuses: Teachers are knowledgeable of and seamlessly integrate the TA TEKS as appropriate for content area and grade level 9-12 Campuses: At least 4 high school TA courses offered and at least 4 taught or included as new courses developed as independent study or innovative courses	K-8 Campuses: Within each grade level cluster (K-2, 3-5, 6-8), TA TEKS are mastered by 86 to 100% of the students 9-12 Campuses: TA TEKS are mastered by 86 to 100% of the students as measured by integration in core classrooms and TA courses	Most teachers create and integrate web-based lessons which include online TEKS-based content, resources, learning activities, and interactive communications that support learning objectives throughout the curriculum
Correlation to Teacher STaR Chart	Patterns of Classroom Use	Frequency/Design of Instructional Setting Using Digital Content	Content Area Connections	Technology Applications (TA) TEKS Implementation (TAC Chapter 126)	Student Mastery of Technology Applications (TA) TEKS	Online Learning

The Texas Campus School Technology and Readiness (STaR) Chart

EDUCATOR PREPARATION & DEVELOPMENT					
EP 1	EP 2	EP 3	EP 4	EP 5	EP 6
Content of Professional Development	Models of Professional Development	Capabilities of Educators	Access to Professional Development	Levels of Understanding and Patterns of Use	Professional Development for Online Learning
Most teachers have completed professional development in technology literacy skills, including the Internet, district information systems, and basic software applications	Our campus provides large group professional development sessions that focus on skills development and basic technology integration	Most of the teachers on my campus demonstrate one of the SBEC Technology Applications Standards	Less than 9 hours of technology professional development available per school year for all teachers	Most teachers understand technology basics and how to use teacher productivity tools	Most teachers have participated in professional development on the use of online learning
Most teachers have completed professional development on the integration of technology specific to their content area and to increase productivity to accomplish a variety of instruction and management tasks	Our campus provides large group professional development sessions that focus on increasing teacher productivity and building capacity to integrate technology effectively into content areas, and include follow-up to facilitate implementation	Most of the teachers on my campus demonstrate two to three of the SBEC Technology Applications Standards	9-18 hours of technology professional development available per school year for all teachers	Most teachers adapt technology knowledge and skills for content area instruction	Most teachers have participated in professional development on the customization of online courses or content for appropriate subject area
Most teachers have completed professional development on integration of technology and use of proven strategies that facilitate the development of higher order thinking skills and collaboration with experts, peers, and parents	Our campus provides on-going professional development utilizing multiple staff development models including training, observation/assessment study groups and mentoring	Most of the teachers on my campus demonstrate four SBEC Technology Applications Standards	19-29 hours of technology professional development available per school year for all teachers	Most teachers use technology as a tool in and across content areas to enhance higher order thinking skills	Most teachers have participated in professional development to teach online
Most teachers participate in or mentor others in the development of strategies for creating new learning environments that empower students to think critically to solve real-world problems and collaborate with experts across business, industry and higher education	Our campus promotes anytime, anywhere learning available through a variety of delivery systems including individually guided activities, inquiry/action research, and involvement in a developmental/improvement process	Most teachers on my campus demonstrate all of the SBEC Technology Applications Standards	30 or more hours of technology professional development available per year school year for all teachers	Most teachers create new interactive, collaborative, customized learning environments	Most teachers customize online content and have taught or are teaching content units or courses online
Professional Development Experiences	Models of Professional Development	Capabilities of Educators	Technology Professional Development Participation	Levels of Understanding and Pattern of Use	Capabilities of Educators with Online Learning

The Texas Campus School Technology and Readiness (STaR) Chart

LEADERSHIP, ADMINISTRATION, & INSTRUCTIONAL SUPPORT					
L 1	L 2	L 3	L 4	L 5	L 6
Leadership and Vision	Planning	Instructional Support	Communication and Collaboration	Budget	Leadership and Support for Online Learning
Campus leadership has basic awareness of the potential of technology in education to lead to student achievement	Campus has few technology goals and objectives incorporated in the Campus Improvement Plan	Campus has limited instructional support for the integration and use of technology in content areas	Campus has limited use of technology to communicate with teachers and parents	Campus has limited discretionary funds for implementation of technology strategies to meet goals and objectives outlined in the Campus Improvement Plan	<p>Grades K-8: Campus leadership has basic understanding about the use of online learning</p> <p>Grades 9-12: Online for-credit courses are not available to students to meet individual learning needs</p>
Campus leadership develops a shared vision and begins to build buy-in for comprehensive integration of technology leading to increased student achievement	Campus has several technology goals and objectives that are incorporated in the Campus Improvement Plan	Campus provides regular access to instructional support for the integration and use of technology in content areas.	Campus uses technology for communication and collaboration among colleagues, staff, parents, students and the larger community	Campus discretionary funds and other resources are allocated to advance implementation of some technology strategies to meet goals and objectives outlined in the Campus Improvement Plan	<p>Grades K-8: Campus uses online learning and educators collaborate on the integration of online learning into the curriculum</p> <p>Grades 9-12: Online for-credit courses are available to meet individual needs learning needs in a limited number (1-2) of specific circumstances</p>
Campus leadership communicates and implements a shared vision and obtains buy-in for comprehensive integration of technology leading to increased student achievement	Campus has a technology-rich Campus Improvement Plan along with a leadership team that sets annual technology benchmarks based on SBEC Technology Applications standards	Teacher cadres have been established to create and participate in learning communities that stimulate, nurture, and support faculty in using technology to maximize teaching and learning	Current information tools and systems are used at my campus for communication, management of schedules and resources, performance assessment, and professional development	Campus discretionary funds and other resources are allocated to advance implementation of most of the technology strategies to meet the goals and objectives outlined in the Campus Improvement Plan	<p>Grades K-8: Online learning is encouraged and supported through professional development; goals for the online learning are being developed for the Campus Improvement Plan</p> <p>Grades 9-12: Online for-credit courses are available to students to meet a variety (more than 2) of specific circumstances</p>
Campus leadership promotes a shared vision with policies that encourage continuous innovation with technology leading to increased student achievement	Campus leadership team has a collaborative, technology-rich Campus Improvement Plan that is grounded in research and aligned with the district strategic plan that is focused on student success	Educational leaders and teacher cadres facilitate and support my use of technologies to enhance instructional methods that develop higher-level thinking, decision-making, and problem-solving skills	Campus uses a variety of media and formats, including telecommunications and the school website to communicate, interact, and collaborate with all education stakeholders	Campus discretionary funds and other resources are allocated to advance implementation of all the technology strategies to meet the goals and objectives outlined in the Campus Improvement Plan	<p>Grades K-8: Online learning is facilitated and supported through professional development and integrated into the Campus Improvement Plan</p> <p>Grades 9-12: Online for-credit courses are available to students as desired to meet their individual learning needs</p>
Leadership and Vision	Planning	Instructional Support	Communication and Collaboration	Budget	Leadership and Support for Online Learning

The Texas Campus School Technology and Readiness (STaR) Chart

INFRASTRUCTURE FOR TECHNOLOGY					
INF 1	INF 2	INF 3	INF 4	INF 5	INF 6
Students per Computers	Internet Access Connectivity/ Speed	Other Classroom Technology	Technical Support	Local Area Network Wide Area Network	Distance Learning Capacity
Ten or more students per Internet-connected multimedia computers	Connectivity to the Internet available at the campus level in less than 50% of the rooms, including the library	Shared use of technologies such as computers, digital cameras, classroom phones, flash drives, portable digital devices, probes, interactive white boards, projection systems, classroom sets of graphing calculators	One technical staff to more than 750 computers	LAN/WAN provides teachers and students access to print/file sharing and some shared resources	Access to online learning: text-based with still images and audio
Between 5 and 9 students per Internet-connected multimedia computer	Direct connectivity to the Internet available at the campus in at least 50% of the rooms, including the library	Dedicated computer per educator with shared use of technologies such as digital cameras, classroom phones, flash drives, portable digital devices, probes, interactive white boards, projection systems, and classroom sets of graphing calculators	At least one technical staff to 501-750 computers	At least half the rooms connected to the LAN/WAN with access for teachers and students to print/file sharing, multiple applications and district servers	Scheduled access to online learning with rich media such as streaming video, podcasts, applets, animation, etc.
Four or less students per Internet-connected multimedia computer	Direct connectivity to the Internet available at the campus in at least 75% of the rooms, including the library	Dedicated computer per educator with assigned use of technologies such as digital cameras, classroom phones, flash drives, portable digital devices, probes, interactive white boards, projection systems, and classroom sets of graphing calculators	At least one technical staff to 351-500 computers	Broadband access to the campus with most rooms connected to the LAN/WAN with access for teachers and students to print/file sharing, and district-wide resources on the campus network.	Simultaneous access to online learning with rich media such as streaming video, podcasts, applets, animation, etc.
All students have 1 to 1 access to Internet-connected multimedia computers when needed	Direct connectivity to the Internet available in all rooms with adequate bandwidth	Fully equipped classrooms with readily available technology to enhance student instruction, including all the above as well and emerging technologies	At least one technical staff to 350 or less computers	All rooms connected to a robust LAN/WAN that allows for easy access to multiple district-wide resources for students, teachers, and administrators, such as video streaming, desktop videoconferencing, online assessment and data access	Simultaneous access to online learning with rich media such as streaming video, podcasts, applets, and animation, and sufficient bandwidth and storage to customize online instruction
Students per Classroom Computers	Internet Access Connectivity Speed Classroom Technology	Classroom Technology	Technical Support	Local Area Network Wide Area Network	Distance Learning Capacity

Texas Campus STaR Chart Summary

Using the Texas Campus STaR Chart, select the cell in each category that best describes the campus.
Enter the corresponding number in the chart below using this scale:

1 = Early Tech 2 = Developing Tech 3 = Advanced Tech 4 = Target Tech

Key Area I: Teaching and Learning

TL1 Patterns of Classroom Use	TL2 Frequency/Design of Instructional Setting	TL3 Content Area Connections	TL4 Technology Applications (TA) TEKS Implementation	TL5 Student Mastery of Technology Applications	TL6 Online Learning	*Total

Key Area II: Educator Preparation and Development

EP1 Professional Development Experiences	EP2 Models of Professional Development	EP3 Capabilities of Educators	EP4 Access to Professional Development	EP5 Levels of Understanding and Patterns of Use	EP6 Professional Development for Online Learning	*Total

Key Area III: Leadership, Administration and Instructional Support

L1 Leadership and Vision	L2 Planning	L3 Instructional Support	L4 Communication and Collaboration	L5 Budget	L6 Leadership and Support for Online Learning	*Total

Key Area IV: Infrastructure for Technology

INF1 Students per Computers	INF2 Internet Access Connectivity Speed	INF3 Other Classroom Technology	INF4 Technical Support	INF5 Local Area Network Wide Area Network	INF6 Distance Learning Capacity	*Total

Key Area Summary

Copy your Key Area totals into the first column below and use the Key Area Rating Range to indicate the Key Area rating for each category.

Key Area	*Key Area Total	Key Area STaR Classification
I. Teaching and Learning (6-8 Early Tech)	9-14 Developing Tech	15-20 Advanced Tech 21-24 Target Tech
II. Educator Preparation and Development (6-8 Early Tech)	9- 4 Developing Tech	15-20 Advanced Tech 21-24 Target Tech
III. Leadership, Administration & Instructional Support (6-8 Early Tech)	9-14 Developing Tech	15-20 Advanced Tech 21-24 Target Tech
IV. Infrastructure for Technology (6-8 Early Tech)	9-14 Developing Tech	15-20 Advanced Tech 21-24 Target Tech

Campus Name: _____ County/District/Campus Number: _____

School Year: _____ Completion Date: _____

Completed by: _____ Email: _____

Please go to the online Texas Campus STaR Chart (www.tea.state.tx.us/starchart) to enter the campus results and print reports.



Copyright © Notice The materials are copyrighted © and trademarked ™ as the property of the Texas Education Agency (TEA) and may not be reproduced without the express written permission of TEA, except under the following conditions:

- 1) Texas public school districts, charter schools, and Education Service Centers may reproduce and use copies of the Materials and Related Materials for the districts' and schools' educational use without obtaining permission from TEA.
- 2) Residents of the state of Texas may reproduce and use copies of the Materials and Related Materials for individual personal use only without obtaining written permission of TEA.
- 3) Any portion reproduced must be reproduced in its entirety and remain unedited, unaltered and unchanged in any way.
- 4) No monetary charge can be made for the reproduced materials or any document containing them, however, a reasonable charge to cover only the cost of reproduction and distribution may be charged.

Private entities or persons located in Texas that are not Texas public school districts, Texas Education Service Centers, or Texas charter schools or any entity, whether public or private, educational or non-educational, located outside the state of Texas MUST obtain written approval from TEA and will be required to enter into a license agreement that may involve the payment of a licensing fee or a royalty.

For information contact: Office of Copyrights, Trademarks, License Agreements, and Royalties, Texas Education Agency, 1701 N. Congress Ave., Austin, TX 78701-1494, phone 512-463-9270 or 512-936-6060, email: copyrights@tea.state.tx.us