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A Correlation of Technology Implementation and Middle School Academic Achievement in
Tennessee's Middle Schools

A dissertation
presented to
the faculty of the Department of Educational Leadership and Policy Analysis
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Doctor of Education in Educational Leadership

by
Howard Thomas Sisco
May 2008

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Dr. Glenn Bettis
Dr. Harold Lee Daniels
Dr. Terrence Tollefson

Keywords: Instructional Technology, Technology Implementation, Academic Achievement,
Computer Integration

ABSTRACT

A Correlation of Technology Implementation and Middle School Academic Achievement in Tennessee's Middle Schools

by

Howard Thomas Sisco

The purpose of this study is to examine the relationship that exists between the reported implementation and integration of computer based technology into the middle schools of Tennessee and the achievement test scores of the middle school students in grades 6, 7, and 8.

In January of 2004, 2005, and 2006 the Tennessee Department of Education implemented the EdTech Tennessee Online Technology Evaluation System (E-TOTE) Survey of technology implementation and integration to gather data from public schools. This survey was intended as a means of providing a measure of the status of technology to the federal government required under the No Child Left Behind (NCLB) legislation. Annually students in Tennessee take the state mandated Tennessee Comprehensive Achievement Program (TCAP) test. The reports of the test results are aggregated by school and by grade.

This study investigated possible correlations between these 2 sets of data. The technology implementation and integration levels of the schools were analyzed to determine if there were any correlations between reported technology levels for the schools and the school-level TCAP achievement scores in reading and language arts, mathematics, science, and social studies. Specific technology indicators that were examined included the level of technology integration, teaching and learning, educator preparation and development, administration and support services and infrastructure for technology, number of computers, network access, and capabilities and percentages of 8th grade technology literacy. The study population consisted of 154 middle schools in Tennessee that were comprised of grades 6, 7, and 8 for which school-

level Tennessee Comprehensive Assessment Program scores were available and who completed the E-TOTE survey in 2004, 2005, and 2006.

The findings include: The correlations identified in this study indicate that there is a very small relationship between the implementation and integration of technology in Tennessee middle schools. The school-level TCAP scores were also found to be increasing for each year from 2004 through 2006 in reading and language arts, mathematics, science, and social studies. Over the same period the number of computers in these schools are increasing, as is the level of technology implementation and integration as measured by the E-TOTE survey system.

DEDICATION

The completion of this study is dedicated to the following persons:

To my wife, Dr. Kathryn Ann Ross-Sisco, without whose love and support this task would not have been possible nor desired, her passion, honesty, and strength of character have made our life together my single greatest accomplishment.

To my son Ronald Sisco, my love for you is without bound, you are my word finder and reader without peer.

To my son Ross Sisco, your smile is the light of my soul, Annalise has been your charge through many hours and you are a great big brother.

To my daughter, Annalise Sisco, you have been the treasure that I steal away with when I want to feel young in my heart, you are my sunshine and my rainbow.

To my Mother-in-Law, Nancy Ross, you know that you are the reason that I have reached any degree beyond high school, you have always been and continue to be a Mother to me in every way.

To my Father-in-Law, Ronald Ross, you have ever been my rock and encouraged me when I needed it most, you have been a father to me and will always remain so.

To my mother and father, Barbara Stanley and Daniel Sisco, last but not least you have given me the desire to be my best, the will to succeed, and all of your love.

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The completion of this study would not have been possible without the support and guidance of the following:

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CHAPTER 1

INTRODUCTION

All of us know our children aren't growing up in the same world we grew up in. They're taking advantage of our iPod-loving, Tivo-watching, ever-flattening world in ways we could never have imagined... All of us know that technology offers tremendous opportunities for education. (Spellings, 2007, p. 1)

This quote from U.S. Secretary of Education, Margaret Spellings illustrates the impact of technology on our children and suggested that technology can impact their education.

Currently, all aspects of education are seemingly tied to achievement as educators strive to meet the goals of the No Child Left Behind (NCLB) Act of 2001 (2005). Kim, Hsu, and Stern (2006) described technology as being ubiquitous and ever present in our lives. According to Wozney, Venkatesh, and Abrami (2006), “We are experiencing exponential growth in the use of computer technology for learning in K-12 schools.” (p. 1) The United Nations Educational, Scientific, and Cultural Organization (UNESCO) (2002), described the importance of technology as:

Information and Communication Technology (ICT) has become, within a very short time, one of the basic building blocks of modern society. Many countries now regard understanding ICT and mastering the basic skills and concepts of ICT as part of the core of education, alongside reading, writing, and numeracy (p. 8).

The importance of technology in daily life and the educational setting was underscored by Secretary Ron Paige (2002), when he made the following observations,

This is the 21st Century. Ours is a world of 24-hour-news cycles, global markets, and instant messaging. And our education delivery system should reflect the time we are living in. Computers are becoming for our children what chalk was for our parents – an essential teaching tool. And all of us – parents, educators and those of us in public life – should be thinking about how we can use e-learning to meet the president’s goal of no child left behind (p. 1).

Khine (2006) noted, “Over the past few decades rapid technological development and innovations have created unprecedented impacts on our day-to-day activities.” (p. 127) Whale (2006) concluded “It is more certain than ever that the appropriate use of technology has a

positive impact on student achievement.” (p. 62) Secretary Paige (2002) identified several uses of online learning that removed the limitations of time and location. Online learning resources empowered greater numbers of students through out the country to study topics and subject matter to a new and greater depth than they could by only having access to the local resources of their immediate learning community. The immediate learning community became the learning resources of the world through the use of online learning. The No Child Left Behind Act of 2001 placed an enormous emphasis on achievement for all students. One intended result of this emphasis on achievement was that all groups of students would reach proficiency in reading and mathematics within 12 years (USDOE, OESE, 2002).

The requirements of increased achievement for all students in the No Child Left Behind Act of 2001 also included increased mandated accountability in the form of state reporting mechanisms (USDOE, OESE, 2002). In Tennessee, student achievement is measured using the Tennessee Comprehensive Assessment Program (TCAP) (Tennessee Department of Education, Assessment, Evaluation, and Research Division, 2006). In the spring of each year, students in grades 3-8 participate in the TCAP by taking a timed, multiple choice achievement test in reading and language arts, science, mathematics, and social studies. The results from these assessments are the primary indicator of the success or failure of schools in Tennessee to have met the required federal benchmarks of the No Child Left Behind Act of 2001.

Statement of the Problem

The problem for this study was that while there were significant investments in technology in schools there was little research that established a connection between the level of integration of technology available and the performance of students on high-stakes achievement tests. This study sought to determine if a relationship existed in the middle schools of Tennessee.

At the same time that the No Child Left Behind legislation required accountability from the states in achievement there were also national goals for technology implementation and student technology literacy as outlined in the publication “No Child left Behind: A Desktop

Reference” (USDOE, OESE, 2002). According to No Child Left Behind, “State agencies are responsible for implementing their state technology plans, including tracking progress according to the goals and accountability measures in their plans.” (p. 60) In response to this requirement, the Tennessee Department of Education implemented a measurement system in the form of a technology implementation and integration survey and inventory. This measurement instrument was named the EdTech Tennessee Online Technology Evaluation System or E-TOTE Survey. The survey had been completed annually since 2003 by each school system in Tennessee and the results had been included in state reports to the federal government (J. Bates, personal communication, November 22, 2002, p. 1).

The purpose of the study was to identify relationships between levels of technology integration and implementation as reported on the E-TOTE surveys and the same middle school’s school-level achievement scores of Tennessee middle schools for the same years.

The technology implementation and integration into teaching and learning measures came from the State of Tennessee EdTech Tennessee Online Technology Evaluation System (E-TOTE) 2004 through 2006. (Tennessee Department of Education, 2007) The school-level achievement data for this study came from the Tennessee Department of Education, Report Card, for the years 2004 through 2006. The Tennessee Department of Education Report Card reported achievement scores for each school district and school in the state annually (Tennessee Department of Education, 2004; Tennessee Department of Education, 2005b; Tennessee Department of Education, 2006a). The school-level average report card grade for reading and language arts, mathematics, science, and social studies are used as the achievement measure.

Significance of the Study

Achievement is at the heart of education, as it is driven by the No Child Left Behind Act of 2001 (United States Congress, 2002). A school either has high achievement or is striving to gain it. The question dealt with in this study was whether the level of implementation of instructional technology had a significant correlation to the achievement scores of middle

schools in Tennessee. This study should be useful to school administrators and teachers as they evaluate the potential for achievement related to computer use in the classroom. This study should provide some meaningful data and insights into the correlations between levels of technology implementation and integration and school's achievement scores. This study may also lead to questions concerning trends in achievement as they relate to technology implementation levels.

Research Questions

The research questions that will guide this study are:

1. Is there a relationship between the level of progress of technology implementation reported on the E-TOTE survey and the school's normal curve equivalency (NCE) achievement scores in reading and language arts, mathematics, science, and social studies?
2. Is there a relationship between the levels of progress of integration into teaching and learning reported on the E-TOTE and the survey school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?
3. Is there a relationship between the level of progress of educator preparation and development reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?
4. Is there a relationship between the level of progress of administration and support services reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?
5. Is there a relationship between and level of progress of infrastructure for technology reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

6. Is there a relationship between the number of computers reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?
7. Is there a relationship between the levels of network access and capabilities reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?
8. Is there a relationship between the percentages of mastery of eighth grade technology literacy reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

Definitions of Terms

The following terms were defined for the purposes of this study:

Criterion referenced score: “A student’s performance is measured against specific standards or criteria, rather than the performance of other test takers.” (CTB/McGraw-Hill, 2007, p. 4)

EdTech Tennessee Online Technology Evaluation System (E-TOTE Survey): A self-reported, web based survey system for schools and systems in Tennessee to report and measure the progress of schools in making technology an integral part of the educational environment. A campus level Tennessee STaR chart was incorporated into the survey to assess a school’s technology and readiness in the four key areas of Teaching and Learning, Educator Preparation and Development, Administration and Support Services, and Infrastructure for Technology.

Level of progress of technology integration into Administration and Support Services: The Administration and Support Services key area focus points are: vision and planning, technical support, instructional and administrative staffing, budget, and funding, see Appendix A for specific criteria (Tennessee Department of Education, 2002).

Level of progress of technology integration into Educator Preparation and Development: The Educator Preparation and Development focus points are: content of training, capabilities of

educators, leadership capabilities of administrator, models of professional development, levels of understanding and patterns of use, and technology budget allocated to technology professional development, see Appendix A for specific criteria (Tennessee Department of Education, 2002).

Level of progress of technology integration into Infrastructure and Technology: The Infrastructure and Technology focus points are: students per computer, Internet access connectivity and speed, distance learning, local area network (LAN) and wide area network (WAN), and other technologies, see Appendix A for specific criteria (Tennessee Department of Education, 2002).

Level of progress of technology integration into Network Access and Capabilities: The Network Access and Capabilities focus points are, home and school communication, wireless or laptop computing, after-hours technology resources, and home access to the Internet, see Appendix A for specific criteria (Tennessee Department of Education, 2002).

Level of progress of technology integration into Teaching and Learning: The Teaching and Learning focus points are: impact of technology on teacher role and collaborative learning, patterns of teacher use of technology, frequency and design of instructional setting using digital content, curriculum areas, technology application assessment, and patterns of student use of technology, see Appendix A for specific criteria (Tennessee Department of Education, 2002).

Middle Schools: Schools that consisted of students in grades 6, 7, and 8 exclusively, including schools entitled Junior High School, Middle School, and other local designations.

Percentage of Mastery of Eighth Grade Technology Literacy: The mastery of eighth grade technology literacy focus points were: hardware and software trouble shooting, knowledge of information technologies in society, legal and ethical behaviors, used content-specific tools and software, used productivity and multimedia software, design and develop and publish products, use collaboration and communications tools for curriculum related projects, selected and used appropriate technology tools, demonstrated an understanding of underlying concepts regarding technology and learning, and researched and evaluated electronic information resources, see Appendix A for specific criteria (Tennessee Department of Education, 2002).

School's Normal Curve Equivalent (NCE) Achievement Score: Normal curve equivalent is the mapping of percentile data, represented on a scale from 1 to 99, into corresponding points in a normal distribution. The purpose was to enable data to be analyzed consistent with the Value-Added Report and the Achievement Report on the Report Card. School NCE scores are scores for schools in the State of Tennessee (Tennessee Department of Education, 2006b).

Limitations and Delimitations

The accuracy of the E-TOTE survey was limited to the level of accuracy and the standardization of answers from the respondents. This study was limited to Tennessee schools.

The TCAP school achievement data was limited to the accuracy of the TCAP test reported by the State of Tennessee. It was assumed that the TCAP school achievement data were accurate and indicated school-level student achievement. The TCAP test was limited to assessing achievement in the areas of reading and language arts, mathematics, science and social studies.

This study was delimited to include only the total number of middle schools (grades 6-8, inclusive) in Tennessee for which there were data available on achievement test scores and technology implementation. The results of this study were generalizable to only the schools in the state of Tennessee that were comprised of grades 6, 7, and 8 and were operationally defined as middle schools.

Overview of the Study

This study is organized into five chapters. The first chapter contains an introduction, a statement of the problem, the significance of the study, the research questions, the limitations and delimitations, and an overview of the study. Chapter 2 is a review of the literature that provided information concerning achievement testing nationally and in Tennessee including an overview of the Tennessee Comprehensive Assessment Program (TCAP). A history of computers in education and description of the use of computers in education is included. The current state of computer implementation for learning, problems regarding computer access,

computer use and student achievement, using technology to enhance higher level reasoning and problem solving, teacher training (professional development) in technology integration, questioning the value of technology implementation, and the digital divide was examined. Chapter 3 describes the methodology of the study. Chapter 4 describes the results of the data analysis. Chapter 5 reports the summary findings, recommendations, conclusions, and other suggested studies.

CHAPTER 2

REVIEW OF THE LITERATURE

This research study investigated possible relationships between standardized academic achievement test scores of Tennessee middle school students in grades 6, 7, and 8 with the schools' reported level of technology integration as measured by the Tennessee Department of Education EdTech Tennessee Online Technology Evaluation System (E-TOTE) Survey. This chapter was a review of the literature that provided information concerning achievement testing nationally and in Tennessee including an overview of the Tennessee Comprehensive Assessment Program (TCAP). A history of computers in education and description of the use of computers in education was included, the current state of computer implementation for learning, issues regarding computer access, computer use, and student achievement, using technology to enhance higher level reasoning and problem solving, teacher training (professional development) in technology integration, the digital divide, and questioning the value of technology implementation.

Achievement Testing – A National Undertaking

The Elementary and Secondary Education Act as reauthorized by the No Child Left Behind Act of 2001 requires, “proficiency on challenging state academic achievement standards and state academic assessments.” (United States Congress, 2002, p. 1439) When President George W. Bush signed the federal No Child Left Behind Act of 2001 into law in January of 2002, it had a major impact on public education in the United States (United States Department of Education, Office of Educational Technology, 2004). According to the United States Department of Education, Office of Educational Technology (2006):

Its ambitious goals, to end the achievement gap between rich and poor and white and minority students and improve the academic performance of all students by 2014, are

requiring states and school districts across the country to reexamine their standards, set targets for improvement, introduce rigorous testing, and give options to parents. (p. 1)

Many states reported gains towards meeting Adequate Yearly Progress (AYP) goals for 2003-2004 and the percentage of schools making AYP increased by at least 10 percentage points over the previous year (United States Department of Education, Office of Educational Technology, 2006). In the elementary grades, schools reported sharp gains for poor and minority children at the same time that they were boosting the performance for all students. Similarly, the Tennessee State Board of Education, (2005) reported increases in test scores in every grade and on every content area test in 2005 for students in Tennessee.

School improvement activities and increased achievement were linked using data-gathering reports. Dougherty (2004) proposed the use of information technology as a tool to support school improvement under the No Child Left Behind Act. He advocated that such information technology support should include a statewide longitudinal student information system and the use of information technology to provide diagnostic information to educators via online assessments. An information technology mechanism to disseminate best practices, such as email and the web, should also be used.

Among the best practices recommended for improving achievement is the use of a standards-based curriculum. Keller and Bichelmeyer (2004) pointed out that having a standards-based curriculum played a valuable and important role in “bringing focus to a diverse curriculum.”(p. 17) Tognolini and Stanley (2007) described standards referencing as a method of referencing achievement that built on criterion-referencing, however, instead of relating the responses to the variety of behaviors that comprise the unit of study, achievement is related to standards of performance.

Not everyone favored high stakes tests, such as those implemented in response to the No Child Left Behind Act (Houston, 2000). Volante (2006) raised concerns about the potential

negative side effects of high stakes testing. These negative side effects included inappropriate levels of test preparation designed only to improve achievement scores that came at the cost of reduced instructional time for subjects such as music, art, or physical education. He also expressed concern regarding the narrowing of the curriculum to only tested material. Expressing concerns arising from the importance placed on high-stakes tests, Volante stated:

In many respects, the utility of a standardized achievement test is premised on a careful balancing act. If the assessment measure becomes too important or high-stake, teachers will skew their teaching in the direction of inappropriate test preparation practices likely to produce elevated scores. Unfortunately, research suggests that this type of teaching discourages inquiry and active student learning. (p. 137)

Some objections to the NCLB have included concerns regarding the diverse populations and the marginalization of instruction that can result from standardized testing and instruction. Mayers (2006) decried the legislation as, “a threat to the fundamental human rights of the children who are being educated under its governance.” (p. 457) This assertion was based on the standardized approach to testing and education that did not adequately take into account the socioeconomic, educational, and language barriers that existed for the diverse populations found in some schools that resulted in their continued struggle in their marginalized and impoverished experiences of life in America. The socioeconomic status of students can greatly affect their educational experience. Flawed accountability schemes can be more harmful than no accountability scheme, according to McGill-Franzen and Allington (2006). They decried the contamination of the accountability systems by summer reading loss, which had a greater reported annual impact on children from poverty than on children of means. Contamination due to flunking students, manipulation of special education accommodations, and narrow test-prep curricula were major concerns to the authors due to tendency for these flaws of accountability systems to result in unreliable reports.

Achievement Testing in Tennessee

The Tennessee Department of Education, Assessment Evaluation, and Research Division (2006) described achievement testing as the use of “a timed, multiple-choice assessment that measures skills in reading and language arts, mathematics, science, and social studies. Student results are reported to parents, teachers, and administrators.” (p. 1) Current trends in education place a heavy emphasis on demonstrating that students are gaining in Adequate Yearly Progress (AYP), as measured on student achievement tests. “Adequate Yearly Progress is a measure of a school’s or school system’s ability to meet required federal benchmarks with specific performance standards from year to year.” (Tennessee Department of Education, 2006b, p. 1)

All students in grades 3-8 are mandated to take the TCAP achievement test each year. The TCAP test includes questions designed to establish student progress in the subjects of mathematics, reading and language arts, science, and social studies (Tennessee Department of Education, Division of Assessment, Evaluation, and Research, 2004; Tennessee Department of Education, Division of Assessment, Evaluation, and Research, 2007). The Tennessee Department of Education reported increases in test scores in every grade and on every content area test in 2005 for students in Tennessee (Tennessee State Board of Education, 2005).

In 2007, the U.S. Chamber of Commerce gave Tennessee a grade of F in the categories of truth in advertising about student proficiency, academic achievement of low-income and minority students, and postsecondary and workforce readiness. The low grade was the result of the discrepancy between state assessment scores in 4th and 8th grade mathematics and reading reported at 87% proficient as compared to 27% or less reported proficiency on the National Assessment of Educational Progress test. The Tennessee State Board of Education, (2007) at the direction of Governor Bredesen and the State Legislature, has initiated the Tennessee Diploma Project in association with the American Diploma Project. The intent of the Tennessee State Board of Education (2008b) under the Tennessee Diploma Project is to:

Align our curriculum then make sure we give students, parents and teachers a pathway to reach those high standards. At the end of the day, make sure that our tests and graduation

requirements reflect that our kids really are prepared for workforce training or college. (p. 14)

The new graduation requirements established as part of the Tennessee Diploma Project are scheduled to be effective for the class of 2013.

A History of Computers in Education

New technologies, such as personal computers and motion pictures, have been a source of expected change and revolution in education for many years. In 1922 Thomas Edison offered a quote that has gained notoriety. He stated, "I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks." (Wise, 1939, p. 1) The expectations for change and revolution seem to continue today for computers in the classroom.

The personal computer has been in some classrooms for more than 25 years. These years have not been a tranquil and calm quarter century with regard to advancements in technology (Norris, Soloway, & Sullivan, 2002). The growth of technological computing power, as measured by nearly any dimension, has grown logarithmically since personal computers began to enter classrooms in the early 1980s. Moore's Law describing the logarithmic rate of technological advancement in semiconductor electronics was established through observation in 1975 as reported by Schaller (1996) when he stated: "Officially, Moore's Law states that circuit density or capacity of semiconductors doubles every eighteen months or quadruples every three years." (p. 7) Examples of the accuracy of Moore's Law in the computer industry include the evolution of the computer microprocessor. "The Intel microprocessor has evolved from the 8086/88 chip in 1979 to the 286 chip in 1982, to the 386 chip in 1985, to the 486 chip in 1989, to the PentiumJ chip in 1993, and the Pentium ProJ chip in 1996, each incremental product has been markedly faster, more powerful, and less costly as a direct result of Moore's Law." (p. 10) Schaller also noted that this increase in capacity is not solely tied to processors but is also demonstrated in software and computer applications.

Access to computers in schools has changed dramatically over time. In 1983 there were only 250,000 computers in American schools (Becker, 2000b). In the early 1990s computer-to-student ratios typically were at 1 to 20 and they were most often located in labs and rarely in the classroom. These computers were largely used to learn basic computer skills and seldom as a major piece of the content-area curriculum. Silverstein, Frechtling, and Miyaoka (2000) reported, “In spite of these impressive increases in technology access, significant disparities remain. The average classroom has only 1.9 computers – which has hindered the ability of some teachers to make effective use of the Internet and other learning technologies.” (p. 4) Within 10 years the computer-to-student ratio was reduced to 1 to 5 and these computers were largely in classrooms (Wenglinsky, 2006). In 2006 there were over 14,100,000 computers in the United States schools. This is a computer-to-student ratio of 1 to 4 (United States Census Bureau, 2006).

Computer Uses in Education

National and state studies link student access to technology-related experiences that can lead to improved skills in reading, writing, and mathematics and show achievement gains on academic achievement tests (Southern Regional Education Board, 2002). Two studies conducted on the West Virginia technology education program, “showed that technology can lead to improved skills in reading, writing, and mathematics.”(p. 4) The study also reported that technology helped rural and low-income students to keep up with other students.

A review of the literature regarding technology and computers in education must include studies that range from the 1980s to the present. The impact of technology on education has been and continues to be of importance to researchers. In order to determine the value and validity of current research we must also consider pertinent previous examinations of the topics covered in this study. Becker (2000b) discussed the importance of access to information and communications. The increased access to information and communications is the true power of technology and the personal computer is at the heart of it. Becker succinctly stated:

In nearly every American city, town, and neighborhood, the personal computer and its electronic offspring have affected young people’s lives. This new Net generation is

evidenced in adolescents playing computer games or surfing the Web, in young children learning abstractions through playful computer generated environments, in precocious hackers busily investigating and modifying the performance of software, in preteens partaking in online chats and electronic mail, and in the many young people expressing themselves with the help of writing and graphic arts software tools (p. 44, 45).

The availability and adoption of new technologies impacted information access on a fundamental level. Prensky (2001a) described a so-called “singularity” resulting from the arrival and rapid dissemination of digital technology in the last decades of the 21st century.” (p. 1) The importance of this singularity is that our students are “Digital Natives” (p. 1). Students are “native speakers” (p. 1) of the language of the Internet, computers, and video games. “Digital Immigrants” (p. 1) are those of us who were not born into a digital world and have experienced the new digital technologies later in life as opposed to having had these experiences from birth. Digital natives also learn and interact with their environment differently because their brains are thought to be physically different as compared to the brains of digital immigrants. (Prensky, 2001b) This difference includes thinking skills such as representational competence or reading visual images in representations of three dimensional space, visio-spatial skills, attentional deployment or watching multiple locations simultaneously. Another difference in digital natives is their ability to parallel process and multi-task as demonstrated by their ability to engage in strategic attendance to multiple activities. Prensky proposed that the Digital Natives need totally different methods of instruction due to the way that their brains process information in order to be successfully engaged in the learning process. VanSlyke (2003) refuted the need for totally different, digital native based, instructional methods in favor of a moderate approach recognizing the need for a common ground where “students learn from thinking in meaningful ways.”

The personal computer and related devices have affected the entire learning community, not just young people. Teachers, as a part of the learning community, are also impacted by personal computers and related technologies. Rakes and Casey (2002) stated:

The ultimate goal of instructional technology integration into PK-12 education is improved student achievement, but teachers must view technology in a positive manner, be comfortable with the technology, and use it effectively before improved student achievement can occur (p. 1).

Okojie and Olinzock (2006) echoed the importance of teacher attitude. The concept of a positive teacher attitude towards the use of technology in classroom instruction is key to the implementation of technology in the classroom according to Okojie and Olinzock. Capobianco and Lehman (2006) stated, “If future teachers are to learn to use technology effectively in K-12 classrooms, they must see it modeled by teacher educators.” (p. 124) The need for teacher preparation and acceptance of technology was also highlighted as Franklin (2007) determined that a majority of the teachers observed taught using computers during class time and that the teachers were well prepared during their teacher preparation program to use technology in their teaching. The respondents also indicated that their students also routinely used computers in the completion of their assignments. The proper preparation of teachers in the use of technology can also lead to other outcomes. Schrum et al. (2007) concluded that “The implication is that properly prepared teachers can take advantage of the unique features of technology to teach content in ways they otherwise could not.”(p. 458)

Current State of Computer Implementation for Learning

The United States Census Bureau (2006) found that in the fall of 2003 75% of all students of ages 3 to 17 were accessing the Internet to complete school assignments. This access was split between home, school, and other locations. In addition, completing school assignments was the most common reason for children to use the Internet (United States Census Bureau). A discussion of computer implementation for learning must include connectivity such as the Internet, communications services, and distance learning. Spellings (2007) stated, “within the last 24 hours, more than half of young adults in our country sent or received a text message.” (p. 1)

A growing area of computer implementation for learning in education today is “online learning (also known as, distance education or e-learning)”(Ronsisvalle & Watkins, 2005, p. 117) Online learning serves to expand the curriculum in many cases, providing access to high

quality and rigorous curricula. In rural areas, the gifted and other special learner groups are often involved in online learning. The researchers also identified the primary role of online learning as supplementary to the regular instructional program with students most often taking online courses as part of their regular course load and completed on the school grounds during the regular school day (Ronsisvalle & Watkins). Online learning in public education also includes distance education courses and in the 2002-2003 school year approximately one third of public school districts had at least one student enrolled in a distance education course (Setzer & Lewis, 2005). The primary reason distance education was viewed as very important by school districts was that distance education provided an avenue to offer courses that were otherwise not available to students on site (Setzer & Lewis). Liu, Theodore, and Lavelle (2004) proposed that more education courses should be taught online based on the results of their study involving teacher attitudes. Lewis and Price (2007) have identified a newer trend in the selection and use of distance education as being less motivated by geographic circumstance and more from a desire to “better meet their andrological needs.” (p. 139) The use of computer technologies and digital tools is also called “E-Learning”. (p. 139) These findings related to distance education research are important for Tennessee school systems because all school systems are required to include distance education in the mandated Tennessee Comprehensive School Planning Process (TCSPP) (Tennessee Department of Education, 2005a). The TCSPP document requires all School Systems to answer the question:

Describe how the applicant will encourage the development and utilization of innovative strategies for the delivery of specialized or rigorous academic courses and curricula through the use of technology, including distance learning technologies, particularly for those areas that would not otherwise have access to such courses and curricula due to geographical isolation or insufficient resources? (p. 141)

When discussing the state of computer implementation for learning, it is appropriate to briefly explore the role of the educational technologist. Educational technology is the field concerned with the design, development, use, management, and evaluation of processes and resources for learning (Lupplicini, 2005). Lupplicini described an educational technologist as a

person concerned with the design, development, use, management, evaluation of processes, and resources for learning. Foti (2005) depicted the current educational technology landscape as being two camps. These camps were divided into “general practitioners who promote the use of commercial products in k-12 settings, and theorists who essentially talk about technology.”(p. 46) Gamske and Hamidon (2006) described the field of educational technology in terms of its being a resource that could positively affect teaching and learning in schools.

Computer Access

It has been postulated for some time that the single most important factor determining the use of school computers was the availability and location of computers in the classroom (Becker, 2000b). Littrell, Zagumny, and Zagumny (2005) found:

Access to technology remains a crucial, if not obvious, component of instructional technology use in the classroom. Current data demonstrate that access to a printer reliably predicts computer use for classroom management tasks, such as word processing handouts or tests, maintaining attendance records, grade calculation, and using e-mail. (p. 44)

In the Editorial Projects in Education Research Center (2006) reported assessing the status of educational technology across the nation, Tennessee was awarded an overall technology score of 74.9, on a 100 point scale, based on “14 individual indicators spanning three core areas of state policy and practice: access to instructional technology, use of technology, and capacity to effectively use educational technology.”(p. 1) The average state was awarded an overall technology score of 76.6, on a 100-point scale. The highest rating awarded to Tennessee was a grade of B- in the use of technology area of state policy. The average state scores were C+ for the use of technology area of state policy by comparison.

Computer access is a broader topic than simply how many computers and where they are located. Kravitz (2004) identified several trends in schools related to education and access to technology. These trends included connecting schools to the Internet, convergent devices that provide access to email, audio, telephone, and web services, students using video production and

editing tools to explore and share new concepts and ideas. “As the technology available to us becomes more and more powerful, we can (and will) be able to use it to take on increasingly complex tasks.”(p. 89) DeBell and Chapman (2003) found that “More children and adolescents use computers at school (81 percent) than at home (65 percent)” (p. v). The United States Census Bureau (2006) stated, “the percentage of public schools with Internet access was 100% in 2003.” (p. 4)

Computer access has also been determined by comparing the local status to that of similar organizations. States and school systems with over 20 years of experience with computers in their classrooms were attempting to measure the effects of these computers. They also sought to simply know where they stood compared to other states and school systems in their implementation and integration efforts. One tool that has been used in a number of state initiatives to measure technology progress in 6 categories is the CEO Forum’s School Technology and Readiness (STaR) chart (Bingham, n.d.). Tennessee adopted a modified version of the STaR chart with additional demographic questions to “measure the progress of schools, local school systems, and the State of Tennessee in making technology an integral part of the educational environment.”(J. Bates, personal communication, November 22, 2002, p. 1)

Tennessee has chosen to gather technology assessment data online through the OnTarget Online Technology Evaluation solution offered by AWS Convergence Technologies (AWS Convergence Technologies, 2003). The Tennessee STaR Chart enables schools to establish a technology implementation and use benchmark within the four areas of: 1. Teaching and Learning, 2. Educator Preparation and Development, 3. Administration and Support Services, and 4. Infrastructure for Technology. The schools level of progress within each of these four areas was determined to be either, 1. Early Tech, 2. Developing Tech, 3. Advanced Tech or 4. Target Tech (Tennessee Department of Education, 2002).

Computer Use and Student Achievement

The history of research concerning computer use and student achievement began with the introduction of computers into the classroom and continues today. There have been numerous studies that indicate positive results from using computer-based instruction, (see for example, Kulik (1994), Wenglinsky (1998), Mann, Shakeshaft, Becker, and Kottcamp (1999), and Wijekumar, Meyer, Wagoner, and Ferguson (2006)). These studies include Kulik's 1994 meta-analysis study of over 500 computer-based instruction research studies that was important historically as it provided an overview of the results of a large number of studies that were conducted prior to 1994.

Kulik reported the following positive findings:

On average, students who used computer-based instruction scored at the 64th percentile on tests of achievement compared to students in the control conditions without computers who scored at the 50th percentile.

Students learn more in less time when they receive computer-based instruction.

Students like their classes more and develop more positive attitudes when their classes include computer-based instruction (p. 12).

The positive effects reported by Kulik were restated by Coley, Cradler, and Engel (1997) who also noted that the use of technology in military training had resulted in a one third decrease in needed training time. The decrease in required training time was linked to increased training efficiency. This review of the research assessed the effect of technology on achievement for all ages of learners. However Clark (2001) rebutted Kulik's meta-analysis and other media studies. He determined that a novelty effect was most likely the cause of the increase in achievement. Clark suggested that the changes in curriculum and instructional design were the cause for increased achievement and not the use of any specific media for instructional delivery. His conclusion was that while most analyses showed positive learning effects for newer media over more conventional treatments, there was compelling evidence for confounding in the reviewed research."(Clark, p.42)

Sivin-Kachala (1998) noted that students in technology rich environments demonstrated positive improvement on achievement in all major subject areas and increased achievement for

regular and special education students in grades preschool through higher education. Similar findings were reported by Schacter (1999) and Waxman, Connell, and Gray (2002).

Computers in the classroom have been shown to increase student achievement in a number of ways according to Rockman et al. (1998). According to the authors, the research supported areas of increased student performance included engaging and involving students, empowering students, fostering the development of higher-order thinking skills, and ensuring student mastery.

When comparing the relationship between educational outcomes and technology, Wenglinsky (1998) stated the following positive findings:

Eighth-grade students who used simulation and higher order thinking software showed gains in math scores of up to 15 weeks above grade level as measured by NAEP (National Assessment of Educational Progress).

Eighth-grade students whose teachers received professional development on computers showed gains in math scores of up to 13 weeks above grade level.

Higher order uses of computers and professional development were positively related to students' academic achievement in mathematics for both fourth and eighth-grade students (p. 275).

This national study had a sample size of 6,227 fourth grade and 7,146 8h grade students. The study controlled for factors including socioeconomic status, class size, and teacher characteristics. Wenglinsky's research was important because: "Unlike other research on education technology that focuses on just a classroom or two, Does it Compute? Is based on analysis of a national database of student test scores, classroom computer use, and other information including school climate." (Rockman et al., 1998, p. 5) However, he also reported some negative findings with regard to the use of drill-and-practice technologies associated with lower performance on NAEP as compared to the control group that did not experience drill and practice technology and these findings were echoed by Schacter (1999).

Mann et al. (1999) examined the achievement gains of students who participated in the West Virginia Basic Skills/Computer Education (BS/CE) technology implementation program. The 11% basic skills achievement test gains experienced by fifth grade students, was directly

accredited to the students' participation in the BS/CE. This particular study was significant due to the 10-year history of the program and its scope, which was statewide (Schacter, 1999).

Silverstein et al. (2000) reported:

The investment in learning technologies appears to be paying off. By controlling for a school's poverty level, we found that technology usage has a small but significant impact on student achievement as measured by the Illinois testing program. This impact is generally strongest at higher grade levels, and the relationship between technology usage and student achievement is not uniform across all subject matters. (p. 7)

Although there have been studies documenting gains in student achievement using educational technology, there were also those who would caution against making a sweeping generalization that all computer use in schools leads to increased achievement. Ravitz, Mergendoller, and Rush (2002) described an apparent relationship between student computer use at home and increased academic achievement and a corresponding decrease in achievement for school-based computer users. The authors also identified a possible weakness in their study concerning socioeconomic status and its possible affect on the findings.

Another measure suggested for analyzing the impact of computer use on student achievement was "software capability" (Ravitz et al., 2002, p. 2). Software capability was a measure related to student computer use. This measure was determined by self-assessed computer use and proficiencies based on time spent on computer use performing various tasks and activities including email, word processing, presentations, spreadsheets, and the Internet at school and at home. Students identified as having higher software capabilities were found to score higher on achievement tests and to have larger gains than other students at the same school who were not identified as having high computer software capabilities.

In a meta-analysis of 42 studies conducted over the previous 10 years, Waxman, Lin, and Michko (2003) reported finding indications that "teaching and learning with technology has a small, positive, significant ($p < .001$) effect on student outcomes when compared to traditional instruction" (p. 11). Fletcher (2003) asserted that, based on a review of the extant research, technology-based instruction had increased instructional effectiveness, reduced time and costs,

and made individualized instruction affordable. Cochran (2004) described the positive association of technology with student achievement as, “In almost all studies, technology is related positively to student achievement.” (p. 4)

Wijekumar et al. (2006) suggested that the ways in which students are accustomed to using the computer, referred to as their affordances, may have a strong impact on the perceived value of instruction delivered via computer systems. These same affordances may cause students to be distracted, have more interruptions, and have less concentration on learning tasks because of their predilection to the gaming and communications aspects of the computer.

To discuss the possible link between computer use and student achievement meaningfully, the source of the achievement data should be considered. Shakeshaft (1999) proposed that the best data available to measure the impact of instructional achievement in the classroom is the existing achievement data. An example of existing achievement data included TCAP achievement test scores. This was an obvious, yet requisite observation, as researchers consider appropriate methods to measure the impact of technology on instruction. Honey, Culp, and Spielvogel (2005) reported that the assessment of the impact of computers on student achievement has been extremely elusive to verify using standard research methods. Reasons for this difficulty lie in the wide array of different types of technology contained within the personal computer. Differing technologies are appropriate for different content and are used for different purposes. “Rather than trying to describe the impact of all technologies as if they were the same, researchers need to think about what kinds of technologies are being used in the classroom and for what purposes” (p. 4). Kacer and Craig (1999) also determined that there is a relationship between middle school achievement scores and the degree of implementation of education technology. In 2007, Lei and Zhao further stated that the important point of the implementation was not the quantity of technology contact or use in the implementation that determines the impact on student achievement. Instead they proposed that the quality, or how the technology was used, had a greater impact on improving achievement for the middle school students studied.

How technology is used in the educational setting is very important. Kent and McNergeny (1999) emphasized that the implementation of technology into the educational setting should be “transparent” (p. 46). Instead of teaching students about technology, the use of technology should be secondary to the constructs that are being taught in the curriculum. In this way, the acquisition of technology skills becomes secondary to the primary instruction within the curriculum. In emphasizing the use of technology in acquiring new instructional goals the student naturally acquires technology competencies just as they do when they incorporate technology into other aspects of their everyday life.

The quality of computer work was more important than the quantity in the NAEP assessments for mathematics, science, and reading according to Wenglinsky (2006). He also stated “Students could receive a substantial benefit, no benefit or even negative benefit consequences from working with computers in the classroom, depending on how teachers chose to use technology.”(p. 30)

The best approach for using technology in school is not to devise dazzling ways to use technology differently. Instead, Wenglinsky (2006), in his study of National Assessment of Educational Progress (NAEP) history scores, suggested, “rather than planning lessons around the computer, high school teachers should assume that students will use technology-based tools to address some of their learning tasks.”(p. 32) Teachers should mirror the technology-rich work environment by making an assignment and assuming that students will use computers to complete the assignment as they will after graduation in the world of work (Wenglinsky). He also reported “4th and 8th graders indicated that the quality of computer work was more important than the quantity.”(p. 30) Wenglinsky suggested that middle school students gained more from technology when it was used to enhance higher order thinking skills while high school students enhance their work products and deepen their thinking using technology. He continued with a caution that the two groups of students that would need additional assistance in preparation of this method of technology integration were students who did not have basic computer skills and

those students who needed enrichment such as those planning on mathematics, science, and engineering post secondary education.

In the delivery of instruction via streaming video, which is delivered via the computer, Smith (2006) found significant statistical differences in the responses of students who received lecture instruction via digitally streamed video as opposed to those who were physically present at the lecture location. These results suggest that the students learned more from the streamed video lecture.

Lei and Zhao (2007) stated, “technology uses that had positive impact on students were those related to specific areas and focused on student construction.”(p. 1) The apparent link between appropriate technology use and student achievement identified within the research has led to the identification of needs and goals related to the student use of technology on national and state levels.

The Appalachian Regional Advisory Committee (2005) reported the following need for the region that included Kentucky, Tennessee, Virginia, and West Virginia, “Schools and school districts need to be provided with programs that will enable them to have all students demonstrate technology literacy.” (p. 32) In recognition of the needs of the Tennessee students in the area of technology, the Tennessee State Board of Education included technology within its goals for students. The Tennessee State Board of Education (2006), in the *Master Plan for Tennessee Schools: Meeting the Challenges of the 21st Century*, included as one of its nine key result areas the Goal: “Technology will be used to improve student learning and analyze data” (p. 10). One strategy under this key result area is to “Focus technology resources to improve student learning.”(p. 19) These focal points include:

- a. Use technology in developmentally appropriate ways to promote active learning and individualize instruction.
- b. Use technology to diagnose student learning problems and provide interventions.
- c. Develop content-appropriate technology learning expectations and appropriately embed aligned technology resources in core content curriculum standards.
- d. Use assistive technology to ensure all students have access to the general curriculum (p. 19-20).

According to the Tennessee State Board of Education (2006), the master plan also addressed technology in the primary and middle school grades with the goal: “Implement student technology learning expectations, embed them in the core content curriculum and align technology resources to improve student learning.”(p. 15)

Higher Level Reasoning and Problem Solving

Rockman et al. (1998), Wenglinsky (1998), and Beglau (2007) reported that computers have been used to improve achievement in higher order thinking skills, reasoning, and problem solving. The importance of higher order thinking and problem solving using technology was underscored when the Tennessee State Department of Education (2004) suggested the following goal to the Tennessee State Board of Education:

In Tennessee, the goal is for teachers to use technology to modify classroom environments so that teaching practices:
are student-centered,
actively engage students in higher-order learning, and
employ generative learning strategies and problem-based learning. (p. 22)

Teachers in Tennessee have been required to incorporate higher order thinking and problem solving into their lessons as part of the teacher assessment framework (Tennessee State Department of Education, Division of Teaching and Learning, 2004). Sanders and Horn (1995) asserted that standardized tests could be used to measure higher order thinking and analysis. Given the research concerning technology and improved achievement in higher level thinking and the stated interest in teaching these higher order skills by the Tennessee Department of Education, a review of higher order thinking and problem solving using technology was pertinent to this study.

In the Apple Classrooms of Tomorrow (ACOT) initiative teachers were encouraged to explore the potential of computers for long-term projects, cooperative learning, and access to multiple resources (Sandholtz, Ringstaff, & Dwyer, 1997). These experiences appeared to result in new experiences emphasizing higher level thinking skills and problem solving. Students in the

ACOT schools also experienced less stand-up lecturing and reported a positive effect on their attitudes. A negative finding from the study was that there was no difference in standardized test results for students in the study and the control groups who didn't have computer access or the nationally reported norms (Schacter, 1999). The Computer Supported Intentional Learning Environment (CSILE) studies demonstrated increased scores on measures of depth of understanding, and reflection. Standardized test scores in reading, vocabulary, and language were also improved over the control group. Independent thinking, student reflection, taking multiple perspectives, and encouraging progressive thought were also maximized using CSILE (Schacter).

In his analysis of five large-scale studies of educational technology, Schacter (1999) identified the following conclusions on the impact and effectiveness of educational technology and the relationship to higher level thinking and problem solving:

These studies showed that students with access to:

1. Computer assisted instruction, or
2. Integrated learning systems technology, or
3. Simulations and software that teaches higher order thinking, or
4. Collaborative networked technologies, or
5. Design and programming techniques, show positive gains in achievement on researcher constructed tests, standardized test, and national tests (p. 9).

In Missouri, the eMints (Missouri Instructional Networked Teaching Strategies) technology integration focused on critical thinking and problem solving skills and inquiry based teaching to improve student achievement as reported by Bickford, Hammer, McGinty, McKinley, and Mitchell (2000). There were noticeable gains in third and fourth grades on the Missouri Assessment Program (MAP) test (Foltos, 2002). Bickford et al. also reported that fewer fourth grade students scored at the lower achievement levels and more students scored at the middle and upper achievement levels on the Missouri Assessment Program (MAP) social studies test as compared to both the control group and all students taking the state assessment. At the same time, the fifth grade students also demonstrated increased achievement levels. "For 5th graders there was an increase in the percentage of MINTs students scoring in the top three

National Stanine categories on the composite total score of the TerraNova standardized test” (Bickford et al., p. i). This increase is due to improvement in the reading and mathematics sections of the TerraNova. Higher percentages of students scoring in the top one-third in the mathematics and reading portions of the TerraNova test were cited, indicating increased performance for eMINTS students. In a more recent study, Beglau (2007) reported that “Results from Missouri Assessment Program testing consistently demonstrate that students in elementary schools eMINTS classrooms outperform their non-eMINTS peers in all content areas tested: communication arts, mathematics, science, and social studies.”(p. 35) The eMINTS sustained and intensive professional development provided to teachers includes the creation of real-world approaches to engaging students in problems and units of study that encouraged problem solving, analysis, collaboration, and communication. In short, the students’ eMints experience resulted in higher level thinking, higher level reasoning, and improved problem solving skills (Beglau).

Sylwester (2003) brought some interesting observations to the instructional technology table regarding the corollaries to be found between how the brain functions during the 20-year maturation period from infancy to adulthood. As a person matures, he or she moves from the slow, laborious, and clumsy efforts of crawling, toddling, and walking to running and leaping over an approximate 10-year period. This developmental path was similar to the development noted with technology as children move from informal games and play to video games to the adoption and integration of technology in the world of productivity (Marcinkiewicz & Sylwester, 2003). Teacher-student interaction was seen as pivotal in determining what reasoning skills students developed during their classroom experiences. If the teacher made all of the decisions, the students were fundamentally removed from the learning and growth exercises available to them on a daily basis in the classroom as they determine the who, what, where, when, and how of the multitude of activities that take place in today’s classroom. These activities are extremely important to students as they each represent opportunities for growth and exercising the brain according to Sylwester (Marcinkiewicz & Sylwester). This concept of involvement was also described by Wenglinsky (2006) when he stated, “Tapping higher order thinking skills by using

computers to help students work through complex problems produced greater benefits than using computers to drill students on a set of routine tasks” (p. 30). These results were even more important when placed in the context that chief executive officers (CEOs) of business and industry said they needed workers who could work with complex problems and come up with creative solutions. Wenglinsky also noted that the optimal role for technology for middle school students occurred when teachers incorporated computers in the content areas to promote higher order thinking. This was different from the high school students who needed to use technology to enhance their work and deepen understanding in areas such as english, history, trigonometry, and physics by enhancing their work products through technology (Wenglinsky).

Problem solving and critical thinking were critical parts of the 21st Century skill set. Rivero (2006) described technology as playing a critical role in developing these 21st century skills. He continued by stating, “For students to have the necessary skills to succeed in a global world, districts must embrace technology – now.”(p. 48) These skills included creative and critical thinking. Valadez and Duran (2007) noted that teachers from higher resource schools encouraged creative and critical thinking by students. They also supported “assertions that high resource schools are more likely to involve students in higher order learning processes such as problem solving and data analysis.”(p. 38)

Teacher Training in Technology Integration

The concept of providing teacher training for the use of technology in the classroom was not new. Taylor (1980) quoted Luehrmann who noted that, “In-service training for teachers is needed to assure adequate staffing of the computer skills courses. Teachers of other courses will also need specialized ‘subject matter’ training to prepare them to apply students’ computer skills to learning” (p. 157). Once the teacher was identified as being at the heart of the issue of implementing technology in schools, the length of time that it took for a teacher to become proficient with technology should be considered. According to Bailey, Lumley, and Dunbar (1995), “On average, it takes teachers five to 7 years to become comfortable, confident users of

educational technology” (p. 158). Casson et al. (1997) stated, “The hardest issues in implementing instructional technology are not concerned with routers, cabling, and the choice of an operating system but with changing the hearts and minds of thousands of educators whose professional world is going topsy-turvy” (p. 132). Professional development or training was the barrier most often cited regarding technology integration projects (Charp, 1997; McGraw, Ross, Blair, Hambrick, & Bradley, 2000) “Current models of training frequently are limited in time and scope; teachers need extended training – possibly with follow-up sessions – to address integration strategies” (McGraw et al., p. 4). It is important to note that the importance of teacher professional development was identified as early as 1980 because this issue remains an important part of technology integration today.

One common thread that was observed in the implementation and integration of the computer into the classroom was the gestalt notion that having computers in classrooms was a good thing. Lim and Khine (2006) noted that the idea that by simply having a powerful tool in the vicinity, learning will be positively impacted more as a by-product than through planned intervention and thoughtful integration of the technology to be used. They noted that this is not the case, instead they proposed that one of the key ingredients for success is appropriate teacher training. Bielefeldt (2005) stated that “(1) the presence of technology is not, by itself, related to student achievement and (2) the use of technology may help or hinder academic learning, depending on the nature of the use.”(p. 345)

Recognizing teacher training as a key piece to the technology integration puzzle, Banister and Vannatta (2006) recommended that teachers should be trained and tested on technology skills as a significant and early part of their teacher preparation program. Burns and Polman (2006) suggested that teachers who are in the field could also become technologically proficient and integrate technology into their daily instruction with appropriate training and support if the resources were available. They further determined that this adoption of technology could lead to positive changes in teacher attitudes towards their professional abilities and performance in the classroom.

Littrell et al. (2005) identified the link between access and teacher training when they reported:

Computer literacy courses required as part of NCATE-accredited teacher preparation programs in the US provide adequate training for these classroom management tasks. The current data support the argument that the utility of this training and use of classroom technology is dependent on access to computers and printers in the classroom (p. 44).

This link was repeated by Bickford et al. (2000) as they identified two critical elements that impacted this research study. These areas were teacher training and high capacity bandwidth and support. They made a strong statement regarding the importance of teacher training.

“Without trained educators who can use the technology and integrate it into their curriculum and instruction, this program would fail” (p. i). This concept of valid and on-going teacher training is key to the proper planning and implementation of technology into the instructional setting (Bickford et al.). Burke (2000) echoed this concept by stating, “teachers are ultimately responsible for the wise use of technology in the classroom. In order for teachers to get the best use from technology, they need teachers who are well prepared to use a variety of teaching methods.” (p. 3) Sahin and Thompson (2007) identified the need for educators to have a self-directed environment to learn about technology in order to foster an environment that lead to the adoption of new technologies resources for instruction.

The ability to use computers is not always the same as the ability to integrate computers into instruction. In 2005, Littrell et al. recommended moving teachers away from “computer literacy courses” (p. 45) and instead emphasizing infusing instructional technology across the curricula. They contended that a better approach is a more constructivist approach leading to the integration of usable technology based on student needs. Judson (2006) examined teacher beliefs as compared to technology use and determined that there was no correlation between self-purported constructivist beliefs and student centered technology use. Luehrmann (2002) identified the predominant use of computers in school today as being limited to computer labs where they are used as teaching tools. The continuing need to revamp pre-service teacher

education is identified as a requirement still needed to prepare future teachers to use technology optimally (Brown & Warschauer, 2006). This revamp should include infusion of technology into the field placements and pre-service teaching. Dexter, Doering, and Riedel (2006) identified the need for a systemic approach to the type and scope of change needed in pre-service teacher training with adequate resources and leadership involvement required for a sustainable initiative.

In addition to specialized training, King (2002) noted that teachers are adult learners who bring their own set of experiences and emotions; therefore, “professional development should engage teachers in a nurturing environment where their expertise is respected, tapped, and further developed.” (p. 28) Consideration of the host of experiences and can aid in the development of life long learning in these teachers (King). Lemke and Coughlin (1998) rightly acknowledged the role of educators in the integration of technology in the classroom with the statement, “Educators are the key to the effective use of technology in schools. It is only through change and school practice that the positive benefits of technology to learning will be realized” (p. 22).

Training and professional development is important at all educational levels. Zhang (2002) made the following recommendation for faculty at East Tennessee State University:

Training sessions or workshops on multimedia classrooms for both instructors and students are also very important to the effective using of multimedia classrooms. Multimedia classrooms can be effective only when both instructors and students know how to use the technology and the capacity of the technology in the class (p. 96).

Stewart (2005) determined “that the teaching and learning field and educational preparation and professional development processes do in fact make a difference in teachers’ use of technology.” (p. 57)

Thompson (2005) stated “Teacher education must be a strong force to promote the appropriate uses of technology to support educational renewal and to prepare a skilled work force for our information society.” (p. 331) Thompson also described teachers as feeling

uncomfortable using technology in their teaching, at the same time that nearly all schools are at a stage where they are connected to the Internet.

Hutinger, Bell, Daytner, and Johanson (2006) identified the teacher's level of comfort and knowledge of technology as the limiter of the success of technology integration in curriculum. "To impact children's learning, teachers must be trained to use technologies and strategies to integrate these technologies into the curriculum." (p. 42) The importance of staff development was also identified by Britt, Brasher, and Davenport (2007) who stated: "Staff development is key to encouraging teachers to adapt their traditional teaching strategies to include contemporary tools."(p. 125) They advocated that the use of technology should be taught in conjunction with other instructional goals, not in isolation.

Computers in Tennessee

Computers have been a part of the public education program in Tennessee for many years. During the period from 1993 to 1997 \$127 million was provided in state funds for educational technology in Tennessee school systems. Nearly \$95 million of this funding was directed towards classroom-based educational technology. According to the Tennessee Department of Education (1997), "In 1996-97, Tennessee became the first state in the nation to establish a statewide network that provides full graphical connections to the World Wide Web for all of its public schools." (p.4)

The Tennessee State Board of Education (2008a) required school systems to verify that all graduating seniors had received a minimum of 180 hours of computer education before graduation. This rule was implemented by the Tennessee State Board of Education for all public schools and became effective September 1, 1994.

The numbers of computers connected to the world in Tennessee classrooms have dramatically increased in recent years. In 1996 the Tennessee Department of Education (1997) determined that there were approximately 7,000 classroom computers online. In 2007, the Technology in Education Survey System reported 284,225 Tennessee classroom computers were

connected to the Internet. (University of Memphis, Center for Research in Educational Policy, 2008)

Questioning the Value of Technology Implementation

Cuban (2001) is one of the most noted critics of the placement of computer technology in schools. He made the case that the billions of dollars that have been spent on school computers over the past 20 years would have been better spent on other aspects of education. Cuban's conclusion is that, "computers in classrooms have been oversold by promoters and policymakers and underused by teachers and students" (p. 195). He is an opponent of technology integration as a means of school reform. He identified the driving force behind technology integration as a stated desire and attempt to provide economic mobility for our children on the part of politicians, school administrators, parents, and communities as a whole. However, Cuban also indicated that the return on the investment of increased productivity and learning that has been observed and should be expected in the future, is insufficient to warrant the effort, measured in the billions of dollars, that is required to integrate technology into the classroom. Cuban (2006) continued to be a skeptic of the ability of computers in the classrooms to transform teaching and learning. He urged educational leaders to recognize that achievement gains related to computers in the classroom can more easily be attributed to teachers than technology.

Becker (2000a) supported some of Cuban's positions "...computers have not transformed the teaching practices of a majority of teachers, particularly teachers of secondary academic subjects..." (p. 29). Romano (2003) provided an overview of technology in education that described successes as few and failures as many over the past 50 years.

In contradiction of Cuban's assertions, Becker (2006a) indicated that under certain conditions: "computers are clearly becoming a valuable and well-functioning instructional tool" (p. 29) and Romano (2003) proposed that in order to be the most effective technology implementation should follow a multi-step evolutionary process leading through a "Technology-Enhanced Curriculum"(p. 7) stage with adapted curriculum based on merging what teachers

traditionally do with the capabilities of technology. This stage would logically lead to the “Technology Dependent Curriculum”(p. 7) referred to as “the ultimate Digital Age model of education.”(p. 7) This final evolved level of technology implementation implies an educational model that is non-functional without technology.

Studies including Ravitz et al. (2002), Waxman, Connell, and Gray (2002), Waxman, Lin, and Michko (2003), Smith (2006), Wenglinsky (2006), Wijekumar et al. (2006), and Lei and Zhao (2007), indicated that technology in the classroom can lead to increased achievement. It should also be noted that there are studies that indicated that teaching using instructional technology does not always lead to increased achievement. Sivin-Kachala, Bialo, and Langford (2000) announced, “While several researchers have attempted to quantify its achievement effects in isolation, actual use of educational technology does not and should not occur in isolation.”(p. 85) Szabo (2001) determined that interactive multimedia improves achievement and increases efficiency through self-pacing. LaPrise (2003) identified the need for “media richness” (p. 132) when delivering instruction via the World Wide Web. The use of text and hypertext alone delivered via the World Wide Web did not result in satisfactory levels of achievement and mastery for the students of this study.

According to Brill and Galloway, (2007) “Modern technologies such as computer-based presentation software, the Internet and sophisticated electronic modeling programs present new opportunities for teaching and learning at all educational levels.”(p. 95) They also noted that instructors’ implementation of technology in classrooms was hampered by the availability of classroom technologies in all classrooms.

Beyond the problems associated with the integration of technology, there are also other factors that can impact the use of technology in the classroom. Keller and Bichelmeyer (2004) raised the question of the inevitability of the overall failure of technology integration efforts in the current accountability movement. They declared:

In sum, our argument is that professional development aimed at getting teachers to use technology is not likely to significantly influence how teachers use technology in their classrooms until it can be demonstrated that using technology is instrumental in meeting the challenge for all students to make adequate yearly progress as measured by standardized test scores. (p. 22)

The Digital Divide

The digital divide is essentially the division between those who have computers, Internet access, and the knowledge to use them and those who do not. This division is often based on differences in the adoption rates between different demographic groups (Leighton, 2001).

Valadez and Duran (2007) further described the effects of the digital divide between high-resource and low-resource schools and the computer and Internet use of teachers and students. Teachers in high-resource schools used more on-line communications and had more communications with students by email and more frequently engaged in professional activities on-line than the teachers from low resource schools. The students were found to be more likely to use computers creatively and experimentally in high-resource schools than their counterparts in low-resource schools. They also redefined the digital divide to go beyond computer to student ratios and Internet connections to encompass what students and teachers do when they are online to support instruction and encourage creative and critical thinking.

Bridging the digital divide is identified as a goal within the No Child Left Behind Legislation (United States Congress, 2002). Technology goals are included in the No Child Left Behind Act of 2001 under Title II Part D Section 2402.

(1) PRIMARY GOAL- The primary goal of this part is to improve student academic achievement through the use of technology in elementary schools and secondary schools.

(2) ADDITIONAL GOALS- The additional goals of this part are the following:

(A) To assist every student in crossing the digital divide by ensuring that every student is technologically literate by the time the student finishes the eighth

grade, regardless of the student's race, ethnicity, gender, family income, geographic location or disability.

To encourage the effective integration of technology resources and systems with teacher training and curriculum development to establish research-based instructional methods that can be widely implemented as best practices by State educational agencies and local educational agencies (United States Congress, p. 1671-1672).

Research-based instructional methods are identified in the NCLB act as a primary criterion that must be applied to the decision making process to select programs, products, and or practices funded through NCLB (Redfield, Schneiderman, & Sivin-Kachala, 2003).

Summary of Review of Literature

The passage of the No Child Left Behind Act of 2002 has made assessment using achievement tests a singular focal point in American education. The No Child Left Behind Act of 2002 requires each state to record and report assessment results for students and schools each year. The Tennessee assessment results are gathered using the TCAP assessment test administered annually to all students in grades 3 through 8. This test assesses skills in mathematics, reading and language arts, science, and social studies.

The personal computer has been used in the classroom for more than 25 years and hundreds of studies have been completed to determine their impact on student achievement. During those years computing power and the access to computers in the classroom have increased dramatically. Using computers in the classroom has been shown to increase achievement under some conditions and in some situations. There are several factors that can affect the impact of technology on achievement. These factors include, computer access, Internet access, user software capabilities, quality of computer work, teacher training in technology education, and positive teacher attitude.

The literature review also indicates that a digital divide between those with access to computers and the Internet exists and that it appears to be based largely on the socioeconomic

capability of individuals and schools. The digital divide is important to this research because bridging it is specifically identified as a goal within NCLB.

This chapter has provided an overview of the role of NCLB in establishing the importance of achievement testing in schools. Tennessee's TCAP assessment program has been described as it relates to meeting NCLB requirements. The uses of technology in education were reviewed and important factors that impact achievement using technology were identified.

CHAPTER 3

METHODS

The purpose of this study was to identify relationships between levels of technology integration and implementation of Tennessee middle schools as reported on the E-TOTE surveys and the same middle school's school-level achievement scores for the same years.

The rationale for initiating this particular study was the desire to provide relevant research that adds to the body of knowledge concerning the implementation and integration of computers for instructional use in Tennessee public schools. Included in this chapter are descriptions of the research design, the population studied, the method of data collection and instrumentation, the validity and reliability, and the methods of data analysis.

Research Design

In this study the researcher sought to investigate possible relationships between numerical data reported concerning the school-level implementation and integration of instructional computers, and individual school grade level TCAP achievement scores in reading and language arts, mathematics, science, and social studies. A quantitative, comparative approach was used. The school-level implementation and integration of instructional computers data to be analyzed were collected using survey methodology as part of the Tennessee Department of Education EdTech Tennessee Online Technology Evaluation System (E-TOTE) survey. This survey was administered annually in 2004 through 2008. Surveys were often used in educational research to collect data that were not readily observable (Borg, Gall, & Gall, 1996).

The individual school-level TCAP achievement score data were collected by the State of Tennessee as part of the Tennessee Comprehensive Assessment Program Administered in March and April of 2004 through 2006. The criterion variable in this study was the school-level TCAP achievement score data. The school-level predictor variables were:

Level of technology integration

Level of integration into teaching and learning

Level of educator preparation and development
Level of administration and support services
Level of infrastructure for technology
Number of computers
Network access and capabilities
Percentages of eighth grade student technology literacy

The Level of technology integration variable was an average of the combined scores of the levels of integration into teaching and learning, educator preparation and development, administration and support services, and infrastructure for technology. The four technology integration indicators were each reported as a separate key indicator on the E-TOTE school reports. The total number of computers was reported on the E-TOTE school report. The network access and capabilities indicator was the average of the four responses to the questions grouped in the network access and capabilities section of the survey report. The percentage of eighth grade student technology literacy was an average of the responses to 11 separate questions. These questions required the respondent to record percentages indicating the mastery of the schools' eighth grade students' regarding specific technology skill areas. These areas included applying productivity and multimedia tools and peripherals to support personal productivity, group collaboration, learning throughout the curriculum, percentage of eighth grade students collaborating with peers, experts, and others using telecommunications and collaborative tools to investigate curriculum-related problems, issues, and information, and to develop solutions or products for audiences inside and outside of the classroom.

Population

The population for this study was all public schools in Tennessee that included student populations in grades 6 through 8 from July, 2003 through April, 2006 and whose school achievement scores, as measured on State mandated Tennessee Comprehensive Assessment Program (TCAP) tests and Tennessee Department of Education E-TOTE EdTech Tennessee

Online Technology Evaluation System Survey for 2004 through 2006 were available for this study. The population excluded all schools that did not meet the stated grade level requirements. Any school with a population that did not have students in the three grade levels for the period of time being studied was excluded. The TCAP State Report by School and Grade did not report test results from schools or grade levels with small student populations requiring the protection of student privacy. Schools without data for all grade-levels were excluded. Any school that did not report E-TOTE data for the period of time being studied was excluded, examples of schools that did not report E-TOTE data included alternative schools and special education schools. When the study progressed to the point of conclusive identification of the total number of schools to be studied, that number was included in the study as well as the number of schools excluded in each category.

The Tennessee School Directory (Tennessee Department of Education, 2008) was used to identify 184 Tennessee public schools with students in grades 6, 7, and 8. Twenty-three schools were excluded from the study because TCAP school-level score results were not available for each of the years 2004, 2005, and 2006. Of the remaining 161 schools, 7 schools were excluded from the study because E-TOTE data were not available for 2004, 2005, and 2006. The school exclusions were solely a result of either incomplete or unavailable TCAP score or ETOTE survey data. No schools were excluded for which the study data were available. One hundred fifty-four schools met the criteria for inclusion in this study. See Appendix C for the List of Schools included in this study.

Instrumentation

The school-level achievement data used in this study were gathered as part of the Tennessee Comprehensive Accountability Program (TCAP) achievement test. The achievement test was administered annually and was a monitored, timed, multiple-choice assessment measuring reading and language arts, mathematics, science, and social studies skills in grades 3 through 8. The test was administered over a period of several days. Each school had some

flexibility in setting the testing schedule within a testing window agreed upon by the school system and the Tennessee Department of Education, Office of Testing and Accountability. Each class was monitored during the administration of the test and very specific rules and guidelines set down by the Tennessee Department of Education were followed to ensure test security and validity. The TCAP test results were posted annually at the official Tennessee State Department of Education web site: <http://www.state.tn.us/education/testing/02tstcapscores.htm> and <http://www.state.tn.us/education/testing/03tstcapscores.htm> respectively.

The implementation and integration of technology data was reported to the Tennessee Department of Education through the EdTech Tennessee Online Technology Evaluation System (E-TOTE) survey. This survey was mandated by the State of Tennessee in its efforts to provide data needed to meet state and national reporting requirements concerning the status of the implementation and integration of technology into the educational environment. The E-TOTE survey was intended to be completed by a school-level person who could best provide current, accurate and complete data (J. Bates, personal communication, November 22, 2002).

The data entry tool for the survey was a web-based form delivered via the Internet. Respondents had the opportunity to print the survey in order to gather the appropriate data to be entered into the E-TOTE system. “The STaR chart is a tool for planning and assessing a School’s Technology and Readiness in four key areas: Teaching and Learning, Educator Preparation and Development, Administration and Support Services, and Infrastructure for Technology.”(J. Bates, personal communication, November 22, 2002, p. 1) The portions of the survey that dealt with teaching and learning, educator preparation and development, administration and support services and infrastructure for technology were taken from the Tennessee STaR chart.

The E-TOTE survey consisted of the district account profile information that included demographic, technology support, web presence, and email questions. The school survey contained school-level demographic questions followed by the Tennessee STaR Chart questions. The STaR Chart questions were designed with four possible answers on a Likert scale. These answers were presented on a continuum of four possible answers starting with one as the lowest

level technology implementation response and four being the highest level of technology implementation. The STaR Chart presented 6 questions exploring separate areas of technology use under the heading of Teaching and Learning. The Educator Preparation and Development section also contained 6 questions. There were five questions under the Administration and Support Services section and the Infrastructure for Technology section also had five questions.

Network Access and Capabilities were measured through questions concerning home and school communication, wireless or laptop computing, after hours technology resources, and home access to the Internet. Each subsection required the respondent to select either all of the appropriate responses or a single response from the prepared answers. Possible responses included by estimation, survey, or other to be specified.

Each school responded to questions in each of the areas of Teaching and Learning, Educator Preparation and Development, Administration and Support, Infrastructure for Technology. Based on the responses to these subsections a key indicator was presented for Teaching and Learning, Educator Preparation and Development, Administration and Support, Infrastructure for Technology. The level of Technology Integration and Implementation was determined taking the average of the four scores representing the school's Teaching and Learning, Educator Preparation and Development, Administration and Support, and Infrastructure for Technology. These questions were phrased in such a manner that the response to each question reflected the score for the whole school-level of Technology Integration and Implementation. In addition, if the school included the 8th grade, the respondent was requested to complete the Eighth Grade Student Technology Literacy section, which was very similar in design and question content to the Student Technology Literacy section. The difference between the two sections was the specificity of the questions that were designed to match the state technology competencies for eighth grade students. Assistive technology was the final question on the survey instrument. The respondent was asked to choose from 6 choices that described the level of use and assistive technology selection process for students with disabilities and students with learning difficulties.

Data Collection

The data collection was completed by the Tennessee State Department of Education as part of the TCAP and E-TOTE programs. The school-level TCAP data was provided to the public for review on the Internet at the Tennessee Department of Education website listed previously in this study. No special permission was required to use the publicly disseminated TCAP data.

The E-TOTE survey reports were requested from Barbara Denson, Coordinator of Instructional Technology for the Tennessee Department of Education. Dr. Denson was contacted verbally and made the data available for this study. The formal written permission to use the 2004, 2005, and 2006 E-TOTE data to conduct this study was requested and approved for this study.

Validity and Reliability

The EdTech Online Technology Evaluation system (E-TOTE) was comprised of data collected at the system and school-level. The data were self-reported. The Tennessee Department of Education (2004) recognized the need for “better-informed self reporting in order to improve the quality of the data.”(p. 22) The Tennessee STaR Chart was selected as the rubric for evaluating school technology and readiness. The StaR Chart was adapted from the CEO Forum (1997) self-reporting survey instrument, School Technology and Readiness (STaR).

The school achievement data analyzed in this study was derived from the criterion-referenced TCAP test administered annually to students in grades 3-8 (CTB/McGraw-Hill, 2007). A criterion-referenced test performance is measured against specific criteria or established standards. “The Achievement Test has fresh, non-redundant test items and is customized yearly to measure the basic academic skills in reading, language arts, mathematics, science, and social studies.”(p. 4)

The TCAP reported criterion-referenced scores for each content objective measured by the test (CTB/McGraw-Hill, 2001). These content objectives were reported in terms of the Objective Performance Index (OPI). The OPI provided an estimate of the true score of an objective reported in a proportion of the total maximum points possible. Using OPIs, 3 levels of mastery could be assigned. The test “meets the highest standards of psychometric and technical standards in the industry”(p. 5). The test has undergone several extensive phases in development including initial screening, test selection, statistical analysis, and iterative review. Standardization was completed in 2000(CTB/McGraw-Hill).

Data Analysis

The Statistical Package for the Social Sciences (SPSS) computer program, version 16, was used to analyze the data. This study was designed to answer the research questions and test the associated null hypotheses presented below.

Research Question #1

Is there a relationship between the level of technology integration reported on the E-TOTE survey and the school’s normal curve equivalency (NCE) achievement scores in reading and language arts, mathematics, science, and social studies?

H₀1₁: There is no significant correlation between the reported level of technology integration and the school-level TCAP reading and language arts achievement scores

H₀1₂: There is no significant correlation the reported level of technology integration between and the school-level TCAP mathematics achievement scores

H₀1₃: There is no significant correlation between the reported level of technology integration and the school-level TCAP science achievement scores

H₀1₄: There is no significant correlation between the reported level of technology integration and the school-level TCAP social studies achievement scores

Research Question #2

Is there a relationship between the levels of progress of integration into teaching and learning reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

H₀₂₁: There is no significant correlation between the reported level of integration into teaching and learning and the school-level TCAP reading and language arts achievement scores

H₀₂₂: There is no significant correlation between the reported level of integration into teaching and learning and the school-level TCAP mathematics achievement scores

H₀₂₃: There is no significant correlation between the reported level of integration into teaching and learning and the school-level TCAP science achievement scores

H₀₂₄: There is no significant correlation between the reported level of integration into teaching and learning and the school-level TCAP social studies achievement scores

Research Question #3

Is there a relationship between the level of progress of educator preparation and development reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

H₀₃₁: There is no significant correlation between the reported level of educator preparation and development and the school-level TCAP reading and language arts achievement scores

H₀₃₂: There is no significant correlation between the reported level of educator preparation and development and the school-level TCAP mathematics achievement scores

H₀₃₃: There is no significant correlation between the reported level of educator preparation and development and the school-level TCAP science achievement scores

H₀₃₄: There is no significant correlation between the reported level of educator preparation and development and the school-level TCAP social studies achievement scores

Research Question #4

Is there a relationship between the level of progress of administration and support services reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

H₀₄₁: There is no significant correlation between the reported level of administration and support services and the school-level TCAP reading and language arts achievement scores

H₀₄₂: There is no significant correlation between the reported level of administration and support services and the school-level TCAP mathematics achievement scores

H₀₄₃: There is no significant correlation between the reported level of administration and support services and the school-level TCAP science achievement scores

H₀₄₄: There is no significant correlation between the reported level of administration and support services and the school-level TCAP social studies achievement scores

Research Question #5

Is there a relationship between the level of progress of infrastructure for technology reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

H₀₅₁: There is no significant correlation between the reported level of infrastructure for technology and the school-level TCAP reading and language arts achievement scores

H₀₅₂: There is no significant correlation between the reported level of infrastructure for technology and the school-level TCAP mathematics achievement scores

H₀₅₃: There is no significant correlation between the reported level of infrastructure for technology and the school-level TCAP science achievement scores

H₀₅₄: There is no significant correlation between the reported level of infrastructure for technology and the school-level TCAP social studies achievement scores

Research Question #6

Is there a relationship between the total computer count reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

H₀₆₁: There is no significant correlation between the reported total computer count and the school-level TCAP reading and language arts achievement scores

H₀₆₂: There is no significant correlation between the reported total computer count and the school-level TCAP mathematics achievement scores

H₀₆₃: There is no significant correlation between the reported total computer count and the school-level TCAP science achievement scores

H₀₆₄: There is no significant correlation between the reported total computer count and the school-level TCAP social studies achievement scores

Research Question #7

Is there a relationship between the levels of network access and capabilities reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

H₀₇₁: There is no significant correlation between the levels of network access and capabilities and the school-level TCAP reading and language arts achievement scores

H₀₇₂: There is no significant correlation between the levels of network access and capabilities and the school-level TCAP mathematics achievement scores

H₀₇₃: There is no significant correlation between the levels of network access and capabilities and the school-level TCAP science achievement scores

H₀₇₄: There is no significant correlation between the levels of network access and capabilities and the school-level TCAP social studies achievement scores

Research Question #8

Is there a relationship between the percentages of mastery of eighth grade technology literacy reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

H₀₈₁: There is no significant correlation between the percentages of mastery of eighth grade technology literacy and school-level TCAP reading and language arts achievement scores

H₀₈₂: There is no significant correlation between the percentages of mastery of eighth grade technology literacy and school-level TCAP mathematics achievement scores

H₀₈₃: There is no significant correlation between the percentages of mastery of eighth grade technology literacy and school-level TCAP science achievement scores

H₀₈₄: There is no significant correlation between the percentages of mastery of eighth grade technology literacy and school-level TCAP social studies achievement scores

All statistical tests were conducted using a preset alpha level of .05 to determine if statistically significant results occurred. The Pearson Product Moment (PPM) and the Spearman's rho correlation tests were used to determine a correlation coefficient between the various achievement years and the technology implementation and integration years. The correlation coefficients or (*r*) values reported through the Pearson's Product Moment and Spearman's *rho* statistical tests were evaluated and reported for effect size using Hopkins (2002) correlation coefficients. The values and descriptors or interpretations for Hopkins correlation coefficients are found in Table 1.

Table 1

Hopkins (2002) Descriptors for Correlation Coefficients

Statistic	Value	Interpretation
Correlation	.90 to 1.00	Nearly, practically, or almost: perfect, distinct, infinite
Coefficients	.70 to .90	Very large, very high, huge
	.50 to .70	Large, high, major
	.30 to .50	Moderate, medium
	.10 to .30	Small, low, minor
	.00 to .10	Trivial, very small, insubstantial, tiny, practically zero

Summary

Chapter 3 presents the methods, research design, population, instrumentation, data collection, validity and reliability, and the data analysis that was a list of the null hypotheses identified in this study. This was a quantitative study. Achievement data for this study were collected by the Tennessee Department of Education and were derived from the school-level achievement scores in reading and language arts, mathematics, science, and social studies for middle schools consisting of students in grades 6, 7, and 8 for 2004, 2005, and 2006. Technology implementation data for this study were collected by the Tennessee Department of Education and were derived from the reported levels of: technology implementation, technology implementation into teaching and learning, educator preparation and development, administration and support services, infrastructure for technology, number of computers, levels of network access and capabilities, and percentages of mastery of eighth grade student technology literacy for 2004, 2005, and 2006.

CHAPTER 4

DATA ANALYSIS

Introduction

The findings of this study are addressed in this chapter. The purpose of this study was to identify relationships between Tennessee middle schools' levels of technology integration and implementation as reported on the E-TOTE surveys and the same middle schools' school-level TCAP achievement scores for 2004, 2005, and 2006. The 8 indicators of technology implementation and integration from the E-TOTE surveys were examined in relation to the school-level achievement scores for 2004, 2005, and 2006. Tennessee schools with students in grades 6, 7, and 8 were the focus of the study. Eight research questions were developed to guide the study and to determine the relationship between technology implementation and integration and school-level achievement scores.

The data for this study were collected by the Tennessee Department of Education. The TCAP school scores came from the Tennessee Department of Education <http://www.k-12.state.tn.us/rptcrd06/>. The 2004 and 2005 E-TOTE data were provided by Barbara Denson, Coordinator of Instructional Technology, Tennessee Department of Education (B. Denson, personal communication, January 22, 2008). The 2006 E-TOTE data came from the Technology in education Survey System (TESS) <http://72.51.41.239/TESS/Public.jsp>.

Analysis of Research Questions

The results of the E-TOTE surveys and TCAP school-level scores were compiled into an Excel spreadsheet. A variety of statistical methods were used to analyze the data. TCAP school scores for mathematics, reading and language arts, social studies, science, and total computer counts were reported for 2004, 2005, and 2006 respectively.

Overall, school-level TCAP scores increased annually with mean scores for each subject area increasing each of the 3 years. The results are shown in Table 2. Reading and language arts

increased 2.62 points. The largest increase to the mean was mathematics with a 2.93 point increase. The smallest increase was in social studies (1.46 points), followed by science (1.7 points).

There were also increases in the minimum and maximum scores for each subject area for each year. Reading and language arts recorded the greatest improvement in minimum scores. It increased from 30 in 2004 to a minimum score of 36 in 2006. social studies test scores had the smallest increase in minimum from 29 to 31.

Table 2
Descriptive Statistics of School-level TCAP Scores by Year and Subject (N=154)

Year	TCAP Test	Minimum Score	Maximum Score	Range	Mean	Std. Deviation
2004	Reading & Language	30	69	39	50.51	7.848
2004	Math	29	69	40	50.66	8.054
2004	Science	28	67	39	49.92	8.191
2004	Social Studies	29	69	40	49.92	8.196
2005	Reading & Language	33	70	37	51.51	7.576
2005	Mathematics	31	70	39	52.06	8.196
2005	Science	31	68	37	50.56	7.970
2005	Social Studies	30	71	41	50.40	8.212
2006	Reading & Language	36	71	35	53.13	7.525
2006	Mathematics	32	73	41	53.59	8.265
2006	Science	32	70	38	51.62	8.220
2006	Social Studies	31	73	42	51.38	8.361

The per school mean number of computers increased by 38.43 computers from 2004 to 2006. This increase indicated that more computers were being added to schools each year. The minimum number of computers for a school was 21 in 2004 and the maximum was 1,039 in 2006. There was also a very large increase of 233% in the maximum category of the total

computer count section. This large increase can be attributed to a one-to-one computer laptop initiative launched in 2006. A one-to-one computer laptop program means simply that each student and teacher has a laptop computer that is used to deliver and receive the curriculum. In this case the school added nearly 700 computers in 1 year. The mean number of computers was 190 in 2004 and 228 in 2006.

The minimum lowest percentage of eighth grade technology literacy was 2.4% reported in 2004 and the highest was 100% reported in 2006. The mean percentage of eighth grade technology literacy increased in each year of the study. The results for computer counts and percentage of 8th grade technology literacy are shown in Table 3.

Table 3
Descriptive Statistics for Total Computer Counts and Percentage of 8th Grade Technology Literacy (N=154)

Year	Total Computers	Minimum	Maximum	Range	Mean	Std. Deviation
2004	Total Computers	21	434	413	189.60	93.766
2005	Total Computers	41	445	404	204.27	101.649
2006	Total Computers	26	1039	1013	228.03	150.438
2004	% of Eighth Grade Technology Literacy	2.4%	98.5%	96.1%	46.31%	20.06%
2005	% of Eighth Grade Technology Literacy	4.5%	93%	88.5%	48.89%	19.63%
2006	% of Eighth Grade Technology Literacy	2.9%	100%	97.1%	53.12%	21.54%

Sections of the E-TOTE survey were organized according to headings based on the technology integration indicators selected for this study. These sections each contained three to five questions. Survey respondents completed the questions in these sections by selection one of four levels of implementation or integration. The levels were Early Tech, Developing Tech, Advanced Tech, and Target Tech in the order of the lowest level of implementation or integration to the highest. The interval or amount of implementation or integration between each

level of implementation is subjective. There were guidelines regarding milestones or indicators for selecting the appropriate level within each technology question on the survey.

The integration and implementation indicators increased from 2004 to 2006. The frequencies and percentages for each year are presented in Table 4 for 2004, Table 5 for 2005 and Table 6 for 2006. It is interesting to note that no schools' average responses were at the Target or highest level of technology implementation and integration in 2004 or 2005 for any of the technology indicators. For clarification, there were schools that provided individual responses at the level of Target Tech, however, the average of the technology indicator questions was below the Target Tech level.

Table 4
Frequency Statistics for 2004 Technology Integration and Implementation Indicators (N=154)

Technology Indicators	Levels of Progress							
	Early		Developing		Advanced		Target	
	Frequency	Valid %	Frequency	Valid %	Frequency	Valid %	Frequency	Valid %
Level of Technology Integration	9	5.8	89	57.8	56	36.4	0	0
Teaching and Learning	14	9.1	85	55.2	55	35.7	0	0
Educator Preparation and Development	21	13.6	88	57.1	45	29.2	0	0
Administration and Support Services	18	11.7	74	48.1	62	40.3	0	0
Infrastructure for Technology	12	7.8	119	77.3	23	14.9	0	0
Network Total Access	93	60.4	57	37	4	2.6	0	0

Table 5

Frequency Statistics for 2005 Technology Integration and Implementation Indicators (N=154)

Technology Indicators Target	Levels of Progress							
	Early		Developing		Advanced		Target	
	Frequency	Valid %	Frequency	Valid %	Frequency	Valid %	Frequency	Valid %
Level of Technology Integration	20	13	105	68.2	29	18.8	0	0
Teaching and Learning	18	11.7	91	59.1	45	29.2	0	0
Educator Preparation and Development	23	14.9	88	57.1	43	27.9	0	0
Administration and Support Services	43	27.9	85	55.2	26	16.9	0	0
Infrastructure for Technology	67	43.5	85	55.2	2	1.3	0	0
Network Total Access	90	58.4	53	34.4	11	7.1	0	0

Table 6

Frequency Statistics for 2006 Technology Integration and Implementation Indicators (N=154)

Technology Indicators Target	Levels of Progress							
	Early		Developing		Advanced		Target	
	Frequency	Valid %	Frequency	Valid %	Frequency	Valid %	Frequency	Valid %
Level of Technology Integration	0	0	45	29.2	106	68.8	3	1.9
Teaching and Learning	5	3.2	58	37.7	82	53.2	9	5.8
Educator Preparation and Development	3	1.9	63	40.9	84	54.5	4	2.6
Administration and Support Services	4	2.6	36	23.4	101	65.6	13	8.4
Infrastructure for Technology	0	0	71	46.1	82	53.2	1	0.6
Network Total Access	60	39.0	55	35.7	31	20.1	8	5.2

The data also show that the percentage of schools that reported levels of implementation and integration at the lowest level of Early Tech decreased from a 2004 to 2006. In 2004, the lowest number schools that were at the Early Tech level for any indicator was 9, while in 2006 there were 0 schools at the Early Tech level for the indicators, level of technology integration and infrastructure for technology. In 2004 more than 50% of the schools were at the Developing Tech level or lower. The 2006 data showed that more than 50 % of the schools had moved to the Advanced Tech level or higher. The highest frequency response for any technology indicator in the study was 106 schools at the Advanced Tech level in 2006.

The data contained an anomaly with regard to the 2005 data showing a higher frequency of Early Tech responses than in 2004. There could be variety of reasons for this anomaly. These reasons include the subjective nature of the selection of the technology level on the survey, changes in respondents' attitudes or perceptions towards technology implementation and integration over the 3-year period, and shifts in local district and school-level priorities and emphasis that result in higher or lower technology use. There could have been other factors that were not indicated here. The data shift or anomaly found in the 2005 information underscored the value of examining and comparing the data from multiple years.

Research Question #1

Is there a relationship between the level of technology integration reported on the E-TOTE survey and the school's normal curve equivalency (NCE) achievement scores in reading and language arts, mathematics, science, and social studies? The null hypotheses for this question were:

H₀₁: There is no significant correlation between the reported level of technology integration and the school-level TCAP reading and language arts achievement scores

H₀₂: There is no significant correlation the reported level of technology integration between and the school-level TCAP mathematics achievement scores

H₀₁₃: There is no significant correlation between the reported level of technology integration and the school-level TCAP science achievement scores

H₀₁₄: There is no significant correlation between the reported level of technology integration and the school-level TCAP social studies achievement scores

The results for 2004 are shown in Table 7, 2005 in Table 8, and 2006 in Table 9. The Spearman Rank Order test was performed to answer this question. Because the probability was greater than the preset alpha of .05, the null hypotheses were retained for 2004, 2005, and 2006. There was a very small negative correlation in each year but it was not significant.

Table 7
Correlations of 2004 School-level TCAP Scores to Technology Integration and Implementation Indicators (N=154)

E-TOTE Technology Indicators	Spearman's rho	2004 Score	2004 Score	2004 Score	2004 Score
		Reading & Language	Math	Science	Social Studies
Level of Technology Integration	Correlation Coefficient	-.018	-.070	-.021	-.037
	Sig. (2-tailed)	.821	.390	.798	.653
Teaching and Learning	Correlation Coefficient	-.039	-.072	-.030	-.052
	Sig. (2-tailed)	.632	.374	.708	.519
Educator Preparation and Development	Correlation Coefficient	.029	.022	.066	.013
	Sig. (2-tailed)	.722	.783	.414	.876
Administration and Support Services	Correlation Coefficient	.104	.017	.069	.069
	Sig. (2-tailed)	.199	.833	.394	.397
Infrastructure for Technology	Correlation Coefficient	-.166*	-.187*	-.175*	-.153
	Sig. (2-tailed)	.040	.020	.030	.057
Network Total Access	Correlation Coefficient	.088	.063	.022	.088
	Sig. (2-tailed)	.277	.441	.785	.280

* Correlation is significant at the 0.05 level (2-tailed).

Table 8

Correlations of 2005 School-level TCAP Scores to Technology Integration and Implementation Indicators, (N=154)

E-TOTE Technology Indicators	Spearman's rho	2005 Score	2005 Score	2005 Score	2005 Score
		Reading & Language	Math	Science	Social Studies
Level of Technology Integration	Correlation Coefficient	-.013	-.030	-.015	-.041
	Sig. (2-tailed)	.875	.715	.857	.612
Teaching and Learning	Correlation Coefficient	-.029	-.056	-.033	-.041
	Sig. (2-tailed)	.721	.491	.685	.614
Educator Preparation and Development	Correlation Coefficient	-.033	-.023	.000	-.048
	Sig. (2-tailed)	.681	.778	.995	.553
Administration and Support Services	Correlation Coefficient	.049	.022	.033	.014
	Sig. (2-tailed)	.550	.791	.682	.862
Infrastructure for Technology	Correlation Coefficient	-.011	-.021	-.024	-.042
	Sig. (2-tailed)	.891	.792	.764	.603
Network Total Access	Correlation Coefficient	.121*	.106	.092	.103
	Sig. (2-tailed)	.134	.191	.257	.204

* Correlation is significant at the 0.05 level (2-tailed).

Table 9

Correlations of 2006 School-level TCAP Scores to Technology Integration and Implementation Indicators (N=154)

E-TOTE Technology Indicators	Spearman's rho	2006 Score	2006 Score	2006 Score	2006 Score
		Reading & Language	Math	Science	Social Studies
Level of Technology Integration	Correlation Coefficient	-.005	-.052	-.087	-.066
	Sig. (2-tailed)	.947	.523	.285	.415
Teaching and Learning	Correlation Coefficient	-.052	-.086	-.084	-.084
	Sig. (2-tailed)	.519	.288	.301	.300
Educator Preparation and Development	Correlation Coefficient	.115	.100	.067	.095
	Sig. (2-tailed)	.157	.218	.410	.243
Administrator and Support Services	Correlation Coefficient	-.046	-.061	-.091	-.096
	Sig. (2-tailed)	.570	.449	.264	.237

Table 9 (continued)

E-TOTE Technology Indicators	Spearman's rho	2006 Score	2006 Score	2006 Score	2006 Score
		Reading & Language	Math	Science	Social Studies
Infrastructure and Technology	Correlation Coefficient	-.047	-.126	-.150	-.118
	Sig. (2-tailed)	.559	.119	.063	.145
Network Total Access	Correlation Coefficient	.137	.162*	.159*	.153
	Sig. (2-tailed)	.090	.045	.049	.058

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Research Question #2

Is there a relationship between the levels of progress of integration into teaching and learning reported on the E-TOTE survey and the schools' NCE achievement scores in reading and language arts, mathematics, science, and social studies? The null hypotheses for this question were:

H₀₂₁: There is no significant correlation between the reported level of integration into teaching and learning and the school-level TCAP reading and language arts achievement scores

H₀₂₂: There is no significant correlation between the reported level of integration into teaching and learning and the school-level TCAP mathematics achievement scores

H₀₂₃: There is no significant correlation between the reported level of integration into teaching and learning and the school-level TCAP science achievement scores

H₀₂₄: There is no significant correlation between the reported level of integration into teaching and learning and the school-level TCAP social studies achievement scores

The results for 2004 are shown in Table 4, 2005 in Table 5, and 2006 in Table 6. The Spearman Rank Order test was performed to answer this question. Because the probability was greater than the preset alpha of .05, the null hypotheses were retained for 2004, 2005, and 2006. There was a very small negative correlation in each year but it was not significant.

Research Question #3

Is there a relationship between the level of progress of educator preparation and development reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies? The null hypotheses for this question were:

H₀₃₁: There is no significant correlation between the reported level of educator preparation and development and the school-level TCAP reading and language arts achievement scores

H₀₃₂: There is no significant correlation between the reported level of educator preparation and development and the school-level TCAP mathematics achievement scores

H₀₃₃: There is no significant correlation between the reported level of educator preparation and development and the school-level TCAP science achievement scores

H₀₃₄: There is no significant correlation between the reported level of educator preparation and development and the school-level TCAP social studies achievement scores

The results for 2004 are shown in Table 4, 2005 in Table 5, and 2006 in Table 6. The Spearman Rank Order test was performed to answer this question. Because the probability was greater than the preset alpha of .05, the null hypotheses were retained for 2004, 2005, and 2006. For 2004 and 2006 there was a small but not significant positive correlation. For 2005, there was a very small but not significant negative correlation.

Research Question #4

Is there a relationship between the level of progress of administration and support services reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies? The null hypotheses for this question were:

H₀₄₁: There is no significant correlation between the reported level of administration and support services and the school-level TCAP reading and language arts achievement scores

H₀₄₂: There is no significant correlation between the reported level of administration and support services and the school-level TCAP mathematics achievement scores

H₀₄₃: There is no significant correlation between the reported level of administration and support services and the school-level TCAP science achievement scores

H₀₄₄: There is no significant correlation between the reported level of administration and support services and the school-level TCAP social studies achievement scores

The results for 2004 are shown in Table 4, 2005 in Table 5, and 2006 in Table 6. The Spearman Rank Order test was performed to answer this question. Because the probability was greater than the preset alpha of .05, the null hypotheses were retained for 2004, 2005, and 2006. For 2004 and 2005 there was a small but not significant positive correlation. For 2006 there was a very small but not significant negative correlation.

Research Question #5

Is there a relationship between the level of progress of infrastructure for technology reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

The results for 2004 are shown in Table 7, 2005 in Table 8, and 2006 in Table 9. Spearman's rho was used to determine the strength and direction of any relationships between the school scores and level of progress of infrastructure for technology.

H₀₅₁: There is no significant correlation between the reported level of infrastructure for technology and the school-level TCAP reading and language arts achievement scores

The null hypothesis was retained for 2005 and 2006 because the probability was greater than the preset alpha of .05. There was a very small but not significant negative correlation.

For 2004 data, the reported level of infrastructure for technology and TCAP reading and language arts achievement scores, the Spearman's *rho* results were $r = -.166$, ($p = .040$). Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small negative correlation (Hopkins, 2002) is indicated by the r value between 0.00 and 0.10. This correlation indicates that when the level of infrastructure for technology decreased, school-level TCAP reading and language arts achievement scores increased in 2004.

H₀₅₂: There is no significant correlation between the reported level of infrastructure for technology and the school-level TCAP mathematics achievement scores

The null hypothesis was retained for 2005 and 2006 because the probability was greater than the preset alpha of .05. There was a very small but not significant negative correlation.

For 2004 data, the reported level of infrastructure for technology and TCAP mathematics achievement scores, the Spearman's *rho* results were $r = -.187$, ($p = .020$). Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small negative correlation is indicated by the r value between 0.00 and 0.10. This correlation indicates that when the level of infrastructure for technology decreased, school-level TCAP mathematics achievement scores increased in 2004.

H₀₅₃: There is no significant correlation between the reported level of infrastructure for technology and the school-level TCAP science achievement scores

The null hypothesis was retained for 2005 and 2006 because the probability was greater than the preset alpha of .05. There was a very small but not significant negative correlation.

For 2004 data, the reported level of infrastructure for technology and TCAP science achievement scores, the Spearman's *rho* results were $r = -.175$, ($p = .030$). Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small negative correlation is indicated by the r value between 0.00 and 0.10. This correlation indicates that when the level of infrastructure for technology decreased, school-level TCAP science achievement scores increased in 2004.

H₀₅₄: There is no significant correlation between the reported level of infrastructure for technology and the school-level TCAP social studies achievement scores

The null hypothesis was retained for 2004, 2005, and 2006 as the probability was greater than the preset alpha of .05. There was a very small but not significant negative correlation.

Research Question #6

Is there a relationship between the total computer count reported on the E-TOTE survey and the school’s NCE achievement scores in reading and language arts, mathematics, science, and social studies?

The results for 2004 are shown in Table 10, 2005 in Table 11, and 2006 in Table 12. Pearson’s correlation coefficient was used to determine the strength and direction of any relationships between the total computer count and the school-level scores.

Table 10
Pearson’s Correlation Coefficient Test of 2004 School-level TCAP Scores to Total Computer Count and Eighth Grade Technology Literacy Scores, (N=154)

Predictor Variables		2004 Score Reading & Language	2004 Score Math	2004 Score Science	2004 Score Social Studies
Total Computer Count	Pearson Correlation	.216**	.191*	.181*	.203*
	Sig. (2-tailed)	.007	.017	.025	.012
Eighth Grade Technology Literacy Score	Pearson Correlation	.173*	.187*	.145	.185*
	Sig. (2-tailed)	.032	.020	.073	.021

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 11
Pearson’s Correlation Coefficient Test of 2005 School-level TCAP Scores to Total Computer Count and Eighth Grade Technology Literacy Score, (N=154)

Predictor Variables		2005 Score Reading & Language	2005 Score Math	2005 Score Science	2005 Score Social Studies
Total Computer Count	Pearson Correlation	.162*	.149	.128	.137
	Sig. (2-tailed)	.044	.066	.112	.090
Eighth Grade Technology Literacy Score	Pearson Correlation	.124	.110	.074	.131
	Sig. (2-tailed)	.125	.174	.360	.105

* Correlation is significant at the 0.05 level (2-tailed).

Table 12

Pearson's Correlation Coefficient Test of 2006 School-level TCAP Scores to Total Computer Count and Eighth Grade Technology Literacy Score, (N=154)

Predictor Variables		2006 Score Reading & Language	2006 Score Math	2006 Score Science	2006 Score Social Studies
Total Computer Count	Pearson Correlation	.151	.132	.212**	.168*
	Sig. (2-tailed)	.061	.104	.008	.038
Eighth Grade Technology Literacy Score	Pearson Correlation	.117	.127	.114	.133
	Sig. (2-tailed)	.147	.117	.158	.101

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

H₀₆₁: There is no significant correlation between the reported total computer count and the school-level TCAP reading and language arts achievement scores

The null hypothesis was retained for 2006 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

For 2004 data, reported total computer counts and TCAP reading and language arts achievement scores, the Pearson's correlation coefficient (r) was .216, $p = .007$. Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive correlation is indicated by the r value, which is between 0.00 and 0.10. This correlation indicates that when the total computer counts increased, school-level TCAP reading and language arts achievement scores increased in 2004.

For 2005 data, reported total computer counts and TCAP reading and language arts achievement scores, the Pearson's correlation coefficient (r) was .162, $p = .044$. Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive correlation is indicated by the r value, which is between 0.00 and 0.10. This correlation indicates that when the total computer counts increased, school-level TCAP reading and language arts achievement scores increased in 2005.

H₀₆₂: There is no significant correlation between the reported total computer count and the school-level TCAP mathematics achievement scores

The null hypothesis was retained for 2005 and 2006 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

For 2004 data, reported total computer counts and TCAP mathematics achievement scores, the Pearson's correlation coefficient (r) was .191, $p = .017$. Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive correlation is indicated by the r value, which is between 0.00 and 0.10. This correlation indicates that when the total computer counts increased, school-level TCAP mathematics achievement scores increased in 2004.

H₀₆₃: There is no significant correlation between the reported total computer count and the school-level TCAP science achievement scores

The null hypothesis was retained for 2005 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

For 2004 data, reported total computer counts and TCAP science achievement scores, the Pearson's correlation coefficient (r) was .181, $p = .025$. Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive correlation is indicated by the r value, which is between 0.00 and 0.10. This correlation indicates that when the total computer counts increased, school-level TCAP science achievement scores increased in 2004.

For 2006 data, reported total computer counts and TCAP science achievement scores, the Pearson's correlation coefficient (r) was .212, $p = .008$. Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive correlation is indicated by the r value, which is between 0.00 and 0.10. This correlation indicates that when the

total computer counts increased, school-level TCAP science achievement scores increased in 2006.

H₀₆₄: There is no significant correlation between the reported total computer count and the school-level TCAP social studies achievement scores

The null hypothesis was retained for 2005 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

For 2004 data, reported total computer counts and TCAP social studies achievement scores, the Pearson's correlation coefficient (r) was .203, $p = .012$. Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive correlation is indicated by the r value, which is between 0.00 and 0.10. This correlation indicates that when the total computer counts increased, school-level TCAP social studies achievement scores increased in 2004.

For 2006 data, reported total computer counts and TCAP social studies achievement scores, the Pearson's correlation coefficient (r) was .168, $p = .038$. Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive correlation is indicated by the r value, which is between 0.00 and 0.10. This correlation indicates that when the total computer counts increased, school-level TCAP social studies achievement scores increased in 2006.

Research Question #7

Is there a relationship between the levels of network access and capabilities reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

The results for 2004 are shown in Table 7, 2005 in Table 8, and 2006 in Table 9.

Spearman's rho was used to determine the strength and direction of any relationships between the school scores and eighth grade technology literacy.

H₀₇₁: There is no significant correlation between the levels of network access and capabilities and school-level TCAP reading and language arts achievement scores

The null hypothesis was retained for 2004, 2005 and 2006 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

H₀₇₂: There is no significant correlation between the levels of network access and capabilities and school-level TCAP mathematics achievement scores

The null hypothesis was retained for 2004 and 2005 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

For 2006 data, reported levels of network access and capabilities and TCAP mathematics achievement scores, the Spearman's *rho* results were $r = .162$, ($p = .045$). Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive correlation is indicated by the r value, which is between 0.00 and 0.10. This correlation indicates that when the levels of network access and capabilities increased, school-level TCAP mathematics achievement scores increased in 2006.

H₀₇₃: There is no significant correlation between the levels of network access and capabilities and school-level TCAP science achievement scores

The null hypothesis was retained for 2004 and 2005 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

For 2006 data, reported levels of network access and capabilities and TCAP science achievement scores, the Spearman's *rho* results were $r = .159$, ($p = .049$). Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive

correlation is indicated by the r value, which is between 0.00 and 0.10. This correlation indicates that when the levels of network access and capabilities increased, school-level TCAP science achievement scores increased in 2006.

H₀₇₄: There is no significant correlation between the levels of network access and capabilities and school-level TCAP social studies achievement scores

The null hypothesis was retained for 2004, 2005, and 2006 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

Research Question #8

Is there a relationship between the percentages of mastery of eighth grade technology literacy reported on the E-TOTE survey and the school's NCE achievement scores in reading and language arts, mathematics, science, and social studies?

The results for 2004 are shown in Table 10, 2005 in Table 11, and 2006 in Table 12. Pearson's correlation coefficient was used to determine the strength and direction of any relationships between the eighth grade technology literacy and school scores.

H₀₈₁: There is no significant correlation between the percentages of mastery of eighth grade technology literacy and school-level TCAP reading and language arts achievement scores

The null hypothesis was retained for 2005 and 2006 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

For 2004 data, reported percentages of mastery of eighth grade technology literacy and TCAP reading and language arts achievement scores, the Pearson's correlation coefficient (r) was .173, $p = .032$. Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive correlation is indicated by the r value, which is between 0.0 and 0.10. This correlation indicates that when the percentages of mastery of eighth

grade technology literacy increased, school-level TCAP reading and language arts achievement scores increased in 2004.

H₀8₂: There is no significant correlation between the percentages of mastery of eighth grade technology literacy and school-level TCAP mathematics achievement scores

The null hypothesis was retained for 2005 and 2006 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

For 2004 data, reported percentages of mastery of eighth grade technology literacy and TCAP mathematics achievement scores, the Pearson's correlation coefficient (r) was .187, $p = .020$. Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive correlation is indicated by the r value, which is between 0.00 and 0.10. This correlation indicates that when the percentages of mastery of eighth grade technology literacy increased, school-level TCAP mathematics achievement scores increased in 2004.

H₀8₃: There is no significant correlation between the percentages of mastery of eighth grade technology literacy and school-level TCAP science achievement scores

The null hypothesis was retained for 2004, 2005, and 2006 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

H₀8₄: There is no significant correlation between the percentages of mastery of eighth grade technology literacy and school-level TCAP social studies achievement scores

The null hypothesis was retained for 2005 and 2006 because the probability was greater than the preset alpha of .05. There was a very small but not significant positive correlation.

For 2004 data, reported percentages of mastery of eighth grade technology literacy and TCAP social studies achievement scores, the Pearson's correlation coefficient (r) was .185, $p = .021$. Because the probability was less than the preset alpha of .05, the null hypothesis was rejected. A very small positive correlation is indicated by the r value, which is between 0.00 and

0.10. This correlation indicates that when the percentages of mastery of eighth grade technology literacy increased, school-level TCAP social studies achievement scores increased in 2004.

Summary

The analysis centered on 8 research questions and associated null hypotheses that were tested for correlation at the .05 alpha level of significance using the Pearson product-moment and Spearman's *rho* bivariate analyses for correlation. The null hypotheses for research questions 1, 2, 3, and 4 were retained for all TCAP school-level score subject areas. This study found no significant correlation between the reported level of technology integration and the school-level TCAP scores in reading and language arts, mathematics, science, and social studies for 2004, 2005, and 2006. A very small but not significant negative correlation was noted. This study found no significant correlation between the reported levels of progress of integration into teaching and learning, or the reported level of progress of educator preparation and development or the reported level of progress of administrator and support services and the school-level TCAP scores in reading and language arts, mathematics, science, and social studies for 2004, 2005, and 2006. A very small but not significant negative correlation was noted for the levels of progress of integration into teaching and learning indicator. The level of progress of educator preparation and development had mixed very small negative and very small positive correlations that were not significant. A very small positive but not significant correlation was also indicated for the level of progress of administrator and support services indicator.

The data analysis for research question 5 resulted in mixed findings by year analyzed. The null hypotheses that there was no significant correlation between the level of infrastructure for technology and school-level TCAP scores for reading and language arts, mathematics, science, and social studies were retained for 2005 and 2006 and for social studies only in 2004, although there was a very small negative but not significant correlation. The analysis indicated that there was a very small significant negative correlation between the level of infrastructure for

technology and school-level TCAP scores for reading and language arts, mathematics, and science in 2004.

The data analysis of research question 6 resulted in the rejection of the null hypotheses for all subjects for 2004 and mixed findings for 2005 and 2006. The null hypothesis that there was no significant correlation between total computer counts and school-level TCAP scores for reading and language arts, mathematics, science, and social studies were retained for mathematics, science, and social studies in 2005 and retained for reading and language arts and mathematics in 2006, there was a very small positive but not significant correlation. The analysis indicated that there was a significant very small positive correlation between the total computer count and school-level TCAP scores for reading and language arts, mathematics, science, and social studies for 2004. A significant very small positive correlation between the total computer count and school-level TCAP scores for reading and language arts in 2005 and the school-level TCAP score for science and social studies in 2006 were also found.

The data analysis of research question 7 resulted in mixed findings for 2005 and 2006. The analysis indicated that there was no significant correlation between the level of network access and capabilities and school-level TCAP scores for reading and language arts, mathematics, science and social studies for 2004 and 2005, and for reading and language arts and social studies in 2006, although there was a very small positive but not significant correlation. A significant small positive correlation was found between the level of network access and capabilities and school-level TCAP scores for mathematics and science in 2006.

The data analysis of research question 8 did not find significant correlation between the percentages of mastery of eighth grade technology literacy and any subjects for 2006. No significant correlation was found between the percentages of mastery of eighth grade technology literacy and science in 2004 or reading and language arts, mathematics, science, and social studies in 2005 and 2006, although there was a very small positive but not significant correlation. The analysis indicated that there was a significant very small positive correlation between the

percentages of mastery of eighth grade technology literacy and school-level TCAP scores for reading and language arts, mathematics, and social studies for 2004.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to identify relationships between the levels of technology integration and implementation as reported on the E-TOTE surveys and school-level achievement scores of Tennessee middle schools for 2004, 2005, and 2006. The 8 indicators of technology implementation and integration from the E-TOTE surveys were used in relation to TCAP school-level achievement scores for 2004, 2005, and 2006. Tennessee schools with students in grades 6, 7, and 8 were the focus of the study.

Summary of Findings

There were 154 schools that met the criteria of having students in grades 6, 7, and 8, and completed E-TOTE surveys and TCAP school scores for mathematics, reading and language arts, science, and social studies for 2004, 2005, and 2006. The researcher selected the representative indicators to analyze from the categories under investigation. These categories were the level of technology implementation, the level of integration into teaching and learning, the level of educator preparation and development, the level of administration and support services, the level of infrastructure for technology, the number of computers, the network access and capabilities, and the percentage of eighth grade student technology literacy. The school-level TCAP scores for the respective subject areas were selected as the measure of achievement. Statistical analyses were completed that determined if a relationship existed between these indicators and the selected school-level TCAP scores for 2004, 2005 or 2006.

The analyses centered on 8 research questions that were tested at a .05 level of significance. The predictor variables for this study were the E-TOTE levels of technology integration, teaching and learning, educator preparation and development, administration and support services, infrastructure for technology, network access and capabilities, the percentage of

mastery of eighth grade technology literacy, and total computer counts for 2004, 2005, and 2006. The criterion variables were the school-level TCAP scores for reading and language arts, mathematics, science, and social studies for 2004, 2005, and 2006.

No significant correlation was identified between the level of technology integration, the level of progress of integration into teaching and learning, the level of progress of educator preparation and development, and the level of progress of administration and support services and the school-level TCAP scores in reading and language arts, mathematics, science, and social studies.

There were mixed results with regard to the relationship of level of progress of infrastructure for technology and achievement scores in reading and language arts, mathematics, science, and social studies. While there were no significant correlations between infrastructure for technology and achievement in 2005 and 2006 there were small negative correlations between infrastructure for technology and reading and language arts, mathematics, and science achievement scores in 2004. There was no correlation in 2004 between infrastructure for technology and social studies scores.

There were mixed results with regard to the relationship of reported total computer counts and achievement scores in reading and language arts, mathematics, science, and social studies. In 2004 there was a small significant positive correlation between reported total computer counts and all subjects. Reading and language arts also had a small significant positive correlation in 2005, as did science and social studies in 2006. There was no correlation between reported total computer counts and mathematics, science and social studies in 2005 or for reading and language arts or mathematics in 2006.

There were small significant positive correlations between levels of network access and capabilities and mathematics and science in 2006. There were no correlations between levels of network access and capabilities and any subject area in 2004 and 2005 or in reading and language arts or social studies in 2006.

In 2004, percentages of mastery of eighth grade technology literacy were found to have a small significant positive relationship with reading and language arts, mathematics, and social studies. In contrast, percentages of mastery of eighth grade technology literacy showed a relationship to neither 2004 social studies, nor any subject of 2005 or 2006.

Conclusions

This study investigated the correlations or relationships between reported levels of technology integration in Tennessee middle schools and school-level TCAP scores for 2004, 2005, and 2006. The technology integration indicators were the level of progress of technology implementation, the level of progress of integration into teaching and learning, the level of progress of educator preparation and development, the level of progress administration and support services, the level of progress of infrastructure and technology, the number of computers, the level of network access and capabilities, and the percentages of mastery of eighth grade technology literacy. There were no significant relationships identified within this study between the technology integration indicators of level of progress for technology implementation, the level of progress of integration into teaching and learning, the level of progress of educator preparation and development, and the level of progress administration and support services and the school-level TCAP scores. There were significant relationships identified between the level of progress of infrastructure for technology, the number of computers, the levels of network access and capabilities, and the percentages of mastery of eighth grade technology literacy and the school-level TCAP scores. There were 8 conclusions drawn from this study.

Overall Conclusion

There were some isolated significant correlations between levels of technology and academic achievement; however, overall these correlations were small and resulted in very low levels of predictability as demonstrated by the low coefficients of determination. As a result, this study does not offer any sweeping general conclusions or strong recommendations regarding the

identified significant relationships between levels of progress and technology integration and achievement scores.

Conclusion #1

An examination of the school-level TCAP scores indicated that the scores had increased from year to year between 2004 and 2006 in all of the subject areas included in this study. This matches reports from the Tennessee Department of Education (Tennessee State Board of Education, 2005) The identified trend of increasing annual school-level TCAP scores is important to this study because these scores represent the criterion variables that are being correlated to the predictor variables. The direction of the significant relationships found between the school-level TCAP scores and the technology indicators was positive with the exception of the level of Infrastructure and Technology indicator, which was negative. There were other positive and negative correlations that were not significant. It should also be noted that the largest coefficient of determination or r^2 value found in this study was 0.047. This corresponds to 4.7% of the correlated achievement score that could be accounted for by the technology implementation indicator.

Conclusion #2

The mean computer count per school increased annually during the years included in this study. The numbers of computers in schools continues to increase (Wenglinsky, 2006) and this is true for Tennessee schools as well (University of Memphis, Center for Research in Educational Policy, 2008). Schools or school systems received additional computers each year from 2004 to 2006. One adage that applies here is “Put your money where your mouth is” or in other words, schools have indicated that they believe that having computers is important because they have elected to spend budget dollars on computers during the years studied. It should also be noted that the association of total computer counts on the achievement scores for the years studied was minimal.

Conclusion #3

The data analyzed indicated that the level of technology implementation and integration had increased from 2004 to 2006 according to all indicators. This is an important finding in that it gives a directional indication with regard to the progress of implementing and integrating technology into the middle schools of Tennessee. There has been much discussion regarding the effectiveness or ineffectiveness and importance of technology in the field of education. This finding shows that, according to the responses to the E-TOTE surveys, Tennessee has moved forward on a continuum towards a Target level of technology use and utilization.

Conclusion #4

The study showed a small significant correlation between total computer counts and school-level TCAP scores in 2004, 2005 and 2006 in various subject areas. This correlation is given additional validity by the fact that this was the only correlation that was identified in each of the three years examined. Given the small size of the significant correlation it is not possible to make any generalizable statement regarding the association of numbers of computers on school-level TCAP test scores. However, it is interesting to note that this very small significant finding coincides with increasing test scores, although there is no cause and effect inferred or implied. Although there were small significant correlations in each of the years studied and there were only 5 subject-year combinations that did not yield correlations as compared to 7 year-subject combinations that did have small significant positive correlations, the size of the r^2 value or the coefficient of determination was between 0.026 and 0.047. In short, there was some small correlation or relationship between computers in the classroom and achievement.

This study did not find a strong enough relationship between the total number of computers in a school and student achievement to make any statement regarding computers and their impact on achievement. However, researchers have identified the availability of computers as the single most important factor determining the use of computers. While the total computer

count does not translate directly into access and availability, having the computers is an important required component and this study did find that the numbers on computers in Tennessee schools are increasing, in some cases dramatically.

Conclusion #5

The study found a small significant correlation between the percentages of eighth grade technology literacy scores and school-level TCAP scores in 2004 in various subject areas. The coefficients of determination for this correlation were between 0.028 and 0.035. The survey questions were aligned with the State computer standards (Tennessee State Board of Education, 2008a). The questions were also presented succinctly with preset criteria accompanying each question as presented. The existence of a State established curriculum with standards and expectations in place that included a minimum of 180 hours of instruction in computer literacy might be linked to this correlation being significant in this study.

Conclusion #6

The study results included a small significant correlation between the level of network access and capabilities and school-level TCAP scores in 2006 in two subject areas. This correlation is not surprising when one considers that access to computers includes access to the Internet and network resources (Becker, 2000b). This finding may also be linked to another significant correlation in this study identifying a relationship between total computer counts and TCAP scores. Access includes having a computer, the availability of the computer, and the connectivity of the computer to the Internet and other networks according to Pensky (2001a) and Kravitz (2004). The Southern Regional Education Board (2002) reported studies that link student achievement and access to technology related experiences, which is wholly in keeping with this finding. It should also be noted that the relationship between the level of network access and capabilities and school-level TCAP scores has a very small r^2 value and as such a weak or nonexistent predictive relationship.

Conclusion #7

There were four research questions in this study that did not yield significant correlations between particular technology integration indicators and the TCAP scores. On reflection, the technology integration indicators that did not have significant correlations also appear to be the technology indicators that were defined in the least specific or concrete terms on the E-TOTE survey. One explanation for the lack of correlation is the possibility that the answers were more varied due to the interpretation of the questions by the respondents. In comparison, the questions that resulted in significant correlations were more comprised of concrete, defined categories. These defined categories included computer counts and infrastructure questions related to specifically defined hardware and transmission services. The questions for technology indicators, such as the level of Teaching and Learning, were centered on the more nebulous and elusive categories of the various patterns of use and frequency of instructional practices and student activities. It was not surprising that there were research questions that did not yield significant results. Honey et al. (2005) reported that it is very difficult to assess the link between assessment and computers.

Conclusion #8

The study results included a small significant correlation between the level of Infrastructure for Technology and school-level TCAP scores in 2004 in all subjects. This finding was a negative correlation. In other words a correlation was identified that when the level of Infrastructure for Technology is lower the TCAP achievement scores are higher and vice versa. I think that this negative relationship could be explained by a flaw in the E-TOTE survey results. In 2004 a majority of schools selected the developing level of infrastructure for technology when completing the E-TOTE survey. The developing technology level is the second lowest of the four implementation levels and would statistically appear below the mid point on a technology implementation scale or continuum. It makes sense that an existing relationship or correlation

would exhibit a negative correlation value if the level of infrastructure for technology was under-reported and the mathematics school-level TCAP scores were high, which was the case.

Recommendations to Improve Practice

This study provided some support that having technology integrated into Tennessee middle schools could have a small positive correlation on school-level TCAP achievement scores. This study is not conclusive, however, and only suggests the possibility of a small positive correlation. It should also be noted that further research is needed to extend these recommendations beyond the scope of this study. The following recommendations are offered to directors, supervisors, administrators, teachers, and parents who have a voice in implementing technology or increasing school-level achievement scores in Tennessee middle schools.

The number of computers in a school may be related to the school-level TCAP achievement scores. The scope of this study does not provide information regarding the optimal, minimum, or maximum number of computers that a school should have.

Local school districts or individual schools should make provisions to ensure that eighth-grade students acquire an adequate percentage of eighth-grade technology literacy. The adequate percentage should be established by the local education agency. This can be accomplished systemically, as in a top-down approach from the director of schools, or from the school's principal, or it can come from the grassroots efforts of parents and students for technology literacy skills and experiences.

Ensuring that adequate levels of network access and capabilities are available to the school demonstrated a small positive relationship to some school-level TCAP scores. The establishment of minimum, maximum, or adequate levels of network access and capabilities that a school would need to correlate to school-level TCAP achievement are beyond the scope of this study.

Recommendations for Further Research

Several recommendations were developed as a result of this study. This study provides information concerning the relationship between certain technology implementation variables and school-level TCAP scores. The need for additional research prompts the following recommendations:

1. This study could be used as the basis for future differential quantitative studies that investigate the nature of the relationship between total computer count and school-level achievement scores established through this study.
2. A recommendation for further research would include a qualitative study that would investigate the validity and consistency of E-TOTE survey responses through a purposeful sampling of the school respondents in the study. This study is needed in order to provide recommendations to the Tennessee Department of Education regarding increasing the specificity of questions and responses in order to increase the granularity of the E-TOTE study to empower further research based on this potentially valuable instrument.
3. A recommendation for future research would be an investigation of the differences study, centered on school-level TCAP scores as they related or differ for the variables of school size, socioeconomic status, ethnicity, homogeneity, English language Learners, and other appropriate school demographics. This study could be a purposeful sampling or it could include a specific subset of Tennessee schools. The study could be based on 1 year's data or multiple years depending on the desired scope and the resources available.
4. A recommendation for further study would be a thorough investigation of the methods and the extent of teacher professional development and the relationship of teacher training regarding the use of technology and academic achievement.

5. A recommendation for further study would be to explore the use of technology in the delivery of instruction and an analysis of instructional practices and curriculum development.
6. A recommendation for further study would be to explore the validity of the E-Tote survey questions and the items outlined in the E-TOTE.
7. A recommendation for further study would be to replicate this study after Tennessee has implemented its new testing protocol and standards in Spring 2010.

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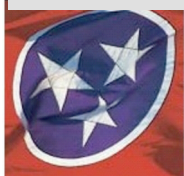
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APPENDICES

APPENDIX A

Tennessee STaR Chart: A Tool for Planning and Assessing School Technology and Readiness,
acctstar-campus-portrait.doc

Tennessee STaR Chart:



A Tool for Planning and Assessing School Technology and Readiness¹

The Tennessee STaR Chart, patterned after the *CEO Forum STaR Chart* (with the additional work done by Texas' Education Agency's Educational Technology Advisory Committee) has been developed around four key areas: Teaching and Learning, Educator Preparation and Development, Administration and Support Services, and Infrastructure for Technology. The Tennessee STaR Chart is designed to help campuses and districts determine their progress toward meeting long-range technology goals. The Tennessee STaR Chart will also assist in the measurement of the impact of state and local efforts to improve student learning through the use of technology.

The Tennessee STaR Chart will help campuses and districts answer some critical questions:

- 1) What are your campuses' and district's current educational technology profiles?
- 2) What evidence can be provided to demonstrate their progress in meeting long-range technology goals?
- 3) What areas should your campus and district focus on to improve its level of technology integration to ensure the best possible teaching and learning?

The Tennessee STaR Chart can be used:

- ★ To create and/or to update the district's Technology Plan
- ★ To set benchmarks and goals. Campuses and districts may use the chart to identify current education technology profiles, establish goals, and monitor progress.
- ★ To create individualized assessment tools. Education administrators and policymakers may use the Tennessee STaR chart as the basis for technology assessments and to evaluate varied perspectives of different staff and clientele.
- ★ To apply for grants. The Tennessee 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 Tennessee STaR Chart to determine where to allocate funds.
- ★ To use the Tennessee STaR Chart for a historical perspective. Campuses and districts can complete the survey and then use the profile annually to gauge their progress. The data can be reported to school boards, and community, campus or district planning committees to gauge progress and align with national and state standards.
- ★ To help conceptualize your campus' or district's vision of technology.

¹ Available online: <http://www.state.tn.us/education/acctstar-campus-portrait.doc>

Instructions for Completing a Campus Tennessee STaR Chart Profile

The printed STaR Chart materials may be used for discussion and collection of data. Use the instructions below to develop your campus STaR profile.

1. Four Key Areas are identified: Teaching and Learning, Educator Preparation and Development, Administration and Support Services, and Infrastructure for Technology.
2. Each Key Area is divided into 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.
3. The number of points for each level of progress is given on the grid. Total the numbers of points for each key area; then use the scoring table (below) to determine your school's "Level of Progress".
4. When the online Tennessee OnTarget system is available, you will enter your STaR Chart responses into the OnTarget system. Summary reports and graphs will then be available.

The Tennessee STaR Chart is a tool to help Tennessee school districts and campuses develop their own long-range technology plan. Campuses and districts can use this data to perform a needs assessment, judge progress, set benchmarks and goals, determine funding priorities, provide information for technology planning, and measure the impact of state and local efforts to improve student learning through the use of technology. Districts will be able to view this data by school, district, and district type (urban, rural, etc.) This data will not be used as an evaluation measure of individual campuses or districts.

Impact of the Tennessee STaR Chart

Future applications for state funded technology grants under the Enhancing Education Through Technology Act will request a completed campus or district Tennessee 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.

Use the completed surveys, the reports and charts to compare your campus' progress to like-sized campuses and to the statewide profile. Your data will be compiled with those of other campuses to provide an overall picture of the state of technology in Tennessee. Additional statewide aggregated data will be available in the Spring of 2003.

Adapted by the Tennessee Department of Education with permission from (1) the Texas STaR Chart (developed by the Educational Technology Advisory Committee of the Texas Education Agency) and (2) the STaR Chart originally created by the CEO Forum. Find the [original] STaR Chart online at ww2.iste.org/starchart. Copyright © 2002, ISTE (International Society for Technology in Education), 800.336.5191 (U.S. & Canada) or 541.302.3777 (Int'l), iste@iste.org, www.iste.org. All rights reserved. Permission does not constitute an endorsement by ISTE.

Tennessee STaR Chart Scoring Table

Key Area	Total Numeric Score	<i>Look up the numeric score for each key area in the grid below to determine the "Level of Progress"</i>				Your School's Level of Progress
		Early Tech	Developing	Advanced	Target	
I: Teaching and Learning		6-8	9-14	15-20	21-24	
II: Educator Preparation and Development		6-8	9-14	15-20	21-24	

III: Administration and Support Services		5-7	8-12	13-17	18-20	
IV: Infrastructure for Technology		5-7	8-12	13-17	18-20	

KEY AREAS:	I. Teaching and Learning					
Focus: Levels of Progress	(A) Impact of Technology on Teacher Role and Collaborative Learning	(B) Patterns of Teacher Use of Technology	(C) Frequency/ Design of Instructional Setting Using Digital Content	(D) Curriculum Areas	(E) Technology Applications Assessment	(F) Patterns of Student Use of Technology
Early Tech (1 pt)	Teacher-centered lectures Students use technology to work on individual projects	Use technology as a supplement	Occasional computer use in library or computer lab setting	No technology use or integration occurring in the core curriculum subject areas	<i>Campuses that serve grades K-8:</i> Within each grade level cluster (K-2, 3-5, 6-8), some but not all Technology standards are met <i>High School Campuses:</i> At least 4 Technology Applications courses offered	Students occasionally use software applications and/or use tutorial software for drill and practice
Developing Tech (2 pts)	Teacher-directed learning Students use technology for cooperative projects in their own classroom	Use technology to streamline administrative functions (i.e., grade book, attendance, word processing, E-mail, etc.)	Regular weekly computer use to supplement classroom instruction, primarily in lab and library settings	Use of technology is minimal in core curriculum subject areas	<i>Campuses that serve grades K-8:</i> Within each grade level cluster (K-2, 3-5, 6-8), most Technology standards are met <i>High School Campuses:</i> At least 4 Technology Applications courses offered and at least 2 taught	Students regularly use technology on an individual basis to access electronic information and for communication and presentation projects
Advanced Tech (3 pts)	Teacher facilitated learning Students use technology to create communities of inquiry within their own community	Use technology for research, lesson planning, multimedia and graphical presentations and simulations, and to correspond with experts, peers, and parents	Regular weekly technology use for integrated curriculum activities utilizing various instructional settings (i.e.,: classroom computers, libraries, labs, and portable technologies)	Technology is integrated into core subject areas, and activities are separated by subject and grade	<i>Campuses that serve grades K-8:</i> Within each grade level cluster (K-2, 3-5, 6-8), all Technology standards are met Grade-level benchmarks (K-8) are established <i>High School Campuses:</i> At least 4 Technology Applications courses offered and at least 4 taught	Students work with peers and experts to evaluate information, analyze data and content in order to problem solve Students select appropriate technology tools to convey knowledge and skills learned

Target Tech (4 pts)	<p>Teacher as facilitator, mentor, and co-learner</p> <p>Student-centered learning, teacher as mentor/facilitator with national /international business, industry, university communities of learning</p>	<p>Integration of evolving technologies transforms the teaching process by allowing for greater levels of interest, inquiry, analysis, collaboration, creativity and content production</p>	<p>Students have on-demand access to all appropriate technologies to complete activities that have been seamlessly integrated into all core curriculum areas</p>	<p>Technology is integral to all subject areas</p>	<p><i>Campuses that serve grades K-8:</i> Within each grade level cluster (K-2, 3-5, 6-8), all Technology standards are met</p> <p>Grade-level benchmarks (K-8) are met</p> <p><i>High School Campuses:</i> All Technology Applications courses offered with a minimum of 4 taught, or included as new courses developed as local elective or included as independent study course</p>	<p>Students work collaboratively in communities of inquiry to propose, assess, and implement solutions to real world problems</p> <p>Students communicate effectively with a variety of audiences</p>
TOTAL SCORE FOR KEY AREA I:				Teaching and Learning		

KEY AREAS:	II. Educator Preparation and Development					
Focus: Levels of Progress	(G) Content of Training	(H) Capabilities of Educators	(I) Leadership Capabilities of Administrators	(J) Models of Professional Development	(K) Levels of Understanding and Patterns of Use	(L) Technology Budget Allocated to Technology Professional Development
Early Tech (1 pt)	Technology literacy skills including multimedia and the Internet	10% meet ISTE technology proficiencies and implement in the classroom	Recognizes benefits of technology in instruction; minimal personal use	Whole group	Most at entry or adoption stage (Students learning to use technology; teachers use technology to support traditional instruction)	5% or less
Developing Tech (2 pts)	Use of technology in administrative tasks and classroom management; use of Internet curriculum resources	40% meet ISTE technology proficiencies and implement in the classroom	Expects teachers to use technology for administrative and classroom management tasks; uses technology in some aspects of daily work	Whole group, with follow-up to facilitate implementation	Most at adaptation stage (Technology used to enrich curriculum) Most beginning to use with students	6-24%
Advanced Tech (3 pts)	Integration of technology into teaching and learning; regularly uses internet curriculum resources to enrich instruction	60% meet ISTE technology proficiencies and implement in the classroom	Recognizes and identifies exemplary use of technology in instruction; models use of technology in daily work	Long term and ongoing professional development; involvement in a developmental/ improvement process	Most at appropriation stage (Technology is integrated, used for its unique capabilities)	25-29%

Target Tech (4 pts)	Regular creation and communication of new technology-supported, learner-centered projects; vertical alignment of all Technology Application curriculum standards; anytime anywhere use of Internet curriculum resources by entire school community	100% meet ISTE technology proficiencies and implement in the classroom	Ensures integration of appropriate technologies to maximize learning and teaching; involves and educates the school community around issues of technology integration	Creates communities of inquiry and knowledge building; anytime learning available through a variety of delivery systems; individually guided activities	Most at invention stage (Teachers discover and accept new uses for technology)	30% or more
TOTAL SCORE FOR KEY AREA II:				Educator Preparation and Development		

KEY AREAS:	III. Administration and Support Services				
Focus:	(M) Vision and Planning	(N) Technical Support	(O) Instructional and Administrative Staffing	(P) Budget	(Q) Funding
Levels of Progress					
Early Tech (1 pt)	No campus technology plan; technology used mainly for administrative tasks such as word processing, budgeting, attendance, grade books	No technical support on-site; technical support call-in; response time greater than 24 hours	No full time dedicated district level Technology Coordinator Campus educator serving as local technical support	Campus budget for hardware and software purchases and professional development	Local fund raisers only
Developing Tech (2 pts)	Campus technology plan aligns with the TN Long Range Technology Plan; integrated into district plan; used for internal planning, budgeting, applying for external funding and discounts. Teachers/administrators have a vision for technology use for direct instruction and some student use	At least one technical staff to 750 computers Centrally deployed technical support call-in; response time less than 24 hours	Full-time district level Technology Coordinator/Assistant Superintendent for Technology Centrally located instructional technology staff; one for every <u>5,000</u> students Additional staff as needed, such as trainer, webmaster, network administrator	Campus budget for hardware and software purchases and professional development, <u>minimal</u> staffing support, and some ongoing costs	Fund raisers and minimum grants/minimal local funding
Advanced Tech (3 pts)	In addition to the above, the campus technology plan is approved by the board and supported by Director of Schools Campus plan collaboratively developed, guiding policy and practice; regularly updated Campus plan addresses technology application essential knowledge and skills and higher order teaching and learning Administrators use technology tools for planning	At least one technical staff to 500 computers Central technology support use remote management software tools Centrally deployed and minimal campus-based technical support on-site; response time is less than 8 hours	Full-time district level Technology Coordinator/Assistant Superintendent for Technology Centrally located instructional technology staff; one for every <u>1,000</u> students Additional staff as needed	Campus budget for hardware and software purchases and professional development, <u>adequate</u> staffing support, and ongoing costs	Grants, E-Rate discounts applied to technology budget, <u>locally supplemented</u> through tax dollars

Target Tech (4 pts)	<p>In addition to the above, the campus technology plan is actively supported by the board</p> <p>Campus plan is collaboratively developed, guiding policy and practice; updated at least annually</p> <p>The campus plan is focused on student success; based on needs, research, proven teaching and learning principles.</p> <p>Administrators use technology tools for planning and decision making</p>	<p>At least one technical staff to 350 computers; centrally deployed and dedicated campus-based</p> <p>Central technology support use remote management software tools</p> <p>Technical support on-site; response time is less than 4 hours</p>	<p>Full-time district level Technology Coordinator/Assistant Superintendent for Technology</p> <p><u>Dedicated</u> campus-based instructional technology support staff—<u>one per campus plus one for every 1,000 students</u></p> <p>Additional staff as needed</p>	<p>Campus budget for hardware and software purchases, sufficient staffing support, costs for professional development, facilities and other ongoing costs</p> <p><u>Appropriate</u> budget to support the district technology plan</p>	<p>Other competitive grants, E-Rate discounts, <u>locally supplemented</u> through tax dollars</p> <p>Other state and federal programs directed to support technology funding, bond funds, business partnerships, donations, foundations, and other local funds designated for technology</p>
TOTAL SCORE FOR KEY AREA III:				Administration & Support Services	

KEY AREAS:	IV. Infrastructure for Technology				
Focus: Levels of Progress	(R) Students per Computer	(S) Internet Access Connectivity/Speed	(T) Distance Learning	(U) LAN/WAN	(V) Other Technologies
Early Tech (1 pt)	<p>Ten or more students per Internet-connected multimedia computer</p> <p>Refresh cycle established by district/campus for every 6 or more years</p>	<p>Dial-up connectivity to the Internet available only on a few computers</p>	<p>No Web based/online learning available at the campus</p> <p>No satellite based learning available at the campus</p> <p>No two-way interactive video distance learning capabilities available at the campus</p>	<p>Limited print/file sharing network at the campus</p> <p>Some shared resources available on the campus LAN</p>	<p>Shared use of resources such as, but not limited to, TVs, VCRs, digital cameras, scanners, classrooms sets of programmable calculators</p>
Developing Tech (2 pts)	<p>Between 5 and 9 students per Internet-connected multimedia computer</p> <p>Refresh cycle established by district/campus is every 5 years</p>	<p>Direct connectivity to the Internet available at the campus in 50% of the rooms, including the library</p> <p>Adequate bandwidth to the campus to avoid most delays</p>	<p>Web-based/on-line learning available at the campus</p> <p>Satellite based learning available at the campus</p> <p>No two-way interactive video distance learning capabilities available at the campus, but available in the district</p>	<p>Most rooms connected to the LAN/WAN with student access</p> <p>Minimum 10/100 Cat 5 hubbed network</p> <p>High-end servers, such as Novell or NT servers, serving some applications</p>	<p>One educator per computer</p> <p>Shared use of resources such as TVs, VCRs, digital cameras, scanners, digital projectors, and analog video cameras; classrooms sets of programmable calculators</p>

Advanced Tech (3 pts)	<p>Four or less students per Internet-connected multimedia computer.</p> <p>Replacement cycle established by district/campus is every 4 years</p>	<p>Direct connectivity to the Internet in 75% of the rooms, including the library</p> <p>Adequate bandwidth to each classroom over the local area network (at least 10/100 MB LAN) to avoid most delays</p> <p>Easy access for students and teachers</p>	<p>Web-based/on-line learning available at the campus</p> <p>Satellite-based learning available at the campus</p> <p>Two-way interactive video distance learning capabilities available in at least one classroom</p>	<p><u>All rooms</u> connected to the LAN/WAN with student access</p> <p>Minimum 10/100 Cat 5 switched network</p> <p>High-end servers, such as Novell or NT servers, serving multiple applications</p>	<p>One educator per computer</p> <p>Dedicated and assigned use of commonly used technologies such as computers with projection devices, TVs, VCRs, programmable calculators assigned to each student, and telephones in each classroom</p> <p><u>Shared use of specialized technologies</u> such as digital cameras, scanners, document cameras and projectors, and digital video cameras</p>
Target Tech (4 pts)	<p>In addition to 4 or less students per Internet-connected multimedia computer, on-demand access for every student.</p> <p>Replacement cycle established by district/campus is 3 or less years</p>	<p>Direct connectivity to the Internet in all rooms on all campuses</p> <p>Adequate bandwidth to each classroom over the local area network (<u>at least 100 MB or fiber network LAN</u>)</p> <p>Easy access for students and teachers <u>including</u> some wireless connectivity</p>	<p>Web-based/on-line learning available at the campus</p> <p>Satellite-based learning available at the campus</p> <p>Two-way interactive video distance learning capabilities available at the campus in multiple classrooms</p>	<p>All rooms connected to the WAN sharing multiple district-wide resources</p> <p>Campus is connected to robust WAN with <u>100 MB/GB and/or fiber switched network</u> that allows for resources such as, but not limited to, video streaming and desktop videoconferencing</p> <p><u>Easy access</u> to network resources for students and teachers, <u>including</u> some wireless connectivity</p>	<p>One educator per computer</p> <p>Fully equipped class rooms with all the technology that is available to enhance student instruction readily available including all of the above as well as the use of new and <u>emerging</u> technologies</p>
TOTAL SCORE FOR KEY AREA IV:				Infrastructure for Technology	

Standards

Profiles for Technology-Literate Students (National Educational Technology Standards for Students [NETS-S]) *

Prior to completion of Grade 8, students will:

1. Apply strategies for identifying and solving routine hardware and software problems that occur during everyday use.
2. Demonstrate knowledge of current changes in information technologies and the effect those changes have on the

Stages of Professional Development ** (CEO Forum STaR Chart)

Entry/Adoption Stage.
Educators move from the initial struggles to learn the basics of using technology to successful use of technology on a basic level (e.g.,

workplace and society.

3. Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse.
4. Use content-specific tools, software, and simulations (e.g., environmental probes, graphing calculators, exploratory environments, Web tools) to support learning and research.
5. Apply productivity/multimedia tools and peripherals to support personal productivity, group collaboration, and learning throughout the curriculum.
6. Design, develop, publish, and present products (e.g., Web pages, videotapes) using technology resources that demonstrate and communicate curriculum concepts to audiences inside and outside the classroom.
7. Collaborate with peers, experts, and others using telecommunications and collaborative tools to investigate curriculum-related problems, issues, and information, and to develop solutions or products for audiences inside and outside the classroom.
8. Select and use appropriate tools and technology resources to accomplish a variety of tasks and solve problems.
9. Demonstrate an understanding of concepts underlying hardware, software, and connectivity and of practical applications to learning and problem solving.
10. Research and evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems.

integration of drill and practice software into instruction).

Adaptation Stage.

Educators move from basic use of technology to discovery of its potential for increased productivity (e.g., use of word processors for student writing, and research on the Internet).

Appropriation Stage.

Having achieved complete mastery over the technology, educators use it effortlessly as a tool to accomplish a variety of instructional and management goals.

Invention Stage.

Educators are prepared to develop entirely new learning environments that utilize technology as a flexible tool. Learning becomes more collaborative, interactive and customized.

* For more information on Profiles for Technology-Literate Students, see http://cnets.iste.org/students/s_profiles.html
For Tennessee Student Technology Standards, see <http://www.state.tn.us/education/ci/cicomputered/cicompedk2.htm>,
[cicomped35.htm](http://www.state.tn.us/education/ci/cicomputered/cicomped35.htm), [cicomped68.htm](http://www.state.tn.us/education/ci/cicomputered/cicomped68.htm)

** For ISTE Technology Proficiencies for Teachers (NETS), see http://cnets.iste.org/students/t_profiles.html

APPENDIX B

Tennessee School Account Profile

Please provide, verify and/or amend the following general information about your school in each text box.

District Name: [redacted]
District Number: [redacted]

School Name: [redacted]

School Number: [redacted]

Street: [redacted]

City: [redacted]

State: [redacted]

Zip: [redacted]

Phone: [redacted]

Fax: [redacted]

Principal's Name: [redacted]

Principal's Email (if none, type "none"): [redacted]

School website address (if none type "none"): [redacted]

Person Completing Survey:

Name: [redacted]

Position: [redacted]

Email (if none, type "none"): [redacted]

Did this school report E-TOTE last year?

- Yes
- No

Are you a new school?

- Yes
- No

1.1 School Information

Definitions

A “computer lab” is a schoolroom having 10 or more stationary computers, available for student or rotating classes use, but not assigned as a regular classroom on your school schedule; a lab is not the library, although it may be adjacent to the library.

For “teachers,” do not count paraprofessionals or aides. Do not count guidance counselors or librarians unless they have regular classroom instructional duties. Indicate teachers in “full-time equivalents” (FTEs). For example, if you have 10 full-time teachers and one half-time that may or may not teach in another school the other half-time, record 10.5 teachers.

1. Please type in the total numbers within your school for the following.

Students:

Teachers:

Classrooms:

Computer Labs:

2. What grades are taught at this school? (Check all that apply)

- PK
- Kindergarten
- 1ST
- 2nd
- 3rd
- 4th
- 5th
- 6th
- 7th
- 8th
- 9th
- 10th
- 11th
- 12th

Ungraded

3. Are these the same grades that were served at your school last year?

- Yes
- No

4. How many students in the following grades are enrolled at your school (if none, answer "0")?

Second graders:

Fifth:

Eighth graders:

Twelfth graders:

1.2 Special Program Information

1. What special programs are in your school? (Check all that apply)

- Vocational Programs
- Special Education
- Alternative Education Programs
- Grant programs this year
- Title I or Targeted Title I Assistance
- Adult High School Programs
- Magnet or Optional School
- Charter School
- None of these special programs

2. Does your school serve ONLY adult high school, special education and or alternative education students?

- Yes
- No

TENNESSEE StaR Chart

For each of the four key areas in the STaR Chart, a series of 5-6 indicators is provided for you to use to indicate your school's Level of Progress (1-4). It is possible that your school may have indicators in more than one Level of Progress. However, select the one Level of Progress that best describes your campus for each indicator.

2.1 Teaching and Learning

A. Impact of Technology on Teacher Role and Collaborative Learning:

1. Teacher-centered lectures and students use technology to work on individual projects.
2. Teacher-directed learning and students use technology for cooperative projects in their own classroom.
3. Teacher facilitated learning and students use technology to create communities of inquiry within their own community.
4. Teacher as facilitator, mentor, and co-learner and student-centered learning, teacher as mentor/facilitator with national /international business, industry, university communities of learning.

B. Patterns of Teacher Use of Technology: What characterizes the overall pattern of teacher use of technology at your school?

1. Teachers use technology as a supplement.
2. Teachers use technology to streamline administrative functions (i.e., grade book, attendance, word processing, e-mail, etc.).
3. Teachers use technology for research, lesson planning, multimedia and graphical presentations and simulations, and to correspond with experts, peers, and parents.
4. Integration of evolving technologies transforms the teaching process by allowing for greater levels of interest, inquiry, analysis, collaboration, creativity and content production.

C. Frequency/Design of Instructional Setting Using Digital Content: The instructional setting where and frequency when digital content is used are characterized by:

1. Occasional computer use in library or computer lab setting.
2. Regular weekly computer use to supplement classroom instruction, primarily in lab and

library settings.

3. Regular weekly technology use for integrated curriculum activities utilizing various instructional settings (i.e., classroom computers, libraries, labs, and portable technologies).
4. Students have on-demand access to all appropriate technologies to complete activities that have been seamlessly integrated into all core curriculum areas.

D. Curriculum Areas: How is technology generally used within the curriculum content areas in your school?

1. No technology use or integration occurs in the core curriculum subject areas.
2. Use of technology is minimal in core curriculum subject areas.
3. Technology is integrated into core subject areas, and activities are separated by subject and grade.
4. Technology is integrated within all subject areas.

E. Technology Applications Assessment: (Select the best description)

1. *Schools with Grades K-8:* Within each grade level cluster (K-2, 3-5, 6-8); some but not all Technology standards are met.
High Schools: At least 4 Technology Applications courses offered.
2. *Schools with grades K-8:* Within each grade level cluster (K-2, 3-5, 6-8), most Technology standards are met.
High Schools: At least 4 Technology Applications courses offered and at least 2 taught.
3. *Schools with grades K-8:* Within each grade level cluster (K-2, 3-5, 6-8), all Technology standards are met and Grade-level benchmarks (K-8) are established.
High Schools: At least 4 Technology Applications courses offered and at least 4 taught.
4. *Schools with grades K-8:* Within each grade level cluster (K-2, 3-5, 6-8), all Technology standards are met and Grade-level benchmarks (K-8) are met.
High School: All Technology Applications courses offered with a minimum of 4 taught, or included as new courses developed as local elective or included as independent study course.

F. Patterns of Student Use of Technology: What is the typical pattern of student use of technology?

1. Students occasionally use software applications and/or use tutorial software for drill and practice.

2. Students regularly use technology on an individual basis to access electronic information and for communication and presentation projects.
3. Students work with peers and experts to evaluate information, analyze data and content in order to problem solve. Students select appropriate technology tools to convey knowledge and skills learned.
4. Students work collaboratively in communities of inquiry to propose, assess, and implement solutions to real world problems. Students communicate effectively with a variety of audiences.

2.2 Educator Preparation and Development

G. Content of Training: What is the typical training content in your teacher technology-related professional development?

1. Technology literacy skills including multimedia and the Internet.
2. Use of technology in administrative tasks and classroom management; use of Internet-curriculum resources.
3. Integration of technology into teaching and learning; regular use of Internet curriculum resources to enrich instruction.
4. Regular creation and communication of new technology-supported, learner-centered projects; vertical alignment of all technology application curriculum standards; anytime anywhere use of Internet curriculum resources by entire school community.

H. Capabilities of Educators: What comes closest to the percentage of your educators who meet most of the ISTE technology proficiencies and implement them in the classroom?

1. 10%
2. 40%
3. 60%
4. 100%

I. Leadership Capabilities of Administrators: Which description most closely characterizes your building administration's leadership with technology?

1. Recognizes benefits of technology in instruction and minimal personal use.

2. Expects teachers to use technology for administrative and classroom management tasks; uses technology in some aspects of daily work.
3. Recognizes and identifies exemplary use of technology in instruction; models use of technology in daily work.
4. Ensures integration of appropriate technologies to maximize learning and teaching; involves and educates the school community around issues of technology integration.

J. Models of Professional Development: When technology-related professional development occurs for your teachers, which describes the model that is most often used?

1. Whole group.
2. Whole group, with follow-up to facilitate implementation.
3. Long term and ongoing professional development; involvement in a developmental/improvement process.
4. Creates communities of inquiry and knowledge building; anytime learning available through a variety of delivery systems; individually guided activities

K. Levels of Understanding and Patterns of Use: Where are most of your teachers in terms of their understanding level and patterns of technology use?

1. Most at **entry** or **adoption** stage (Students learning to use technology; teachers use technology to support traditional instruction).
2. Most at **adaptation** stage (Technology used to enrich curriculum; Most beginning to use with students).
3. Most at **appropriation** stage (Technology is integrated, used for its unique capabilities).
4. Most at **invention** stage (Teachers discover and accept new uses for technology).

L. Technology Budget Allocated to Technology Professional Development: Considering all sources of technology funds that benefit your school, what percentage is allocated to technology professional development?

1. 5% or less.
2. 6-24%

3. 25-29%
4. 30% or more

2.3 Administration and Support Services

M. Vision and Planning: Consider your School Improvement Plan (TSIP), other strategic vision documents, and the actual vision embodied in practice. Which of the following most accurately characterizes your school?

1. Technology is only minimally addressed in our TSIP; technology used mainly for administrative tasks such as word processing, budgeting, attendance, grade books.
2. Technology planning in TSIP aligns with the state long range technology plan and the district technology plan; technology used for internal planning, budgeting, and applying for external funding and discounts. Teachers/ administrators have a vision for technology use for direct instruction and some student use.
3. In addition to the above, the campus technology plan is approved by the board and supported by Director of Schools. Campus plan collaboratively developed, guiding policy and practice; regularly updated. Campus plan addresses technology application essential knowledge and skills and higher order teaching and learning. Administrators use technology tools for planning.
4. In addition to the above, the campus technology plan is actively supported by the board. Campus plan is collaboratively developed, guiding policy and practice; updated at least annually. The campus plan is focused on student success; based on needs, research, proven teaching and learning principles. Administrators use technology tools for planning and decision-making.

N. Technical Support: At your school, what is the technical support situation?

1. No on-site technical support; technical support is by call-in with response time greater than 24 hours.
2. At least one technical staff to 750 computers, with centrally deployed technical support call-in; response time less than 24 hours.
3. At least one technical staff to 500 computers with central technology support that uses remote management software tools. Tech support is centrally deployed with minimal campus-based technical support on-site; response time is less than 8 hours.
4. At least one technical staff to 350 computers, both centrally deployed as well as dedicated campus-based. Central technology support uses remote management software tools. There

is on-site technical support with response time is less than 4 hours.

O. Instructional and Administrative Staffing:

1. No full time dedicated district level Technology Coordinator; rely on campus educator serving as local technical support.
2. Full-time district level Technology Coordinator. Centrally located instructional technology staff with one for every **5,000** or more students. Additional staff as needed, such as trainer, webmaster, network administrator.
3. Full-time district level Technology Coordinator. Centrally located instructional technology staff with one for about every **1,000** students. Additional staff as needed.
4. Full-time district level Technology Coordinator. **Dedicated** campus-based instructional technology support staff-one per campus **plus** one for about every **1,000 students**. Additional staff as needed.

P. Budget: Select the best description of how your school spends its technology funds, whether from donations, building level funds or budget, or district apportionment.

1. For hardware and software purchases and professional development.
2. For hardware and software purchases and professional development, **minimal** staffing support, and some ongoing costs.
3. For hardware and software purchases and professional development, **adequate** staffing support, and ongoing costs.
4. For hardware and software purchases, sufficient staffing support, costs for professional development, facilities and other ongoing costs. **Appropriate** budget to support the technology in the TSIP.

Q. Funding: What best describes the source for your school technology funding? (Consult with your district TC for advice on best answer.)

1. School-level fundraisers only.
2. Fund raisers, minor grants, minimal local funding managed at the district level.
3. Grants, E-Rate discounts applied to technology budget, **locally supplemented** through tax dollars.
4. Other competitive grants, E-Rate discounts, **locally supplemented** through tax dollars. Other state and federal programs directed to support technology funding, bond funds,

business partnerships, donations, foundations, and other local funds designated for technology.

2.4 Infrastructure for Technology

R. Students per Computer: How many students are there for each Internet-connected multimedia computer?

1. Ten or more students.
2. Between 5 and 9 students.
3. Four or less students.
4. In addition to 4 or less, on-demand access for every student.

S. How regularly are these computers replaced? ("refresh cycle")

1. Every 6 or more years.
2. Every 5 years.
3. Every 4 years.
4. 3 or less years.

T. Internet Access Connectivity/Speed: Which best describes the internet access, connectivity type, and speed at your school? (Recommend consulting with your district TC.)

1. Only dial-up connectivity to the Internet is available and that is only on a few computers.
2. Direct connectivity to the Internet is available in 50% of the rooms, including the library. There is adequate bandwidth to the campus to avoid most delays
3. Direct connectivity to the Internet in 75% of the rooms, including the library. There is adequate bandwidth to each classroom over the local area network (**at least 10/100 MB LAN**) to avoid most delays, with easy access for students and teachers.
4. Direct connectivity to the Internet in all rooms. There is adequate bandwidth to each classroom over the local area network (**at least 100 MB or fiber network LAN**) and easy access for students and teachers **including** some wireless connectivity.

U. Distance Learning: Which best characterizes the state of distance learning at your school? The delivery methods included here are web-based, satellite, and 2-way interactive video.

1. No Web based/online learning, satellite based learning OR two-way interactive video distance learning capabilities available at the school.
2. Available in the school: web-based/on-line learning and/or satellite based learning, but not two-way interactive video. Available in the district: two-way interactive video distance learning capability.
3. Web-based/on-line learning and/or satellite-based learning available at the school and two-way interactive video distance learning capabilities available in at least one classroom.
4. Web-based/on-line learning and/or satellite-based learning available at the school and two-way interactive video distance learning capabilities available at the school in multiple classrooms.

V. LAN/WAN: What best describes your school's local/wide area network (LAN/WAN)?

1. Limited print/file sharing network with some shared resources available on the school LAN.
2. Most rooms connected to the LAN/WAN with student access available. Minimum 10/100 Cat 5 hubbed networks. High-end servers, such as Novell or NT servers, serve some applications.
3. **All rooms** connected to the LAN/WAN with student access; minimum 10/100 Cat 5 switched network; and high-end servers (such as Novell or NT) serving multiple applications.
4. All rooms connected to the WAN sharing multiple district-wide resources; school is connected to robust WAN with **100** MB/GB and/or fiber **switched** network that allows for resources such as, but not limited to, video streaming and desktop videoconferencing. **Easy access** to network resources for students and teachers, **including** some wireless connectivity.

W. Other Technologies: What is the status of various other technology resources at your school?

1. Shared use of resources such as, but not limited to, TVs, VCRs, digital cameras, scanners, classrooms set of programmable calculators.

2. One educator per computer with shared use of resources such as TVs, VCRs, digital cameras, scanners, digital projectors, and analog video cameras; classrooms sets of programmable calculators.
3. One educator per computer with dedicated and assigned use of commonly used technologies such as computers with projection devices, TVs, VCRs, programmable calculators assigned to each student, and telephones in each classroom. **Shared use of specialized** technologies such as digital cameras, scanners, document cameras and projectors, and digital video cameras.
4. One educator per computer with fully equipped classrooms with all the technology that is available to enhance student instruction readily available including all of the above as well as the use of new and **emerging** technologies.

Equipment

3.1 Computer Count

Using the definitions presented here, type the number of computers of each type in each location. Do not leave blanks. When appropriate, type “0” to indicate no computers of a certain capacity in a given location. (To help you, the table initially displays the values you provided last year to help. Be sure to update them with the current data.

Definitions

High Capacity: Pentium III (PCs) or Macintosh G4 or higher

Mid Capacity: Pentium II or Macintosh G3

Low Capacity: Thin Client, Pentium 486 processors or 68040 processors (Macintosh, Centris, Quadra, LC475, LC575, LC 580) that are “school owned” and **still in use**. A computer should only be counted once.

Type	Offices	Classrooms	Computer Labs	Library/Media Center	Used in Mobile Capacity
High Capacity					
Medium Capacity					
Low Capacity					

3.2 Classroom Computer Access

1. How many classrooms (**not including labs or media centers**) have **at least one** mid- or high – capacity computer connected to the Internet for teachers use. (The computer maybe for **teacher** use only or shared with student.)
2. How many classrooms (not including labs or library media centers) have **at least one** mid- or high-capacity computer connected to the internet available for **students** use? (Be sure to include in this count any classrooms counted in the item able where the students are permitted to use the computer which is available to teachers.)
3. How many classrooms (not including labs or library media centers) have **at least 5** mid- or high-capacity computers connected to the Internet available for student use? (Be sure to include those counted in the item directly above.)
4. How many **instructional computers** in all (classrooms, labs, libraries, but NOT in offices) are connected to the Internet?
5. How many **non-instructional computers** (offices, libraries) are connected to the Internet? (Do not count file servers.)

3.3 Computer Projection Devices

If the answer is “none”, type in “0”

1. How many classrooms have a computer projection device or LCD panel connected an online computer?
2. How many classrooms have a TV of sufficient size for classroom viewing connected to an online computer?
3. How many classrooms have an interactive whiteboard connected to an online computer?
4. How many computer labs (not included in the classrooms reported above) have a computer projection device or LCD panel connected to an online computer?
5. How many computer labs (not included in the classrooms reported above) have a TV of sufficient size for classroom viewing connected to an online computer?
6. How many computer labs (not included in the classrooms reported have) an interactive whiteboard connected to an online computer?
7. How many traveling usable computer projection devices, such as the ones named above, do

you have which are not included in the above counts?

3.4 Operating System

1. Which is the dominant Operating System on the classroom computers in your school?
 - Macintosh
 - Windows
 - Both present, but Macintosh predominates
 - Both present, but Windows predominates
 - DOS
 - LINUX

2. Which is the dominant Operating System on the administrative computers in your school?
 - Macintosh
 - Windows
 - Both present, but Macintosh predominates
 - Both present, but Windows predominates
 - DOS
 - LINUX

Network Access and Capabilities

4.1 Home/School Communication

1. The following types of electronic Home/School communications systems are in place for our school: (Check all that apply)

- Telephone homework hotline
- Voice Bulletins/Voice Mail
- School District Website
- None

4.2 Wireless/Laptop Computing

1. The following wireless or laptop computing resources are available in our school. (Check all that apply)

- Laptop computers primarily for administrative use
- Laptop computers primarily for teacher use
- Laptop computers primarily for students use
- Wireless laptop computing
- No laptop or wireless computing

4.3 After Hours Technology Resources

1. What are the PRIMARY delivery resources available to students or community after school hours?

- No laptop or wireless computing
- Online internet resources
- Interactive video course
- Teacher led courses
- No after hours resources available

2. These technology resources are available for student or community use after school hours. (Check all that apply)

- Computer Lab
- Library Media Center
- Classrooms
- Interactive Video classrooms
- Laptop Computers for Teacher check-out
- Laptop Computers for Student check-out
- None
- Other (Please Specify)

4.4 Home Access to the Internet

1. What percent of the students in your school have access to the internet in their homes?
[redacted] %
2. How did you arrive at this percent?
 - Estimation
 - Survey of students
 - Survey of parents/guardian
 - Other (Please specify): [redacted]
3. What percent of the teachers/staff in your school have access to the internet in their homes?
[redacted] %
4. How did you arrive at this percent?
 - Estimation
 - Survey of teachers/staff
 - Other (Please specify): [redacted]

STUDENT TECHNOLOGY LITERACY

According to the National Educational Technology Standards for Students, the profiles for technology-literate students include cumulative performance for students prior to the completion of grades 2, 5, 8, and 12. In this section, if you have students in these grades, we ask you to determine what percentage of those students has demonstrated competence in these areas. (The profiles are used with permission.)

5.1 Kindergarten-Second Grade Technology Profile

Does your school have Second Graders?

- Yes
- No

If yes, please complete this section.

What percent of all current SECOND grade students in your school have demonstrated competence in the following second grade expectations?

1. Use input devices (e.g., mouse, keyboard, remote control) and output devices (e.g., monitor, printer) to successfully operate computers, VCR's audiotapes, and other technologies? %
2. Use a variety of media and technology resources for directed and independent learning activities? %
3. Communicate about technology using developmentally appropriate and accurate terminology? %
4. Use developmentally appropriate multimedia resources (e.g., interactive books, educational software, elementary multimedia encyclopedias) to support learning? %
5. Work cooperatively and collaboratively with peers, family members, and others when using technology in the classroom? %
6. Demonstrate positive social and ethical behaviors when using technology? %
7. Practice responsible use of technology systems and software? %
8. Create developmentally appropriate multimedia products with support from teachers, family members, or student partners? %
9. Use technology resources (e.g., puzzles, logical thinking programs, writing tools, digital cameras, drawing tools) for problem solving, communication, and illustration of thoughts, %

ideas, and stories? [redacted]%

10. Gather information and communicate with others using telecommunications, with support from teachers, family members, or student partners? [redacted]%
11. For the answers provided above about SECOND grade student technology literacy, what was the primary method you used to determine the percentages?
 - No organized way to ascertain the information
 - Estimates based on teacher informal reporting
 - Student self-reported skills checklist
 - Teacher informal observation using skills checklist
 - Site-developed technology literacy test
 - End-of-experience test for technology application experience
 - Performance-based authentic assessment (portfolios)

5.2 Third - Fifth Grade Technology Profile:

Does your school have Fifth Graders?

- Yes
- No

If yes, please complete this section.

What percent of all current FIFTH grade students in your school have demonstrated competence in the following fifth grade expectations?

1. Use keyboards and other common input and output devices (including adaptive devices when necessary) efficiently and effectively. [redacted]%
2. Discuss common uses of technology in daily life and the advantages and disadvantages those uses provide. [redacted]%
3. Discuss basic issues related to responsible use of technology and information and describe personal consequences of inappropriate use. [redacted]%
4. Use general purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum. [redacted]%
5. Use technology tools (e.g., multimedia authoring, presentation, Web tools, digital cameras, scanners) for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom. [redacted]%
6. Use telecommunications efficiently and effectively to access remote information,

communicate with others in support of direct and independent learning, and pursue personal interests. [redacted]%

7. Use telecommunications and online resources (e.g., e-mail, online discussions, Web environments) to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom. [redacted]%
8. Use technology resources (e.g., calculators, data collection probes, videos, educational software) for problem-solving, self-directed learning, and extended learning activities. [redacted]%
9. Determine when technology is useful and select the appropriate tool(s) and technology resources to address a variety of tasks and problems. [redacted]%
10. Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources. [redacted]%
11. For the answers provided above about FIFTH grade student technology literacy, what was the primary method you used to determine the percentages?
 - No organized way to ascertain the information
 - Estimates based on teacher informal reporting
 - Student self-reported skills checklist
 - Teacher informal observation using skills checklist
 - Site-developed technology literacy test
 - End-of-experience test for technology application experience
 - Performance-based authentic assessment (portfolios)

5.3 Sixth - Eighth Grade Technology Profile:

Does your school have Eighth Graders?

- Yes
- No

If yes, please complete this section.

What percent of all current EIGHTH grade students in your school have demonstrated competence in the following eighth grade expectations?

1. Apply strategies for identifying and solving routine hardware and software problems that occur during everyday use. [redacted]%
2. Demonstrate knowledge of current changes in information technologies and the effect those changes have on the workplace and society. [redacted]%

3. Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse. [REDACTED]%
4. Use content-specific tools, software, and simulations (e.g., environmental probes, graphing calculators, exploratory environments, Web tools) to support learning and research. [REDACTED]%
5. Apply productivity/multimedia tools and peripherals to support personal productivity, group collaboration, and learning throughout the curriculum. [REDACTED]%
6. Design, develop, publish, and present products (e.g., Web pages, video tapes) using technology resources that demonstrate and communicate curriculum concepts to audiences inside and outside the classroom. [REDACTED]%
7. Collaborate with peers, experts, and others using telecommunications and collaborative tools to investigate curriculum-related problems, issues, and information, and to develop solutions or products for audiences inside and outside the classroom. [REDACTED]%
8. Select and use appropriate tools and technology resources to accomplish a variety of tasks and solve problems. [REDACTED]%
9. Demonstrate an understanding of concepts underlying hardware, software, and connectivity, and of practical applications to learning and problem solving. [REDACTED]%
10. Research and evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems. [REDACTED]%
11. For the answers provided above about EIGHTH grade student technology literacy, what was the primary method you used to determine the percentages?
 - No organized way to ascertain the information
 - Estimates based on teacher informal reporting
 - Student self-reported skills checklist
 - Teacher informal observation using skills checklist
 - Site-developed technology literacy test
 - End-of-experience test for technology application experience
 - Performance-based authentic assessment (portfolios)

5.4 Ninth - Twelfth Grade Technology Profile:

Does your school have Twelfth Graders?

- Yes
- No

If yes, please complete this section.

What percent of all current TWELFTH grade students in your school have demonstrated competence in the following twelfth grade expectations?

1. Identify capabilities and limitations of contemporary and emerging technology resources and assess the potential of these systems and services to address personal, lifelong learning, and workplace needs. [redacted]%
2. Make informed choices among technology systems, resources, and services. [redacted]%
3. Analyze advantages and disadvantages of widespread use and reliance on technology in the workplace and in society as a whole. [redacted]%
4. Demonstrate and advocate for legal and ethical behaviors among peers, family, and community regarding the use of technology and information. [redacted]%
5. Use technology tools and resources for managing and communicating personal/professional information (e.g., finances, schedules, addresses, purchases, correspondence). [redacted]%
6. Evaluate technology-based options, including distance and distributed education, for lifelong learning. [redacted]%
7. Routinely and efficiently use online information resources to meet needs for collaboration, research, publications, communications, and productivity. [redacted]%
8. Select and apply technology tools for research, information analysis, problem-solving, and decision-making in content learning. [redacted]
9. Investigate and apply expert systems, intelligent agents, and simulations in real-world situations. [redacted]%
10. Collaborate with peers, experts, and others to contribute to a content-related knowledge base by using technology to compile, synthesize, produce, and disseminate information, models, and other creative works. [redacted]%
11. For the answers provided above about TWELFTH grade student technology literacy, what was the primary method you used to determine the percentages?
 - No organized way to ascertain the information

- Estimates based on teacher informal reporting
- Student self-reported skills checklist
- Teacher informal observation using skills checklist
- Site-developed technology literacy test
- End-of-experience test for technology application experience
- Performance-based authentic assessment (portfolios)

The Student Technology Literacy competencies are based on *National Education Technology Standards for Students – Connecting Curriculum and Technology*, copyright © 2000, ISTE (International Society for Technology in Education), 800.336.5191 (U.S. and Canada) or 541.302.3777 (International), iste@iste.org, www.iste.org. All rights reserved. Permission does not constitute and endorsement by ISTE. For information about the NETS Project, contact Lajeane Thomas, Director, NETS Project, 318.257.3923, lthomas@latech.edu.

Assistive Technologies

6.1 Assistive Technologies

Is assistive technology (e.g., portable word processors and brailers, intellikeys, electronic communication aids for speech or computers with adaptive devices, touch screens) used by students with disabilities or students with learning difficulties? (Choose one answer)

- Yes, for both students with disabilities who have an Individualized Education Plan or a 504 Plan and for students who experience difficulties learning but do not receive special education services or support through a 504 Plan.
- Yes, primarily for students with disabilities who have an Individualized Education Plan or a 504 Plan.
- No, most teachers are aware of these options but have not been trained how to support students who use the technology.
- No, most teachers are not aware of these options.
- No, there is not a clear process in place in our school for obtaining assistive technology.
- No students with these needs at this time.

APPENDIX C
School List

Districts	Schools
Anderson County	Lake City Middle School
Anderson County	Norris Middle School
Anderson County	Norwood Middle School
Bedford County	Harris Middle School
Benton County	Camden Jr High School
Bledsoe County	Bledsoe County Middle School
Blount County	Carpenters Middle School
Bradley County	Heritage Middle School
Bradley County	Ocoee Middle School
Campbell County	Jacksboro Middle School
Campbell County	Lafollette Middle School
Cleveland	Cleveland Middle School
Coffee County	Coffee County Middle School
Crockett County	Crockett County Middle School
Dickson County	Charlotte Middle School
Dickson County	Dickson Middle School
Dickson County	W James Middle School
Dyer County	Three Oaks Middle School
Dyersburg	Dyersburg Middle School
Elizabethton	T A Dugger Junior High School
Franklin County	South Middle School
Giles County	Bridgeforth Middle School
Greeneville	Greeneville Middle School
Hamblen County	East Ridge Middle School
Hamblen County	Lincoln Heights Middle School
Hamblen County	Meadowview Middle School
Hamblen County	West View Middle School
Hamilton County	Brown Middle School
Hamilton County	Chattanooga Middle Museum Magnet School
Hamilton County	Dalewood Middle School
Hamilton County	East Lake Academy Of Fine Arts
Hamilton County	East Ridge Middle School

Districts	Schools
Hamilton County	Hixson Middle School
Hamilton County	Hunter Middle School
Hamilton County	Loftis Middle School
Hamilton County	Ooltewah Middle School
Hamilton County	Orchard Knob Middle
Hamilton County	Red Bank Middle School
Hamilton County	Signal Mountain Middle School
Hamilton County	Soddy Daisy Middle School
Hamilton County	Tyner Middle Academy
Hardeman County	Bolivar Middle School
Hardin County	Hardin County Middle School
Hawkins County	Church Hill Middle School
Hawkins County	Rogersville Middle School
Hickman County	East Hickman Middle School
Hickman County	Hickman Co Middle School
Houston County	Houston Co Middle School
Humboldt	Humboldt Middle School
Humphreys County	Mc Ewen Junior High School
Jefferson County	Jefferson Middle School
Jefferson County	Maury Middle School
Kingsport	Robinson Middle School
Kingsport	Sevier Middle School
Knox County	Bearden Middle School
Knox County	Carter Middle School
Knox County	Cedar Bluff Middle School
Knox County	Farragut Middle School
Knox County	Gresham Middle School
Knox County	Halls Middle School
Knox County	Holston Middle School
Knox County	Karns Middle School
Knox County	Northwest Middle School
Knox County	Powell Middle School
Knox County	South Doyle Middle School
Knox County	Vine Middle/Magnet

Districts	Schools
Knox County	West Valley Middle School
Knox County	Whittle Springs Middle School
Lauderdale County	Lauderdale Middle School
Lenoir City	Lenoir City Middle School
Lewis County	Lewis County Middle School
Lexington	Paul G. Caywood Middle School
Loudon County	Ft Loudoun Middle School
Macon County	Macon County Junior High School
Maury County	Whitthorne Middle School
Meigs County	Meigs Middle School
Memphis	A. Maceo Walker Middle School
Memphis	Airways Middle School
Memphis	Bellevue Junior High School
Memphis	Colonial Middle School
Memphis	Corry Middle School
Memphis	Craigmont Middle School
Memphis	Cypress Middle School
Memphis	Fairview Jr High School
Memphis	Geeter Middle School
Memphis	Hamilton Middle School
Memphis	Havenview Middle School
Memphis	Hickory Ridge Middle School
Memphis	Humes Middle School
Memphis	Kirby Middle School
Memphis	Lanier Middle School
Memphis	Raleigh Egypt Middle School
Memphis	Ridgeway Middle School
Memphis	Riverview Middle School
Memphis	Sherwood Middle School
Memphis	Vance Middle School
Memphis	White Station Middle School
Memphis	Wooddale Middle
Monroe County	Madisonville Middle School
Montgomery County	Kenwood Middle School

Districts	Schools
Montgomery County	Montgomery Central Middle School
Montgomery County	New Providence Middle School
Montgomery County	Northeast Middle School
Montgomery County	Richview Middle School
Montgomery County	Rossvie Middle School
Morgan County	Central Middle School
Oneida	Oneida Middle School
Paris	W O Inman Middle School
Polk County	Chilhowee Middle School
Roane County	Cherokee Middle School
Roane County	Midway Middle School
Roane County	Rockwood Middle School
Robertson County	Greenbrier Middle School
Robertson County	Springfield Middle School
Rutherford County	Blackman Middle School
Rutherford County	Rock Springs Middle School
Rutherford County	Siegel Middle School
Rutherford County	Smyrna Middle School
Sevier County	Sevierville Middle School
Sevier County	Seymour Middle School
Shelby County	Appling Middle School
Shelby County	Arlington Middle School
Shelby County	Collierville Middle School
Shelby County	Elmore Park Middle
Shelby County	Germantown Middle School
Shelby County	Houston Middle School
Shelby County	Millington Middle School
Shelby County	Schilling Farms Middle
Shelby County	Shadowlawn Middle School
Shelby County	Southwind Middle School
Shelby County	Woodstock Middle School
Sullivan County	Blountville Middle School
Sullivan County	Bluff City Middle School
Sullivan County	Colonial Heights Middle

Districts	Schools
Sullivan County	Holston Middle School
Sullivan County	Holston Valley Middle School
Sullivan County	Sullivan Middle School
Sumner County	Joe Shafer Middle School
Sumner County	Knox Doss Middle School
Sumner County	Portland Middle School
Sumner County	Robert E Ellis Middle
Sumner County	Rucker Stewart Middle
Sumner County	T. W. Hunter Middle School
Sumner County	V G Hawkins Middle School
Tipton County	Munford Middle School
Trousdale County	Jim Satterfield Middle School
Tullahoma	West Middle School
Union City	Union City Middle School
Warren County	Warren County Middle School
Weakley County	Martin Middle School
White County	White Co Middle School
Williamson County	Heritage Middle School
Wilson County	Mt. Juliet Middle School
Wilson County	West Wilson Middle School

VITA

HOWARD THOMAS SISCO

Personal Data: Date of Birth: January 8, 1963

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Kent State University, Kent, Ohio; Educational Technology, M.Ed., 1988

Lincoln Memorial University, Harrogate, Tennessee; Curriculum & Instruction,
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East Tennessee State University, Johnson City, Tennessee; Ed.D., 2008

Professional

Experience: Adjunct Instructor, College of Education, Kent State University, Kent, Ohio,
1987 and 1988

Coordinator of Equipment Services, College of Education, Kent State
University, Kent, Ohio, 1987 and 1988

Dean of Education, Academy of Court Reporting, Cleveland, Ohio, 1988 and
1989

Multimedia Systems Developer, University of Pittsburgh Medical Center,
Pittsburgh, Pennsylvania, 1989-1992

Director of Instructional Technologies, Roane State Community College,
Harriman, Tennessee, 1992 and 1993

Supervisor of Technology & Communications, Hamblen County Department of
Education, Morristown, Tennessee, 1993 - 2008