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Technology integration in a Title I elementary school: An exploratory case study

Barbara Louise Radecki
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TECHNOLOGY INTEGRATION IN A TITLE I ELEMENTARY SCHOOL:

AN EXPLORATORY CASE STUDY

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of

Doctor of Philosophy Degree in Learning and Technology
Department of Educational Psychology
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By the undersigned on April 21 2009

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ABSTRACT

Technology Integration in a Title I Elementary School: An Exploratory Case Study

by

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The purpose of this study was to determine how technology was integrated into the curriculum of a Title I high achieving elementary school in a large school district in the Southwestern United States. Three research questions guided the study: How did teachers integrate technology and curriculum in a Title I, high achieving elementary school? How did that integration translate into the classrooms of this Title I, high achieving school? What existed in the school environment that promoted the integration of technology into the curriculum?

Six volunteer teachers from grades kindergarten through fourth filled out two screening instruments, were interviewed twice, and were observed two or three times. Also interviewed were the technology coordinator, librarian, principal, and assistant principal. During the observations, teachers' technology use was assessed using a three-tier level which determined whether they were using technology strictly for their own use or classroom presentations, level one; their students were using technology for skill building or free time activities, constituting level two; or their

students were using technology to develop critical thinking skills, the goal of level three. The teachers' lesson plans were reviewed to determine their objectives when using technology. Students had access to technology in their classrooms, the library, and the newly opened computer lab.

During data analysis, three themes were identified: definition of technology integration, levels of technology use, and beliefs versus actions. Although the definitions of technology integration differed, two underlying concepts were present in all teachers' beliefs: the students needed to learn to use technology now to be successful in their futures, and technology use needed to be purposeful, and not used for fluff.

The six teachers observed used technology effectively at levels one or two; however, only two teachers were observed using level three. The level system did provide a method for determining technology use in schools. Another important finding was the evaluation of how technology was being used at each level which led to the creation of the degrees of responsiveness, the degrees of implementation, and the degrees of adherence indicators. Teacher self-efficacy was an important component contributing to the teachers' technology use.

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GLOSSARY

Software Programs and Technology Used in the School

Descriptions based on Internet site descriptions

Accelerated Reader (AR): A software program in which students read books, then took quizzes which determined their comprehension. Students received a printout immediately after taking the quiz giving them the results, to include vocabulary progress. Books ranged in reading level from primary though ninth grade reading.
http://www.renlearn.com/ar/howitworks.aspx

DIBELS: Dynamic Indicators of Basic Early Literacy Skills was a testing program that measured the five big ideas in reading of phonemic awareness, alphabetic principle, accuracy and fluency, vocabulary, and comprehension. The teachers tested students with a Palm Pilot; the students read a passage to the teacher, who marked responses on the Palm Pilot. The results were uploaded from the Palm to the DIBELS website, which provided instant feedback to the teacher. The tests were short (one minute) fluency measures used to regularly monitor the development of early literacy and early reading skills.
http://www.dibels.org/

ELMO: A document camera used primarily as a projection system in the classrooms.
http://www.elmousa.com/

EnVision Math: The math program adopted by the district to be used in all elementary schools. The program had a large technology component in addition to textbooks and workbooks.
http://www.pearsonschool.com/index.cfm?locator=PSZ16d&elementType=mergedNavGroup&navGroupName=View%20Sample&navGroupChildren=Preview%20Print%20Products,Preview%20Digital%20Products&PMDbProgramID=34350

Imagine Learning English: A software program which provided a language acquisition curriculum especially designed to meet the needs of English language learners. The program focused on vocabulary development, listening and speaking, literacy, and school readiness.
http://www.imaginelearning.com/school/Curriculum.html
Lexia: A software program to supplement the reading program. It was designed to help students master basic reading skills through the application of phonics skills.

The activities promoted comprehension skills through the application of phonological strategies to single words, phrases, sentences, paragraphs and stories and emphasized listening skills and following directions. Lexia is an Integrated Learning System (ILS).
http://www.lexialearning.com/forschools/products/primaryreading.php

PowerPoint: A presentation software program.
http://office.microsoft.com/en-us/powerpoint/default.aspx

Ticket to Read: A web based reading program designed for K – 6 students to help them learn to become active readers. Students work independently based on their fluency and reading skills. The program can be reached from any computer, allowing students to work at or from any computer with an internet connection. The program was designed to teach reading skills at the individual level with adaptive instruction in phonics, fluency, vocabulary, and comprehension.
http://www.tickettoread.com/about/index.jsp

Type to Learn: A software program that combined touch typing keyboarding instruction and games in which students were recruited to help save the world's most vital information from being lost forever. Built on a pedagogy of sequential skills-building instruction.
http://www.sunburst.com/reseller/ttl/TTL_Series_RS.pdf

Smartboard: A brand of interactive whiteboard which attached to a computer and projector.
http://smarttech.com/

Success Maker: A reading software program for kindergarten through fifth grade students. Created to engage the digital natives with scaffolded support. The concepts and skills addressed a variety of instructional needs within the five major components of the Learning Management System which provided on-demand reports for quickly assessing progress by classroom or student.
http://www.pearsonschool.com/index.cfm?locator=PSZ16c&filter_161=&filter_423=6731&filter_422=&filter_424=&filter_281=&filter_425=&programFilterTypeList=161%2C423%2C422%2C424%2C281%2C425&PMDbSiteid=2781&PMDbSolutionid=6724&PMDbSubSolutionid=&PMDbCategoryid=1662&&PMDbProgramID=55601

Video Streaming: A website whereby teachers were able to download educational videos by grade level, subject, and standards. A school district must subscribe to the service.
http://www.klvx.org/index.asp?NID=91

Waterford: A software program designed to develop reading skills of phonics, comprehension and vocabulary, language concepts, and phonological awareness; math skills of numbers and operations, geometry and algebraic thinking, measurement, time, and money, and data analysis and problem solving strategies; and science concepts of science as inquiry, physical science, life science, earth and space science, and personal and social perspectives. Waterford is an Integrated Learning System (ILS).
http://www.waterford.org/index.jsp

ACKNOWLEDGMENTS

I would like to thank my advisor, Dr. LeAnn Putney, for her patience, her guidance, her support, and her encouragement during the past six years. She was always willing to take time from her busy schedule to meet with me (frequently at our favorite coffee shop), hold my hand when necessary, and prod me to reach my full potential. Her ability to understand a problem and develop and explain a solution was truly amazing. Without her help, this dissertation would not have reached completion.

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Special thanks go to the principal, assistant principal, teachers, technology coordinator, and librarian of the elementary school in which I did my research who so graciously welcomed me, allowed me into their daily lives, and answered countless questions. Without their support this dissertation could not have been written.

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Last, but certainly not least, I want to acknowledge and thank my life partner, Gloria Lynn. Her love, support, patience, and understanding over the last six years allowed me to finish this dissertation and fulfill a life-long dream. Without her, I would never have been able to accomplish this goal.

This paper is dedicated to the memory of

Dr. Marie E. Wirsing
June 1, 1931 to November 12, 2004

Professor, Social Foundations of Education
University of Colorado
1966 to 2004

Her belief in me enabled me to believe in myself.
With all good wishes.

"Maybe time was just too short, or I was just too late,
But I'll meet you just beyond the Eastern Gate."

Eastern Gate by Marsha Stevens-Pino,
Used with permission

CHAPTER 1

INTRODUCTION

As a Technology Coordinator at an elementary school in a large school district in the Southwestern United States, I am responsible for helping teachers integrate technology into their curriculum. However, after many staff development sessions, many individual teaching sessions, and many sessions in which I modeled the use of technology with students, teachers were not effectively integrating technology in their curriculum. Discussions with other technology coordinators in the district and an extensive review of literature indicated this problem was pervasive: teachers were not effectively integrating technology into their curriculum.

There are many concerns focused on using technology in elementary school classrooms. As Cuban, Kirkpatrick, and Peck (2001) noted, schools and school districts have spent enormous amounts of money wiring classrooms, purchasing technology equipment, and training teachers to use technology. This has not resulted in the increased teacher and student use originally expected. Although studies indicate an increase in teacher and student computer use, technology is still being used in limited ways. Students in 21st Century schools need to develop higher order thinking skills, but technology is not always being used as a viable tool for developing these much needed skills. Information technology and 21st Century skills are critical for success in higher education and the work world, but schools are obsessed with

teaching basic skills, primarily due to the emphasis on assessment of student academic achievement. Technology integration has excellent potential to enhance higher order thinking skills and higher level student achievement—skills necessary for the 21st Century work world. Yet, schools tend to focus on lower order skills, and research indicates mixed results when the focus on technology use is teaching lower order skills (Wenglinsky, 2006).

This lack of technology use to teach higher order thinking skills is even more evident in lower socio-economic status (SES) schools. Research has identified a major equity issue—not just counting computers and access, but the equity issue of how students use the computers. In lower SES schools computers tend to be used for lower order skills, such as drill and practice activities, at a disproportionate rate than in higher SES schools (Goode, Margolis, and Stumme, 2004; Warschauer, 2000; Warschauer, Knobel, and Stone, 2004). Additionally, teachers in lower SES schools tend to be less skilled with technology use, have less training in technology integration, and have less of a vision for technology integration than teachers in higher SES schools (Esch, Chang-Ross, Guha, Tiffany-Morales, and Shields, 2004). In fact, Henke, Chen, and Geis (2000) found that nationally, teacher undergraduates with a grade point average (GPA) of 2.75 (out of a possible 4.0) or lower were more likely to work at a lower SES school than teachers with higher GPAs. The inequity continues with teaching methodology: teachers in lower SES schools tend to be more task-oriented while teachers in higher SES schools tend to be more constructionist in their teaching (Lubienski, 2001).

In the "Technology Counts 2006" report, an annual report by *Education Week* measuring the status of K-12 technology throughout the states, this state in the

Southwestern United States received a score of 62 (D-), the lowest of the 50 states. The report was based on six criteria: a state overview, access to technology, use of technology, the capacity to use technology, state data systems, and data access/analysis tools. The United States as a nation received a C+ or 77 (Smith and Throne, 2007). These results further indicated that technology was not being used in education on a systematic basis throughout the United States, and especially not in this particular state.

These inequities and the Technology Counts report begged the question, were schools in this state, specifically in this large district, with a lower SES, both successfully integrating technology and meeting the goals of student achievement? We had a need to know what successful technology integration looked like in such schools.

Purpose of Study

The topic for my research study was successful technology integration into the curriculum in a lower SES school. Technology integration was defined as using technology so that it is a seamless part of a learning environment in which teachers used technology across the curriculum (Strudler and Hearrington, 2008). The emphasis is on what the student is learning, rather than on using the technology. The International Society for Technology in Education (ISTE) defines curriculum integration in the National Educational Technology Standards for Students (2000).

> Curriculum integration with the use of technology involves the infusion of technology as a tool to enhance the learning in a content area or multidisciplinary setting. Technology enables students to learn in ways not previously possible. Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in

> a timely manner, analyze and synthesize the information, and present it professionally. The technology should become an integral part of how the classroom functions—as accessible as all other classroom tools (page 6).

In the primary grades students learn to read. In later grades, they read to learn. The same can be said about technology: first, students learn to use technology; then, students use technology to learn. Using technology to learn relies on the integration of technology into the curriculum. Just as students keep increasing their reading skills by learning new words, so students keep increasing their technology skills by learning new software and new hardware.

The purpose of this study then was to identify and describe how teachers of at-risk students effectively integrated technology to support student learning and achievement. Identifying and describing how teachers successfully integrated technology in their classrooms would help educators determine how they can further enhance technology integration. The target in this sense was a school that did well in standardized measures of student achievement as well as 21st Century skills and higher order thinking. While this mix was more common in higher SES schools, it was critical for lower SES schools to address both the achievement divide and the digital divide.

Statement of Problem

A current problem is a lack of understanding by researchers and educators of what constitutes a highly integrated technology school. Many ideas have been proposed such as available technology hardware (Becker, 2000; Becker and Ravitz, 2001; Dexter, Anderson, and Ronnkvist, 2002; Dwyer, Ringstaff, and Sandholtz, 1991; Penuel, 2006; Warschauer, 2005-2006), technology repair support (Dexter et

al., 2002; Penuel, 2006; Strudler, 1995-1996; Strudler, Falba, Hearrington, 2005), staff development (Birman, Desimone, Porter, and Garet, 2000; Dexter et al., 2002; Penuel, 2006), teacher beliefs, practices, and teaching styles (Becker et al., 2001; Birman et al., 2000; Cradler, 2002; Dwyer, 1994; Dwyer et al., 1991; Fullan, 1996; Partnership for 21st Century Skills, 2006; Penuel, 2006; Wenglinsky, 2006), and the school community itself. But even with all these components in place, a majority of elementary schools do not demonstrate the integration of technology into the classroom curriculum (Cuban, 1990). This suggests that not all the components had been identified or accurately described.

Computers are valuable and well-functioning instructional tools found in almost every classroom throughout the United States. In most classrooms, teachers have convenient access to computers, are trained to use computers, and have a degree of freedom in presenting their curriculum (Becker, 2000). Whether or not teachers effectively use computers appears to depend on their computer efficacy and technology. It is important to study the link between teacher beliefs, their computer efficacy, and teachers' actual use of computers in their classroom practice because such knowledge may help educators understand why some teacher beliefs are hard to change (Levin and Wadmany, 2006). Understanding the connection or disconnection between computer efficacy and practice may help educators and administrators understand how to help teachers use technology effectively in their classrooms. Rakes, Field, and Cox (2006) suggested a need for further research on the link between teachers' technology use and their classroom instructional practices.

As technology has become more advanced, varied, and pervasive in schools, defining and measuring teachers' use of technology has become increasingly complex. Teachers use technology in various ways, and, as a result, researchers may not have a clear definition of what is meant by teachers' use of technology. Too often the variety of ways in which teachers employ technology has been grouped together into a single dimension.

The term "teachers' use of technology" varies widely from one research study to another. The term may be specific to teachers' use while delivering instruction in the classroom; or it may involve teachers requiring students to use technology to develop products; or it may include non-student activities such as e-mail, lesson planning, record keeping, or data analysis. As the variety of ways teachers use technology increases, defining "a technology using teacher" has become more complicated and more complex (Bebell, Russell, and O'Dwyer, 2004). Another area of concern is the quality of computer use. Over a decade ago, Ertmer, Evenbeck, Cennamo, and Lehman (1994) recognized the value of quality of computer use above the quantity of computer use in their research study.

Beginning in 1994, the National Center for Educational Statistics (NCES) has conducted several surveys in public schools to determine how teachers are using computers and the internet. The NCES has documented that teachers' use of technology has increased and changed dramatically since 1994. One of the difficulties in determining how teachers use technology is the instruments used to collect the information. These instruments frequently collapse all the data into a single generic variable, usually labeled "technology use" (Bebell et al., 2004), overlooking the quality versus quantity discussion.

Significance of the Study

The potential significance to researchers and to the educational community of my research study is threefold. First, my study presents a description of what a highly integrated technology school looks like based on my observations of teachers. Second, it provides an understanding of the role teacher computer efficacy plays in computer use. Third, my study identifies the ways teachers use technology within a Title I elementary school that integrates technology into the curriculum. Such identification within the identified problem areas may help those in teacher education and those responsible for staff development know what concepts to focus on to enable teachers to integrate technology effectively in the curriculum. For the purposes of this research study, technology refers to electronic hardware such as desk computers, laptops, personal digital assistances, LCD projectors, interactive whiteboards, and CD and DVD players; software; wireless networks; and the internet (Bruning, Schraw, Norby, and Ronning, 2004).

Levels of Technology Use

For purposes of conducting an exploratory study, I proposed a method for defining teacher use of technology through the identification of three levels of technology use. From my position as a technology coordinator, I developed a three-tier model for identifying teacher computer use. The three levels of technology use are described and explained through the International Society for Technology in Education (ISTE) Standards and the six cognitive levels of Bloom's Taxonomy: knowledge, comprehension, application, analysis, synthesis, and evaluation. Unlike Bloom's Taxonomy, however, the three levels of technology use are neither

sequential nor interdependent. It is possible for a teacher to be using technology on level three, but not levels one or two. A much more likely scenario is that most teachers would use computers at levels one and two on a regular basis, and level three on a much less frequent basis. The theory of the levels of use is a ground theory from my personal experience as a technology coordinator.

Level one involves strictly teacher use for administrative record keeping types of activities, communication, lesson preparation, lesson presentations, and data analysis, and does not involve Bloom's Taxonomy. At this level technology is for teachers and not for students. Examples of level one include use of the computer for taking attendance; recording grades in a grade book; printing progress reports and report cards; emailing communications to other teachers, administrators, and parents; typing letters to send to parents; developing lesson plans; creating student worksheets that are printed, copied, and given to the students (usually as seatwork); searching the internet for lesson ideas; and using programs required by the administration. Teachers may use technology for instructional purposes such as creating a PowerPoint lesson, a clip from video streaming, or even a lesson on an interactive whiteboard that is presented to the students as a whole class in place of a teacher lecture. Another example is teaching a lesson on the parts of a computer.

Teachers' use of technology for administrative purposes is further driven by the need for data management. The new buzzwords "data-informed instruction" and "data-driven decision making" are a result of accountability demands (Smith and Throne, 2007). In this particular school district, elementary level students are tested four or five times a year and the results provided to teachers with the intent that the teachers will develop lessons based on the students' test results. Technology

enables teachers to receive these results in days or even hours after the students are tested.

At level one, the teacher's use of technology (including computers, LCD projectors, and interactive whiteboards) may be either non-instructional or instructional, but it does not result in the students' use of technology. This level of use is for management, preparation, analysis, and presentation purposes. Most teachers in this school district appear to be operating at level one, frequently due to district level requirements to use technology for specific purposes, such as attendance, grade books, report cards, data analysis of students' test results, and email. Although this level does not result in student use, it is important for teachers to be able to function comfortably at level one. Goddard (2002) stated in his paper that teachers must first integrate technology into their personal lives before they can use technology as an effective tool for educating their students.

At level two, students use computers primarily for lower order skills such as fact mastery, skill building, (King, 2003); remembering, reciting, producing isolated segments of information (McLoughlin and Oliver, 1998); learning to use the computer (e.g., how the mouse works); or learning to use specific computer software (e.g., word processing programs). Level two of the technology use levels corresponds to the knowledge cognitive level in Bloom's Taxonomy in which students remember or recall information, specific facts, terminology, or major ideas (Bissell and Lemons, 2006). Students searching the Internet or watching a video from video streaming for information about a specific subject are examples of level two. These activities may be small group or individual lessons. Teachers at this level of use may create lessons for students that are used on the computer, e.g., worksheets that students fill in on

the computer or a document of hot links for student research. Students' use of a word processing program to type an assignment is another example of level two. Also, teachers at this level may post assignments or homework on the teacher's web site.

At level two, technology is a vehicle for delivering the information, either from teacher to student, student to student, or student to teacher. But as Rakes et al. (2006) in their research indicated, at this level, students are not provided with whole, dynamic technology learning, but with limited, arbitrary technology activities. Numerous studies by Cradler, McNabb, Freeman, and Burchett (2002); Dwyer et al. (1991); Kulik (2003); McKenzie (1999); Penuel (2006); Warschauer (2006); and Wenglinsky (2006), indicated that computer usage does not necessarily result in higher achievement scores. Wenglinsky noted that technology in schools could actually produce a negative effect if the technology is being used only for drill or other uncreative ways.

Teachers functioning at level two tend to use computers to increase students' computer skills, as practice drills, as free-time activities, and for reward activities (Ertmer, 2005). Teachers at this level sometimes believe that technology is an add-on, rather than an integral part of the curriculum (Ertmer, Addison, Lane, Ross, and Woods, 1999), especially if they are using technology for free-time and reward activities. Teachers who are behaviorist-oriented tend to use technology at this level as a means for rote memorization (Morrison and Lowther, 2002); as behaviorists, they are concerned about outcomes. Although level two activities might be of use in the classroom, these activities do not engage students in higher level cognitive processes (McLoughlin and Oliver, 1998), as one finds in Bloom's Taxonomy. In the

taxonomy, the lower levels support the higher levels and each level builds on the previous level. In the levels of technology use, higher order thinking skills rest on a foundation of lower order thinking skills (Booker, 2008). There is a place for level two skill building activities in the elementary classroom.

Level two also includes the use of Integrated Learning Systems (ILS), a very popular delivery system for educational software. The characteristics of ILS are that they are computer-delivered instructional packages comprised of comprehensive software systems that operate on their own networked hardware platforms. ILSs control the sequence of instruction by a management system that assigns lesson sequences, monitors learner performance, and generates student progress reports.

ILS software uses principles of learning theory and instruction in its software design. However, research that supports the effectiveness of ILSs for learning has been inconclusive. ILSs have their supporters and their critics, but one assumption all agree on is that the quality and effectiveness of an ILS is directly related to the quality of its implementation. Unless an ILS is implemented with fidelity, it is not possible to reasonably determine the quality of the ILS instruction and its effectiveness for learning (Mills and Ragan, 2000). ILS systems are skill builders, and therefore part of level two. The research seems to indicate that a majority of teachers using technology in their classrooms are using it at levels one and two.

Level three involves the integration of technology in the curriculum. At this level, technology is a vehicle for learning, not just a vehicle for delivering the information. This level incorporated Bloom's Taxonomy cognitive levels of comprehension, application, analysis, synthesis, and evaluation (Bissell and Lemons, 2006). Students may create presentations in software programs such as Publisher,

Word, Excel, PowerPoint, Photo Story, or Inspiration, as a culminating activity to a project, not as the main purpose of the project. Using a digital camera to take pictures demonstrating concepts such as fractions, geometric shapes (Li 2005), percents, or other mathematical concepts is an example of level three.

Researching internet sites to find specific information that is part of a larger process of research in which the information was examined and synthesized is another example of level three. The focus is not on the technology, but on student learning using technology. The students may learn about technology as they study other subjects, but that is not their main purpose. The students are intellectually engaged as they experience inquiry-based activities (King, 2003). Simulation and problem solving software that emphasizes higher order thinking skills is also part of level three. Level three teachers tend to be constructivist-oriented and view technology as a tool to get students involved with problem-solving work (Morrison and Lowther, 2002). Goddard (2002) stated that technology should support models of teaching that incorporate real-world applications. Such applications require students to research, design, analyze, and communicate information.

To further distinguish between level two and level three, the question is where does the teacher place the emphasis, on the interaction (level three) or on the activity (level two)? An example is the use of the software Photo Story. The teacher teaching the students to use Photo Story is an example of a level two activity—the emphasis is on learning to use the technology. This is the knowledge level in Bloom's Taxonomy. However, if the students are using Photo Story as one part of a larger assignment, such as the culmination project of a field trip, then the activity would be level three—the emphasis is on the content, not how to use the tool. This would be

the synthesis level in Bloom's Taxonomy. If students would be judging how well the photos fit the story, this would be the evaluation level. In level three the student is doing something other than just using the computer; the computer is used as an aid or a tool in the development of higher order thinking skills and problem solving. Waycott, Jones, and Scanlon (2005) describe the computer as the tool used for achieving an objective. A much smaller number of teachers use technology for comprehension, application, analysis, synthesis, or evaluation—level three activities (Ertmer, 2005).

Watching a clip from video streaming may be observed in all three levels. However, in level one, the teacher is showing the video clip to the entire class. Students may have worksheets to guide them in identifying specific information, or there may be a class discussion following the viewing. In this situation, the video clip would be replacing or enhancing a teacher presentation, and students would be passive recipients. No direct student involvement with the computer would happen; control would be in the hands of the teacher.

In level two, students may be working individually or in small groups watching a video clip. They may be using worksheets to guide them in the identification of information the teacher deems important. Groups or individuals may present their findings to each other individually, to the small group, to the entire class, or to the teacher, as in a written report. At this level, using the video clip to gather specific information is the goal. The emphasis is on the activity of watching the video clip.

Ertmer et al. (1999) described teachers' use of technology at this level as an add-on, rather than an integral part of the curriculum, and Rakes et al. (2006) in their research indicated students at this level would not be provided with whole, dynamic

technology learning, but with limited, arbitrary technology activities. Nevertheless, I recognize that lower level skill building could be an important activity. Without mastery of the basic lower level skills, students may not master higher order thinking skills. Therefore, a need and a place for level two skill building technology activities are recognized as an integral part of the elementary school classroom.

In level three, students might be watching a video clip, again either in small groups or individually, as one step in a process to gather and synthesize information about a specific topic. The students would use other sources in addition to the video clip to obtain information. The students would synthesize the information from several sources to create a final project that would be presented to others (such as the entire class and teacher). During the presentation of the students' final projects, students and teachers may interact with the presenters asking questions to clarify or challenge information presented. The objective would be gathering, analyzing, and synthesizing information for the creation of a final project, and perhaps evaluating the effectiveness of the presentation.

Other criteria for determining at which level teachers would be using technology in their lessons would be determined by the answers to the following questions. Why is the teacher using technology in the lesson? What is the purpose? What are the objectives? What is he or she trying to accomplish? In this day of accountability, teachers must write out the objectives and goals of each lesson. Does the lesson have separate goals for using technology (i.e., learn to use a software program), or is the software program a vehicle for presenting analyzed and synthesized information? If the objective to use technology is a separate goal, such as learning to use the software, the lesson would be an example of level two. If the

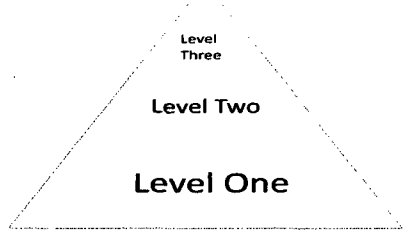
objective for using technology were incorporated into the lesson (i.e., the finished project would be presented in a software program such as Photo Story, Power Point, Publisher), then the lesson would be an example of level three.

Although the three levels could be contemplated as equal steps in the classroom setting, as depicted in figure 1, too often their use resembles a pyramid, with level one receiving the most emphasis, and level three the least, as depicted in figure 2.

Figure 1: Ideal Levels of Use

Level One
Level Two
Level Three

Figure 2: Realistic Levels of Use



Wenglinsky (2006) found that using computers to encourage higher order thinking skills produces greater achievement than using computers for drill or routine tasks. Jonassen, Howland, Moore, and Marra (2003) emphasize that it is more important to learn with technology rather than just learning to use technology. Li's (2005) research found that technology, when integrated into the curriculum, should be used in authentic tasks and, whenever possible, applied to real-world situations. Li further suggests that the most important reason for integrating meaningful technology into the curriculum is that it fosters higher-order thinking skills.

Moersch (1999, 2002) states that using technology appropriately not only reinforces higher cognitive skill development, it also reinforces complex thinking

skills such as problem solving, reasoning, decision making, and scientific inquiry. Wenglinsky (2006), too, notes the benefit of using computers to help develop students' higher-order thinking skills. Warschauer (2006) states that educators need to put education goals first and technology goals second. The focus should be on using technology to learn, as opposed to learning to use the technology. This is the goal of technology use at level three.

Figure 3: Summary of Levels of Technology Use

Levels of Technology Use	How Technology is Used	Examples of Use and Correlation to Bloom's Taxonomy	Purpose or Objectives of Teacher's Use
Level 1	Teacher use only; does not result in student use.	Administrative; data management; lesson presentations. No correlation to Bloom's Taxonomy	For administrative purposes; lesson presentation; no direct student use.
Level 2	Students use as reward or for lower level skill building.	Whole class, individually, or in small groups; may or may not be teacher directed. Cognitive level was knowledge in Bloom's Taxonomy.	Fun time use; development of lower level skills; emphasis frequently on learning to use technology.
Level 3	Students use for higher order thinking skills.	Used as part of larger project. Correlated to cognitive levels of comprehension, application, analysis, synthesis, or evaluation in Bloom's Taxonomy.	Development of higher order thinking skills. Emphasis is on learning with technology.

Using the three levels when observing teachers helps me classify and determine how teachers are using technology—not just how much teachers are using

technology. Using the three levels also enables me to analyze teachers' lesson plans to determine how and why they are using technology in their lessons.

Theoretical Framework

The theoretical perspective of this study is social cognitive and constructionist. Both terms refer to learning that is social (Wink and Putney, 2002), enactive (Bandura, 1997), reorganized or restructured (Moersch, 2002), and vicarious (Bandura). The social cognitive perspective involves Bandura's theory that learning is the result of interacting variables, and Vygotsky's perspective that learning involves social, cultural, and historical relationships. Knowledge changes and is mutually constructed with others. The student is an active thinker and active social participator (Wink and Putney, 2002).

The constructionist perspective is based on the premise that students construct their own understanding of knowledge based on their own experiences. Learning is a search for knowledge; therefore, learning must commence with issues around which students are actively trying to construct meaning. Learning requires wholes because it focuses on primary concepts, not just parts as in isolated facts. Learning is the process of reconstructing mental models (Moersch, 2002). Assessment of such a learner must be ongoing over multiple sites (Wink and Putney, 2002).

Using the "Conceptual Funnel" metaphor (Marshall and Rossman, 1999), the general conceptual focus of my research study is the components of the Title I, high achieving elementary school that successfully integrates technology into the curriculum in academic subjects. Narrowing the funnel, focus is placed on teachers

who use technology successfully in this school (success being defined in terms of technology integration). At the small end of the funnel, I focused on the experiences, beliefs, and efficacies that shaped the teachers' development.

Research Questions

Three research questions guided this study:

1. How did teachers integrate technology and curriculum in a Title I, high achieving elementary school?
2. How did that integration translate into the classrooms of this Title I, high achieving school?
3. What existed in the school environment that promoted the integration of technology into the curriculum?

These questions are important because the requirements of accountability have left many teachers focusing on assessment and test-taking skills, and eliminating technology from their schedules. As the Technology Counts 2006 report (Smith and Thorne, 2007) indicates, although the technology is present in schools, it is not being used in a manner that consistently improves student academic achievement, and the situation is even worse in lower SES schools. While the expectations for technology use are prevalent, the levels of use are not being articulated. A data table describing the questions and sources for answers is located in Appendix A.

CHAPTER 2

REVIEW OF RELATED LITERATURE

American students of the 21st century are relatively comfortable with technology. They play games, watch videos, and email each other on computers; text message friends and take pictures with cell phones; download and listen to music on their iPods; all with an ease that sometimes confounds their elders. It is estimated that one-fifth of the technology elite (those who are technology trend setters) are around the average age of 22 (Horrigan, 2003). Young technology elites have a very hands-on approach when managing their technology experiences. However, Horrigan also notes that 69% of the population is not part of the technology elite.

What are their teachers doing with technology in the schools these children attend? Students are not apprehensive about using technology in the classrooms—their teachers are. However, although the "digital natives" (Prensky, 2006) of today are the teachers of tomorrow, many of these "digital natives" are not experienced in integrating technology into the curriculum (Li, 2005). These "digital natives" use technology solely for entertainment because they lack role models who could show them how to use technology for learning. Educational leaders and administrators cannot take the attitude that as new teachers come into the educational field they will use technology effectively to improve student academic achievement. Present day teachers need to be able to integrate technology into their curriculum now.

Indeed, if teachers today are not able to effectively integrate technology into their curriculum, it is unlikely that students, the "digital natives," will learn to use computers in ways that improve their learning when they become adults and teachers (Fuller, 2000). Technology would remain to them a mode of entertainment, just as television has become a mode of entertainment, and never fulfilled its expectations of revolutionizing education.

An example of young teachers failing to integrate technology in teaching is the study by Ma, Andersson, and Streith (2005). The authors worked with student teachers, most of whom had been exposed to technology at an earlier age than most experienced teachers of today. However, only 50% of these student teachers viewed computer technology as a pedagogical instrument. Just because people grow up with technology does not mean they will integrate it into their curriculum as teachers. Many teachers today grew up with televisions in their homes, but they still do not use television to any great extent in their classroom curriculum. Reiser (2001) discusses a history of instructional media in education, and notes that Edison believed motion pictures would make books obsolete in schools. That same prediction has been made about computers in school. Changes in education certainly do occur slowly. There is a parallel between the visual instruction movement of the early 20th century and the technology instruction movement of the late 20th early 21st centuries in education. Just as the audiovisual instruction movement began to grow in our society, but did not largely affect the educational community, so too we see technology becoming an integral part of our society, but much of the educational community is not changing, or is lagging behind the technology growth spurt (Bruning et al., 2004).

The following literature review demonstrates that some concepts influencing a teacher's interest in and willingness to use technology in the classroom involve self-efficacy, teacher efficacy, and computer efficacy. The review indicates that researchers are attempting to understand how teachers use technology and how they feel about using technology. As Ma, Andersson, and Streith (2005) found, young teachers may not automatically use technology effectively to increase student achievement simply because they grow up with computers. They need guidance, models, and training. The following literature review discusses studies in the four areas of self-efficacy, teacher self-efficacy, computer efficacy, and technology use, to include technology use with at-risk students.

Self-Efficacy

The concept of self-efficacy was the cornerstone of Albert Bandura's social cognitive theory (Pajares, 1992). Bandura (1977) described self-efficacy as the belief (or conviction) that a person can successfully execute a behavior that was required to produce a desired outcome. This differed from an outcome expectancy, which was the belief that a given behavior led to a specific outcome. Teachers can believe that a certain course of action, such as using technology, will produce a certain outcome, such as increased student learning; however, if they have serious doubts about their ability to perform the necessary activity, such as using computers in their lessons, then the knowledge they had about that course of action (teaching with technology) did not influence their behavior, and they did not use technology in their lessons.

Self-efficacy beliefs involved personal judgments about one's capability actions, such as cognitive, behavioral, social, and emotional, which varied in terms of

their level, their generality, their strength, and mastery criteria (Bong and Clark, 1999; Denzine, Cooney, and McKenzie, 2005; Pajares, 1996). Deemer and Minke (1999) described self-efficacy as the belief in one's capability to execute the necessary actions to achieve a certain level of performance or outcome. Self-efficacy influenced behavior, goal setting, effort expenditure, and levels of persistence. Teachers who had the belief in their capability to use technology would be persistent in their efforts to teach with technology.

Perceived self-efficacy had a directive influence on an individual's choice of activities and settings. Perceived self-efficacy can affect coping efforts positively when people have expectations of eventual success. Self-efficacy expectations played a major role in people's choice of activities, how much effort they put into the activities, and how long they sustained the effort to deal with stressful situations. Self-efficacy differed in magnitude, generality, and strength. An individual's self-efficacy was comprised of several sources of information: performance accomplishments, based on personal mastery experiences; vicarious experience, if someone else can do it, so can I; verbal persuasion, being led through suggestions that they can cope successfully with something that has overwhelmed them in the past; and physiological states, such as emotional arousal, a drive that activated *avoidance behavior* (Bandura, 1977).

Self-efficacy theory stated that it was perceived inefficacy in coping with potentially aversive events that made people fear those events. However, if people believed that they were able to exercise control over the occurrence of those events that they feared, then they would be able to overcome their fear of such events. The perceived control reduced that fear. As individuals' strength of their self-percepts of

efficacy increased, their fear declined. Perceived self-efficacy was not concerned with what a person had, but rather with judgments of what the person could do with what he or she had (Bandura, 1983).

Researchers determined self-efficacy by asking people to report their confidence level concerning the accomplishment of a task (Pajares, 1996). Although many types of self-efficacy instruments measuring self-efficacy and technology have been created, such as the Computer User Self-Efficacy Scale by Cassidy and Eachus, (2002); the Attitude towards Computer Technologies (ACT) by Kinzie and Delcort (1991); Moersch's Level of Technology Implementation (LoTi) (1995); the Computer Aversion, Attitudes, and Familiarity Index (CAAFI) by Schulenberg, Yutrzenka, and Gohm (2006); the Survey of Teachers' Self Perception of Self-efficacy Beliefs and Innovation Practice in Integrating Technology by Yan (2000); and the Teacher Efficacy Scale as modified by Denzine et al. (2005), new self-efficacy assessments are usually constructed for each individual study because of the specificity of self-efficacy beliefs (Smith, Wakely, de Kruif, and Swartz, 2003). This specificity of self-efficacy beliefs was the reason for the development of the Computer Efficacy for Teachers screening instrument (Appendix B) specifically for this study.

Teacher Self-Efficacy

How did self-efficacy translate into teacher efficacy? Vannatta and Fordham (2004) defined teacher self-efficacy as "one's belief in affecting student performance" (p. 262), while King (2003) defined it as "the teachers' beliefs about their own capacities as teachers" (p. 6). Some definitions of teacher self-efficacy included the ability of teachers' beliefs to have a positive effect on student learning

and their achievement (Ashton, 1984). Teachers' self-efficacy beliefs were founded in social cognitive theory (Henson, 2001). Denzine et al. (2005) equated the social-cognitive approach as emphasizing the relationship between teacher efficacy beliefs and outcome expectations. Further, efficacy expectation, as described by Bandura (1977), involved the conviction that an individual can successfully perform the behavior needed to produce a desired outcome. Teachers may believe that a certain course of action will produce desired outcomes in their students, but may doubt their ability to execute the necessary activities. Such doubt may have prevented teachers from accomplishing the needed course of action. How much persistence teachers put into an activity depended on their efficacy expectations. The stronger their perceived self-efficacy expectations, the stronger their efforts to persist, even in the face of obstacles and aversive experiences.

Why was teacher self-efficacy important? Some researchers have hypothesized that teachers' self-efficacy was a significant predictor of teacher computer use in the classroom (Albion, 2001; Ashton and Webb, 1986; Busch, 1995). Self-efficacy beliefs have been associated with positive teaching behaviors and positive student outcomes (Henson, 2001). Further research has indicated that teacher self-efficacy was related to teachers' successes in a wide variety of areas in education to include curriculum innovations, quality of student relationships, time spent on academic learning, and confidence in working with parents (Denzine et al., 2005). Collier (2005) noted that the higher the level of teacher efficacy the higher the level of teacher effectiveness and performance in the classroom. Franklin (2007) advocated the importance of teacher efficacy in relation to the integration of technology in the curriculum.

Additionally, Henson (2001) also discussed self-efficacy and its importance for teachers in his paper. Self-efficacy assumed that people were capable of intentional pursuit of courses of action. Self-efficacy beliefs in education were related to academic performance and self-regulated learning. Self-efficacy beliefs influenced a teacher's choices, effort, persistence when facing adversity, and emotions. One point of interest was the statement that "[t]eachers with high efficacy tend to experiment with methods of instruction, seek improved teaching methods, and experiment with instructional materials" (p. 7). If his statement were true, would teachers with high efficacy tend to experiment with technology in their classrooms? A teacher's efficacy belief stemmed from the dynamic interplay of the teacher's environment, behavior, and personal factors.

Henson (2001) commented that most efficacy research had been self-report, survey, and correlational in nature. Henoted that Pajares (1997) suggested using observation rather than self-reports. My research study was based on observations, not solely self-reports. Henson further stated that there was consistent evidence that efficacy, while malleable in teachers' preservice years, tended to be resistant to change for experienced teachers. This would be true if personal teaching efficacy were an internally held belief about oneself and that belief solidified with experience and time.

Another researcher defining teacher efficacy was Coladarci (1992). In his study, he defined teacher efficacy in terms of teachers' beliefs affecting student learning. Teacher efficacy referred to a teacher's *beliefs* rather than *observable behavior*. Human behavior was influenced by two classes of expectations in the individual's beliefs system: outcome expectation and efficacy expectation. Outcome

expectation was a person's belief that a specific behavior will lead to certain outcomes. Efficacy expectation was the individual's conviction that he or she could successfully execute the behavior which was required in order to produce the desired outcome. Coladarci differentiated between personal efficacy and general efficacy. General efficacy was based on statements about teachers in general, and used the noun "teacher" when formulating the questions. Personal efficacy was based on statements directly related to the teacher as an individual, and used the pronoun "I" when formulating questions.

Coladarci (1992) sent out a questionnaire to 364 teachers in Maine, with 170 teachers responding. The questionnaire contained teacher efficacy and school-climate scales. Coladarci's study found personal efficacy and general efficacy to be strong predictors of an individual's commitment to teaching. This study indicated that features of school organization promoting a teacher's sense of efficacy also promoted that teacher's commitment to the school and to teaching. Based on Coladarci's results, one may ask, will an improvement of a teacher's efficacy increase a teacher's commitment to the use of technology, and to the use of constructivist methodology, which had been shown to be effective when using technology? If so, how do we improve a teacher's self-efficacy for technology use?

Bandura's social cognitive theory, which was the belief in an individual's capabilities to organize and execute the specific action needed to produce a given outcome, was the basis of Ross, Hogaboam-Gray, and Hannay's (2001) research. The authors studied the effects of changes in teachers' self-efficacy beliefs on the computer skills and computer cognition of young students. They defined self-efficacy with Bandura's social cognitive theory, which was the belief in an individual's

capabilities to organize and execute the specific action needed to produce a given outcome. Self-efficacy, which was situationally specific, developed from a person's appraisal of their past experiences with the task or similar activities. However, many teachers had no experience with computers until computers were introduced into their schools and classrooms. How then does a lack of experience affect self-efficacy? Bandura (1997) suggested that when prior experience was lacking, social comparison became critical. When teachers did not have prior experiences with computers, they tended to watch other teachers using computers, and gauged their own percepts of their computer efficacy.

In their study, Ross, Hogaboam-Gray, et al., (2001) found that self-efficacy could be modified by sources of information such as observing the performances of others, just as Bandura (1997) suggested. However, the concept of modification of teacher efficacy was contrary to Henson's (2001) conclusion that teacher efficacy tended to be resistant to change for experienced teachers. Ross, Hogaboam-Gray, et al., also found that teacher efficacy contributed to student achievement because the higher the teacher efficacy the more the teacher tried to teach students. They pointed out that no studies examined the effects of teacher efficacy for teaching with computers on student attainment of computer skills or computer cognitions. They further noted that the measurement of self-efficacy was "fraught with controversy" (p. 143).

Using Bandura's proposal that the construction of self-efficacy measures be linked to competencies with specific outcomes in specific domains, Ross, Hogaboam-Gray, et al., (2001) designed their research study around teacher computer efficacy and student trajectories in computer skills. They predicted that students who went

from teachers with lower to higher computer self-efficacy would have an upward trajectory, while those who moved from teachers with higher computer self-efficacy to lower would have a downward trajectory. Their findings were statistically significant for the effects of students moving from a lower to a higher confidence teacher. Students who went from a higher to a lower confidence teacher also improved their computer skills, but not to the degree of those going from lower to higher. Ross, Hogaboam-Gray, et al.'s, research was important to my research study because it strengthened the claim that teacher efficacy affected student outcomes, to include teachers' use of technology.

In another teacher self-efficacy research study, Gibson and Dembo (1984) examined the differences in effectiveness among teachers and found that the teachers' effectiveness may be related to the teachers' beliefs in their abilities to instruct students. They developed the Teacher Efficacy Scale (TES) which included 30 items in Likert format. The study was in two phases. The first phase involved 208 elementary school teachers from 13 elementary schools who were asked to complete the TES at faculty meetings. In the second phase, 55 teachers enrolled in graduate education courses completed the TES, and then selected 10 out of 20 variables they believed contributed the most to a student's success or failure in school.

Conceptualizing and adequately measuring the construct of teachers' efficacy has been difficult. The Teacher Efficacy Scale (TES) developed by Gibson and Dembo (1984) was followed by the classroom observation of eight teachers, four of whom rated high on the TES and four of whom rated low on the scale. The results from the authors' factor analysis component indicated two factors: a teacher's sense of

personal teaching efficacy, which was the belief that the teacher had the skills and abilities to bring about student learning; and a teacher's sense of general teaching efficacy, which was a teacher's belief that student learning was limited by factors external to the teacher. The multitrait-multimethod analysis verified the distinction between teacher efficacy and two other traits—verbal ability and flexibility—and validated the use of the Teacher Efficacy Scale to measure teacher efficacy. The classroom observation found a significant difference in the amount of time spent in small group instruction; low-efficacy teachers spent half their time (50%) in small group instruction, while high-efficacy teachers spent only 28% of their time in small group instruction. High-efficacy teachers tended to spend more time in whole group instruction when compared to low-efficacy teachers. I found this very interesting since teachers using whole group instruction tended to be more behaviorist-oriented while teachers using small group instruction tended to be more constructivist-oriented. Gibson and Dembo suggested that one reason for spending less time in small group instruction for high-efficacy teachers was that students tended to be less focused academically while working in small groups, and more focused academically while working in the whole group. It was possible that in this study the teachers felt less capable of managing small groups of students.

Teachers who believed they could help even the most difficult or unmotivated students to learn have a strong teacher efficacy. Research studies such as Gibson and Dembo (1984) have found that the greater a teacher's efficacy, the more that teacher's students advanced academically. Self efficacy was not only outcome oriented, it also involved individuals believing they could perform the necessary activities to obtain the desired outcomes. Teacher efficacy indicated teachers' beliefs

in their abilities to bring about positive student change. This was important to my study because teacher efficacy indicated teachers' beliefs in their abilities to effectively use technology to bring about positive student change in academic achievement.

The perception that teacher-efficacy was difficult to define and measure was further acknowledged by Deemer and Minke (1999) in their research study. The authors determined from their study that the self-efficacy construct when applied to teachers (teacher efficacy) influenced teachers' instructional practices and attitudes toward students. They found that teacher efficacy appeared to be related to instructional effectiveness; however, they, too, determined that incongruities in construct definition and measurement made findings difficult to interpret. The authors examined the Teacher Efficacy Scale (TES) developed by Gibson and Dembo (1984), and noted that when measuring general teaching efficacy, the items tended to be negative in orientation and have an external locus.

The personal teaching efficacy items, however, were positive in orientation and had an internal locus. Deemer and Minke (1999) compared a modification of the TES developed by Guskey and Passaro (1994) and found an internal versus external distinction between factors rather than a teacher versus personal factor. The internal factor reflected teachers' perceptions of their personal influence and impact on teaching and learning situations. The external factor reflected teachers' influence and impact over elements that were beyond the classroom but still affected student learning within the classroom.

Deemer and Minke (1999) also demonstrated the plausibility of the TES being biased based on the positive and negative orientation of the items rather than an

internal-external distinction. The results of this study suggested that the TES did not measure two distinct dimensions as Gibson and Dembo (1984) suggested. However, teacher efficacy was not a unidimensional construct either, but may actually be more differentiated than the TES adequately captured. Deemer and Minke's study was important to my study because it determined that teacher efficacy can vary depending on the teacher's activity.

Another attempt to define and measure teacher-efficacy is the paper by Tschannen-Moran, Hoy, and Hoy (1998). These authors discussed the construct of teacher efficacy from a theoretical and empirical perspective in an attempt to define and measure it. The authors discussed both the history of efficacy research, beginning with Rotter (1966), and the concept of teacher efficacy as presented by RAND researchers; and the strand of self-efficacy which resulted from Bandura's social cognitive theory and his construct of self-efficacy. They presented several examples of efficacy measurements to include the one developed by Gibson and Dembo (1984).

When analyzing the results obtained from researchers using the Gibson and Dembo (1984) instrument, Tschannen-Moran et al. (1998) found that high-efficacy teachers were more likely to divide the class into small groups for instruction, rather than instructing the class as a whole. This statement, however, was contrary to the results stated by Gibson and Dembo which stated that low-efficacy teachers spent half their time (50%) in small group instruction, while high-efficacy teachers spent only 28% of their time in small group instruction. Tschannen-Moran et al. also stated in their paper that teacher self-efficacy was a powerful construct related to student outcomes such as achievement, motivation, and student sense of efficacy. The

authors proposed their own integrated model in which they described teacher efficacy as context specific. They suggested some areas for further research which included collective efficacy, which existed as a group process and was related to group performance; changing efficacy beliefs; and the refinement and development of new measures of efficacy.

These studies demonstrated that teacher self-efficacy was an influential construct that affected student academic performance. Additionally, teacher efficacy enabled teachers to perform the behaviors needed to produce the desired outcomes of increased student performance. Teacher efficacy indicated that teacher expectations controlled teachers' persistence in an activity, such as working with technology. Unfortunately, teacher efficacy could be thwarted by doubt. Teachers who doubted their ability to use technology or doubted the value of technology in improving student academic achievement tended to not use technology with their students on either level two or level three.

Computer Efficacy

An assumption expressed by King (2003) was that the effective use of technology was a skill worth developing among school teachers; however, many teachers appeared to resist integrating computers into their curriculum. George and Camarata (1996) stated this was because teachers felt frustrated and incompetent when considering computer integration. The use of technology in education involved change. Change was not an event that occurred in a short period of time; rather, it was a process (Adams, 2003). Hall and Hord (1987) have determined that innovation and change took time and discussed a three-to-five-year implementation timeline for

technology innovations. Although school districts had been implementing technology innovations for more than three to five years, technology was not being integrated into the curriculum with any degree of success in many districts (Bebell et al. 2004). Cuban (1990) stated that one reason educational reform was so slow was because policy makers ignored teachers' beliefs, which were big factors in how and when change occurred in education. Computers have been in most classrooms at least five years; however, computer use was not embraced by all teachers. Was Cuban correct that teachers' beliefs, and thus teacher self-efficacy, have been ignored concerning the use of technology?

Research on computer-efficacy has been a concern in academic areas other than education. A study by Hasan (2003) re-examined the relationship between computer experience and computer self-efficacy, and assessed the influence of eight types of computer experiences—word processing, spreadsheets, databases, operating systems, computer graphics, games, telecommunications, and program languages—on computer self-efficacy beliefs. The participants in his quantitative study were 151 part-time and non-traditional students enrolled in a computer information system course in a four-year college. Participants completed a survey questionnaire during a class session. This questionnaire asked about students' demographic characteristics and their experiences with software packages, operating systems, programming languages, and computer self-efficacy beliefs.

The results of Hasan's (2003) study indicated that experiences with programming and computer graphics applications positively influenced computer self-efficacy. Certainly these computer programs involve higher cognitive thought processes than a teacher would need for using technology in elementary classrooms.

However, this study did have importance to my study because Hasan's results indicated that experience was an important factor in computer self-efficacy.

In another computer self-efficacy study outside the field of education, Compeau and Higgins (1995) developed an instrument to measure computer self-efficacy in Canadian business managers' and professionals' use of computers. They mailed their survey to 2,000 Canadian business managers and professionals of varying computer use, and had 1,020 returned for a return rate of 53.4%. The computer self-efficacy test measured traits such as encouragement by others, others' use, support, computer self-efficacy, outcome expectations, affect, anxiety, and use. Some of their findings suggested that encouragement had an indirect influence on behavior by influencing self-efficacy and outcome expectations.

The Compeau and Higgins' (1995) study discussed the Theory of Reasoned Action: the theory that people in the business world would use computers if they saw positive benefits (outcomes) associated with using them. This theory certainly applied to teachers in the education world—teachers would use technology in teaching if they saw positive outcomes associated with using technology. The authors defined self-efficacy as the belief that an individual had the capability to perform a specific behavior; self-efficacy influenced what decisions about what behaviors to undertake. Thus, self-efficacy was concerned not only with the skills individuals have, but with the judgments of what individuals do with the skills they have. This applied to teachers: it was not the computer skills the teachers possessed, but their judgments about how to use the skills they possessed. Compeau and Higgins found three distinct, but interrelated, dimensions of self-efficacy: magnitude, strength, and

generalizability. The authors defined computer self-efficacy as people's perception of their ability to use a computer to accomplish a specific job or task.

Compeau and Higgins' (1995) study found that self-efficacy played a significant role in shaping people's behaviors. The higher an individual's computer self-efficacy, the more they not only used computers, but enjoyed using them and the lower their anxiety level. The study determined that people used computing technology if the technology could be shown to have positive outcomes. This was certainly true of teachers—there were those who used computers because they believed computers had a positive outcome. The question was, on which level were they using computers for that positive outcome? Compeau and Higgins found a negative influence of technological support on computer self-efficacy and outcome expectations, which was surprising; however, this researcher questioned whether such negative influence would be true in education. The majority of findings in this business world study can be applied to teachers using technology in the classroom. Although this study included the instrument for measuring computer self-efficacy, the instrument was structured for the business world and was not suitable for teachers in the classroom.

Several research studies explored computer self-efficacy in education. Ross, Ertmer, and Johnson (2001) studied how teacher beliefs, practices, and self-efficacy changed in a professional development course on technology integration. The participants in this study were 12 teachers of various grade levels, with bachelors or master degrees, from four private schools in a Midwestern city. The components of this professional development course included peer modeling, peer collaboration, and reflection. This research design was a form of mixed methods research: the

qualitative data were gathered using a case study methodology; the quantitative data were gathered using surveys. The purpose of the qualitative data was to explore and describe teachers' beliefs relating to technology and technology integration. The purpose of the quantitative data was to compare teachers' levels of self-efficacy with actual classroom technology use. By interviewing teachers at the beginning and end of the course, the researchers were able to evaluate the changes in teachers' beliefs, practices, and self-efficacy. The results of this study indicated that some teachers did change their beliefs about technology use, realizing that using technology made their classes more student-centered.

Most of the teachers (five out of seven) in the Ross, Ertmer, et al. (2001) study felt more confident about using technology in their classrooms. Reasons given for the increase in confidence were being willing to ask for support, having more knowledge about technology, being willing to experiment with technology in the classroom, peer support, success with technology in the course, having time to reflect about their use of technology, and hands-on experiences during the course. The teachers did express their concerns about assessment and classroom management when using technology. Overall the professional development course did help most teachers change their computer self-efficacy and their method of teaching, becoming more student-centered. The results of the Ross, Ertmer, et al. study indicated that Ross, Hogaboam-Gray, et al.'s, (2001) statement of changing teacher efficacies was realistic, and contrary to Henson's (2001) conclusion that teacher efficacy was resistant to change in experienced teachers.

The skill versus performance discussion of Hasan (2003) was also found in Ertmer et al. (1994). The purpose of their study was to investigate the effects of

teachers' experiences with computers on teachers' attitudes toward using computers. In this study, 32 undergraduate students enrolled in a summer course called computer applications in physical education, a course designed to introduce teachers to using computers to enhance physical education programs, were randomly assigned to one of three groups: an e-mail treatment group, a word-processing treatment group, or a control group. The students, between the ages of 18 and 33 with 59% male, were fairly inexperienced with computers; 59% indicated they had never or rarely operated a computer before this class.

The students in Hassan's (2003) study were taught in a computer lab in a non-threatening learning environment in which assignments were application-oriented and evaluations were based on a point system. Those in the email section were required to communicate with the instructor via email for the eight week course, while those in the word-processing session communicated by word-processed notes, and the students in the control group communicated by hand-written notes. Students were given a pre-, post-, and delayed test which measured their attitudes toward computers and their perceived self-efficacy for using email and word processing applications. The results of the study indicated that all three groups showed significant increases in computer self-efficacy, even though there were wide differences in the amount of time each group spent on technology.

Ertmer et al. (1994) found that skills were needed before performance was possible; however, without self-efficacy, performance was not attempted. Teachers were capable of operating a computer in that they had the basic skills to do so, but did not attempt to use computers in teaching because they did not have a high self-efficacy for the computer tasks needed in developing lessons using computers. It

was not that teachers needed more training in basic computer skills; they needed changes in their perceived self-efficacy about their abilities to use computers successfully in teaching. One very interesting finding from the authors' study was that time on task was not a critical variable in increasing self-efficacy in computer use. A much more critical variable was quality of computer experiences. The quality of computer experiences may be what influenced Hasan's (2003) results. Programming languages and computer graphics applications involved a much deeper level of experience and understanding than his other six computer experiences. So too, teacher computer efficacy may also be influenced by quality of computer experiences, rather than quantity of computer experiences.

One criticism of educational research studies was that the data collected was self-reported by teachers (Henson, 2001; Pajares, 1997). Levin and Wadmany's (2006) three-year longitudinal study, conducted in one school in grades four through six in Israel, was an example of a study that collected data through teacher observations. Their study explored the evolving of teachers' beliefs in learning, teaching, technology, and their instructional practices. Participants in the study were six teachers selected by the school principal and their 164 students. Their teaching experiences ranged from three to 29 years, and their ages ranged from 26 to 52 years of age. Two of the teachers were studied for two years and four of the teachers were studied for three years. Research tools included structured interviews with teachers; open questionnaires for teachers; and classroom observations.

Levin and Wadmany (2006) found that teachers' educational beliefs strongly influenced their classroom practices, and the strength of that belief was indicated by the teachers' beliefs that they had the ability to perform the desired behavior. Most

studies researching the link between practices and beliefs relied upon surveys and self-reported data from teachers, and few, if any, had examined the effects over time (in a longitudinal study). Levin and Wadmany's research study did both. Their study also found that teachers who spent three years in a technology-rich learning environment changed their educational beliefs and classroom practices. One of the questions this researcher asked the teachers during the teacher interview phase of this research study was how long they had been teaching at that specific Title I school. According to Levin and Wadmany's results, teachers who have been in the school three years or longer should have been using technology frequently on levels two and three, if the authors' findings were accurate. Levin and Wadmany's study concluded that researchers cannot rely on teachers' statements regarding their beliefs and practices because these beliefs may be in a period of transition without the teacher being aware of their emergent beliefs.

In summary, these studies indicated that teachers' computer efficacy was enhanced by experience (Hasan, 2003), and professional development courses on technology integration (Ross, Ertmer, and Johnson, 2001). However, teachers' skill development in technology was needed before teachers' performance was possible, and the quality of instruction in skill development was more important than the quantity of instruction (Ertmer et al., 1994). Information and communication technologies (ICT) have strongly affected all aspects of our society and culture; however, ICT had not been widely integrated into education, especially not with any indication of success in improving student academic achievement (Levin and Wadmany, 2006).

Technology Use

One of the issues discussed by Bebell et al. (2004), Jonassen et al. (2003), Li (2005), Warschauer (2006), Waycott et al. (2005), and Wenglinsky (2006) concerning technology was an attempt to answer the question, how do teachers actually use technology in the classroom? The research study by Ertmer, Addison, Lane, Ross, and Woods (1999) examined teachers' perceptions of the value of using technology in the classroom, and teachers' beliefs concerning effective classroom practices. The authors focused on both the how and the why of teachers' technology use in the classroom. They collected data through surveys, interviews, and observations over a six weeks period of time in seven classrooms for grades kindergarten through second in one urban elementary school. Teachers were given a survey at the beginning of the study that asked them to list their goals for technology use in their classroom, and to define what technology integration meant to them. During observations, data were gathered to substantiate teachers' descriptions on their initial surveys.

The results of Ertmer et al.'s (1999) study indicated teachers' classroom technology use ranged from infrequent to daily, and the purposes ranged from free-time (usually based on rewards), skill-building games, to thematic instruction scheduled for one hour four times a week. The most typical use of computers was as a presentation tool, followed by skill building activities for individual students and the whole class. Four of the teachers did not believe computers played a central role in their curriculum, although they did believe it was important for children to learn to use computers. The other three teachers believed that technology augmented their lessons and provided powerful visuals to help students retain information. (My

question is, why not use television to provide powerful visuals?) The authors noted that technology levels of use varied within this one school, and suggested that many factors influenced teachers' use of technology in the classroom, including teachers' beliefs about technology and their own pedagogical beliefs. This finding contradicted Levin and Wadmany's (2006) finding that teachers who spent three years in a technology-rich learning environment changed their educational beliefs and classroom practices.

Another problem was that too many studies in the past have relied on teachers' self-reported data (Rakes, Fields, and Cox 2006). Teachers' perceptions of how they used computers in their classrooms and what they actually did in their classrooms sometimes differed. They may have believed that they were being constructivists in their pedagogy, but were actually behaviorist. They may have believed that they were implementing technology, when in reality they were spending very little of the school day working with students and technology.

The evolution of technology use in education was the subject of Moersch's (1995) paper. He discussed five distinct problem areas of computer usage in education: staff development was usually insufficient and misdirected; computers tended to be used for isolated activities unrelated to central instructional themes or concepts; computer usage was one step removed from the classroom teacher; technology usage sustained the existing curricula rather than being a catalyst for change; and technology plans failed to establish a link between the need for technology and identifiable instructional priorities. Staff development sessions usually failed to enable teachers to use technology because either the technology did not reflect the instructional level of the teacher or it failed to address fundamental

self-efficacy issues. The author noted the importance of self-efficacy theory in the adoption of innovation.

The author developed the conceptual framework for measuring levels of technology implementation through his Level of Technology Implementation (LoTi). This instrument proposed seven implementation levels of teacher use. Moersch (1995) contended that as teachers progressed from level to level, their instructional methodology changed from teacher-centered to learner-centered. The seven levels were nonuse, awareness, exploration, infusion, integration, expansion, and refinement. I disagree with Moersch's contention that as teachers progress from level to level, their instructional methodology changes. Although the levels of nonuse and awareness were easily defined, the other five levels became entwined and difficult to distinguish. Moreover, the seven levels applied solely to the teacher and did not take into account teachers' relationships to students. It is possible for teachers to be in the expansion and refinement categories for their own use, but still be at level two for student use, and still using a teacher-centered methodology.

Both the Russell, Bebell, O'Dwyer, and O'Connor (2003) and Bebell et al. (2004) studies analyzed data collected from the Use, Support, and Effect of Instructional Technology (USEIT) survey, which was designed to provide information about educational technology usage by teachers and students from 22 school districts in Massachusetts over a three year period. The purpose of Russell et al. (2003) was to determine to what extent technology was used in and out of the classroom for instructional purposes. The authors defined six categories of instructional use of technology: preparation; delivery; directed student use of technology; special education and accommodation; e-mail; and recording grades. Of

the six categories the authors defined, four were classified in level one (preparation, delivery, email, and recording grades). The other two categories (special education and accommodation, and directed student use of technology) would be in either level two or three, depending on whether the emphasis was on learning to use the technology or using the technology to learn.

The purpose of Bebell et al.'s (2004) study was twofold: one, to review the ways technology has been used during the past two decades, and two, to present data demonstrating the feasibility of using multiple measures to determine teachers' technology use. These authors identified seven categories of teacher technology use: preparation, professional email, teacher-directed student use, recording grades, delivering instruction, accommodation, and student products. Of these seven categories, four fit level one (preparation, professional email, recording grades, and delivering instruction). The other three (teacher-directed use, accommodation, and student products) fit either level two or three, depending on teacher objectives. A correlation table of these seven measures indicates little or no correlation among forms of technology use. This finding supported my concept that the three levels of teacher technology use are not sequential, and that it is possible for a teacher to be at level three with student use without having used technology at level one for teacher use.

The Russell et al. (2003) study indicated that teachers tended to use technology more for preparation and communication (level one), and much less for assigning student activities that required the use of technology (level two or three), as did the study by Bebell et al. (2004). Bebell et al.'s analysis of the teachers' responses indicated that teachers' technology use was highest for preparation (a

level one activity) and lowest for student products (a level three activity). The question was no longer was the teacher using technology; the questions should now be how was the teacher using technology, and for what purposes. Bebell et al. summarized their findings by stating that using a single generic measure to measure technology use masked far more than it revealed about teachers' use of technology. To determine how teachers and students were using technology, my study identified three different levels of technology use: one level being used by teachers, and two levels being used by students.

The findings of Bebell et al. (2004) further agreed with Ertmer (2005) that only a small number of teachers used technology for higher order thinking and problem solving skills. New (and usually younger) teachers felt more comfortable using technology than more experienced (and usually older) teachers, and tended to use technology more for preparation (level one). However, the more experienced teachers tended to use technology for delivering instruction (level one) and for assigning student activities that required the use of technology (level two or three) to a greater degree than their less experienced counterparts (Russell et al., 2003). This was a concern that was also expressed by Ma et al. (2006): although younger teachers were more familiar with technology, they used it for entertainment and not for learning. Therefore, they were not integrating technology into the curriculum when they became teachers.

Whereas Russell et al. (2003) and Bebell et al. (2004) studied how teachers used technology, Becker and Ravitz's (1999) study examined computer use as a possible catalyst leading to teachers' increased use of constructivist practices. They sent surveys to 726 teachers and received 441 responses (61% return rate) from

teachers in 151 U.S. elementary schools. The teachers used in this study were part of the National School Network, a loose confederation of more than 100 different organizations playing various roles in developing Internet use in K – 12 schools. The authors' study examined four categories of teacher practices and contrasted constructivist and behaviorist poles: student tasks, curriculum focus, general teaching style, and related perceptions. The authors further studied computers as facilitators of constructivist practices. To measure teachers' computer use, the authors compared four aspects of technology: the teacher's personal computer use (level one); the teacher's assignment of computer activities to their students (levels two and three); the teacher's use of the Internet with their classes (levels two and three); and the teacher's preference of educational software: skill acquisition (level two) or productivity-oriented (level three).

The results of Becker and Ravitz's (1999) study found that teachers' pedagogical practices were not static, but changed based on school climate and teachers' underlying beliefs about what constituted good teaching. The results of the study further indicated that teachers who used computers with their students tended to be constructivist-oriented in their teaching practices. Constructivist theories of learning have been influenced by Dewey, Piaget, and Vygotsky. Constructivism involved student-centered learning, designing activities around teacher and student interests rather than an externally mandated curriculum, focusing instruction on students' understanding of complex ideas rather than definitions and facts, and encouraging students to assess their own understanding. Technology can play an important role in the implementation of constructivist approaches to education. But how can a constructivist methodology be implemented in a classroom with the

requirements of accountability for student academic achievement? My research study focused on this issue.

The study by Rakes et al. (2006) also looked at constructivist practices. The authors compared technology use and skills, and teachers' use of constructivist instructional practices by using the Levels of Technology Implementation (LoTi) instrument developed by Moersch (1995). The authors posed four research questions comparing teacher levels of technology use, current instructional practices, personal computer use, and teachers' scores on LoTi. The researchers also used the Current Instructional Practices (CIP) survey which measured teachers' current classroom practices based on subject-matter versus a learner-based curriculum approach.

The sample for the Rakes et al. (2006) study was 186 fourth and eighth grade teachers from 36 elementary schools, 17 middle schools, and 13 high schools from 11 rural school districts. These 11 districts had received a total of $10,931,503 for technology equipment funded by a Technology Literacy Challenge grant, and about 300 hours of professional development for teachers about a year before the collection of survey data. The teachers responded to the LoTi survey.

One of the findings of interest in Rakes et al. (2006) was that teachers who had strong, basic technology skills were comfortable with computers and with constructivist teaching practices. Another interesting finding was that teachers' beliefs about their ability to use technology and their beliefs regarding technology's effect on student achievement were significant factors in what happened in the classroom. One of the limitations of this study that the authors acknowledged was that all the information gathered was self-reported data—the perceptions of the

participants. The authors suggested a need for further research on the link between teachers' technology use and classroom instructional practices. My study provided data about teachers' technology use and classroom instructional practices based on observations of teachers in a Title I high achieving school.

My research study focused on elementary school teachers because that was my area of interest and expertise. Franklin (2007) studied elementary teachers' computer use in the classroom in a quantitative study. The purpose of her study was an examination of the various ways elementary school teachers used technology, specifically for instructional purposes, and the factors influencing their technology use. The population for her study was 100 elementary teachers who graduated from a mid-Atlantic university within the last three years prior to the study. The data were gathered from a survey instrument which addressed four factors supporting teacher's technology use: 1) access and availability of computers; 2) teacher preparation and training; 3) leadership within the school; and 4) time.

The results of Franklin's (2007) study indicated teacher preparation, teacher philosophy, and grade level taught were factors in how elementary teachers used computers in their classrooms. Nearly 77% of the teachers indicated that their educational philosophies—which were aligned with constructivism—were a factor in their computer classroom use. Teachers of primary students (K-3) tended to use computers for skill building activities while teachers of older students tended to spend more time using word processing software.

Although this mid-Atlantic university from which the teachers graduated had won numerous awards for preparing teachers to teach with technology in innovative and creative ways, the teachers did not appear to use those skills consistently once

they began teaching in their own classrooms. Three major reasons given by the teachers for their lack of student use of technology were too much curriculum to cover, a lack of time in their daily schedule, and the emphasis on high-stakes testing. Nevertheless, teacher preparation and a constructivist philosophy were factors indicating high level computer use in elementary classrooms. One limitation to this study, as in Rakes et al. (2006), was that the information was self-reported. Again, my study gathered data through teacher observations, rather than self-reported data. Also, the school I selected was a high achieving school that meant the teachers were integrating technology while successfully managing the requirements of high-stakes testing.

The on-going study conducted by Radlick, Stefl-Mabry, and Theroux (2006) measured real-time computer usage in two school districts based on teacher web survey data, focus group interview data, and direct observation data. Although the study was being conducted in two K – 12 school districts, the authors' focus was on grades 6-12 for their study. The first district had a student population of 2,500 with more than 30% of the students on free and reduced lunch. The district was classified as "High Need Rural District." The population of the second district was 3,000 students of which 4% were on free and reduced lunch. This district was classified as "Low Student Needs in Relation to District Resource Capacity." The two districts were of opposing socio-economic status (SES). The teachers in these two districts provided data to the researchers through teacher surveys; the students provided data through web surveys developed by the researchers. The researchers retrieved student and teacher computer use information through a ClassLink system which allowed them to keep track of usage both in and outside of school. The authors also observed

teachers teaching and used an observational rubric to record when computers and other technology were being used by the teachers and by the students. In my study, I observed how teachers and students were using computers (based on the three levels), not just when or how much they were using them.

Radlick et al. (2006) stated that the *belief* about the amount of technology used in schools today may not reconcile with the *reality* of computer use. Based on this statement, the study posed three questions: 1) what was the extent of time computers were perceived to be used in the classroom, and what was the extent they were actually used? 2) What was the extent of time computers were used outside of school for school related purposes? 3) How did computer usage data compare among groups based on grade level, SES, gender, and student self-reported computer skill levels?

Results of the Radlick et al. (2006) study indicated that most students felt they used computers too little in their classes. Factors influencing the amount and type of computer usage were the locations and accessibility of computers at school. When teachers had fewer computers in the classroom, they tended to use computers less in their instruction. Teachers tended to use computers on a regular basis to support their own professional work (level one) and less frequently for presentations of material to their classes (level one). Students used computers even less frequently for class projects (levels two or three). Teacher observations supported these conclusions. The authors found that the actual use of computers reflected only a small portion of the total school day, that the usage was overall usage and did not distinguish types of usage, and that the small amount of time devoted to computer usage was disheartening. This lack of implementation could well be one reason

researchers do not see computer usage impacting student academic achievement. Mills and Ragan's (2000) assessment concerning Integrated Learning Systems held true for all technology: unless the technology was implemented with fidelity, it was not possible to reasonably determine the quality of the technology instruction and its effectiveness for learning.

Technology Integration in At-Risk Schools

Technology integration was a focus in the success of one of Ohio's lowest-performing elementary schools in an economically depressed community. The school's four criteria for technology integration were described by Eaton (2005). The first criterion was the incorporation of standards. The software needed to do more than provide correlation documentation that explained how the program related to state standards. The software must have standards language built into the software program, allowing teachers to go directly from a specific reading standard to tutorials and assessments that directly supported that specific standard. Curriculum alignment was the second criterion. Eaton's school was using the Four-Blocks Literacy Model and required the technology component to support each of the four elements of this model. The third criterion was that the technology be whole-class instruction, useable in the classroom, not just in the computer lab. The teachers wanted technology that furthered student interaction, not isolated them in front of a monitor wearing headsets. The last criterion was adaptive, engaging content software that responded to the needs of every learner, especially the at-risk students.

The district invested in hardware such as projectors, laptops for teachers, and interactive whiteboards in each classroom. Additionally, all teachers were trained by grade level to use the technology purchased by the school and the district. The

administration of the school took courses to become instructional leaders in technology. Teachers who once feared technology were now using it at level one (e-mail, presentation tools, and personal web pages), level two (student skill building activities), and level three (extended projects). Although not delineated in Eaton's (2005) study, teachers' computer self-efficacy was changed for the better by the courses of action undertaken by the school. As Bandura (1983) noted, if teachers believed that they could exercise control over events they feared, they could overcome their own fear of such events. Teachers in this Ohio school were able to overcome their fear of using technology.

The third grade in this low performing, at-risk school raised their reading score on the Ohio state reading test by 124 percent in one year (Eaton, 2005). This was an example of an at-risk school integrating technology successfully. My study analyzed the components of an at-risk school that was high-achieving.

Another example of successful integration of technology with at-risk students was found in the Constructionist Learning Laboratory (CLL) at the Main Youth Center (MYC) for adjudicated youth, ages 11-21 (Stager, 2001). The students within this program were regarded as learning disabled, having poor literacy levels, and displaying low student motivation in traditional schools. However, in CLL, they were successful--many of them for the first times in their lives. The CLL secondary school was multi-aged, self-contained, interdisciplinary, computer-rich, and learner-centered. Although this study focused on secondary school-age students, it was important to my study because it successfully combined technology, constructivism, and at-risk students.

In CLL each student had a personal computer and access to various materials. The students used the computer as a medium for constructing new things, and for keeping track of their own progress. The computer was an intellectual laboratory as well as a vehicle for self expression. Students were expected to construct knowledge by engaging in personal and collaborative learning projects, which usually resulted in student artifacts. In addition, CLL used no bell schedule, no tests, and no artificially segregated subject-area classes. Students made their own connections between disciplines by working on in-depth, personally meaningful projects, and working without interruptions. There was a full-time teacher and special projects leader working with students on a daily basis. Volunteers and experts were brought in on an occasional basis to lead week-long intensive workshops. Students were encouraged to provide visitors with impromptu demonstrations of the students' projects (Stager, 2001).

The success of the CLL secondary school after its first year was evident in student inventions. These at-risk, learning disabled, unmotivated students invented a conveyor belt system to route baggage at an airport; robotic arms; machines to play the xylophone; digital gingerbread houses complete with twinkling lights and programmed carols; and a miniature vehicle capable of climbing a 110 degree incline. In addition, they built handcrafted classical guitars, complete with wood inlays; ultra-light airplanes that could fly for minutes unpowered; and handmade telescopes. The hope was that, once released, these students would understand the world around them, live happily in that world, and make important contributions to the world of ideas (Stager, 2001).

Although many researchers used the term teacher beliefs, the term as they used it frequently referred to teacher efficacy. Teacher efficacy affected student academic achievement—teachers who believed they could teach all students generally did, while those who had doubts about teaching all students generally did not reach all students. Teacher efficacy can be applied to technology use. The teacher who believed technology could positively affect student academic outcomes used technology effectively—possibly at level three.

Computer efficacy in education involved teachers' perceptions of their ability to use computers to accomplish specific tasks in the classroom. Technology use in the classroom as a construct was difficult to measure because the term "technology use" was nebulous. Teachers who used technology successfully tended to be constructivists, i. e., designing activities that were student-centered, to focus instruction on students' understanding of complex ideas, and encourage students to assess their own understanding. My study analyzed how teachers used computers in teaching, and how they integrated technology into their curriculum. My study attempted to make "technology use" less nebulous and more precise by providing strategies to determine how teachers were using technology through the use of the three-level concept.

ISTE Standards

The National Educational Technology Standards for Students, developed by the International Society for Technology in Education (ISTE), described the ideal standards school districts and schools should be attempting to implement in their classrooms. These standards, comprised of six strands, were printed here with permission from ISTE.

The International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS•S) and Performance Indicators for Students:

1. Creativity and Innovation - Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:
   a. apply existing knowledge to generate new ideas, products, or processes.
   b. create original works as a means of personal or group expression.
   c. use models and simulations to explore complex systems and issues.
   d. identify trends and forecast possibilities.
2. Communication and Collaboration - Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:
   a. interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
   b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.
   c. develop cultural understanding and global awareness by engaging with learners of other cultures.
   d. contribute to project teams to produce original works or solve problems.
3. Research and Information Fluency - Students apply digital tools to gather, evaluate, and use information. Students:
   a. plan strategies to guide inquiry.
   b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
   c. evaluate and select information sources and digital tools based on the appropriateness to specific tasks.
   d. process data and report results.
1. Critical Thinking, Problem Solving, and Decision Making - Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:
   a. identify and define authentic problems and significant questions for investigation.
   b. plan and manage activities to develop a solution or complete a project.
   c. collect and analyze data to identify solutions and/or make informed decisions.
   d. use multiple processes and diverse perspectives to explore alternative solutions.
2. Digital Citizenship - Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:

a. advocate and practice safe, legal, and responsible use of information and technology.
b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.
c. demonstrate personal responsibility for lifelong learning.
d. exhibit leadership for digital citizenship.

3. Technology Operations and Concepts - Students demonstrate a sound understanding of technology concepts, systems, and operations. Students:
   a. understand and use technology systems.
   b. select and use applications effectively and productively.
   c. troubleshoot systems and applications.
   d. transfer current knowledge to learning of new technologies.

The ISTE standards listed above emphasize technology integration at level three. Within the six strands of these standards, students are required to use technology as a tool to learn. These standards require students to move beyond knowledge in Bloom's Taxonomy, and focus on comprehension, application, analysis, synthesis, and evaluation. For example, under standard one, Creativity and Innovation, students are required to "apply existing knowledge to generate new ideas," "create original works," "explore complex systems"—all level three activities.

Section two, Communication and Collaboration, requires students to "interact, collaborate, and publish with peers," activities that require student-centered learning activities. Even section six, Technology Operations and Concepts, requires students to understand the technology systems they are using and be able to select and use the appropriate software application effectively.

During the last decade, the ISTE standards have progressed from level two, learning to use technology, to level three, using technology to learn. Unfortunately, it appears that many schools and school districts have not yet followed that same

progression. The literature review contains a number of studies that support the direction of my study.

CHAPTER 3

METHODOLOGY

Implementation

The purpose of this study was to determine how technology was integrated into the curriculum of a Title I, high achieving, K - 5 elementary school in a large school district in the Southwestern United States. The three questions guiding this research study were:

1. How did teachers integrate technology and curriculum in a Title I, high achieving elementary school?
2. How did that integration translate into the classrooms of this Title I, high achieving school?
3. What existed in the school environment that promoted the integration of technology into the curriculum?

Using an exploratory case study design, my study identified and described how teachers of at-risk students effectively integrated technology by utilizing a three-tier level system I developed. Creswell and Clark (2007) described the exploratory method as useful when a researcher needs to explore a phenomenon or test an emergent theory or classification, such as the three-tier system I developed. Marshall and Rossman (1999) described the purpose of an exploratory study as identifying or discovering important categories of meaning. Yin (2003) described the aim of an

exploratory case study as defining the questions and hypotheses of subsequent studies.

Merriam and Associates (2002) defined a case study as being bounded by a system, such as space (a particular place, such as an elementary school), and being purposefully selected, rather than randomly selected. My case study was about a single organization—a Title I, high achieving elementary school—that was purposefully selected. The units of analysis within the organization were six volunteer K – 4 teachers in the school. Thus, this study was an exploratory case study, which identified and described how the teachers integrated technology, using my three-tier system, in a Title I elementary school that was successful in technology integration across the curriculum and in meeting the criteria for student achievement. Case studies that drill down to address these issues help us understand how these goals are not mutually exclusive. This may help other schools seeking to accomplish similar goals.

The research for my study took place in a Title I, high-achieving elementary school that was highly technically integrated (i.e., the teachers used technology effectively with their students on a regular basis). Prior to beginning the research, I determined the school by first examining school district documents such as district vacancy announcements to determine which schools were Title I schools. I had access to these documents because I was a technology coordinator with the school district. Next I reviewed the state web site http://www.doe.nv.gov/accountability/ayp/ayp_2006_07.html to determine which Title I schools were High Achieving. I met with School District personnel (a Project Facilitator for Technology; the Coordinator IV, Instructional Technology and Innovative

Programs; and the Assistant Superintendent for Curriculum and Professional Development) to identify which school all of them thought integrated technology into the curriculum. I then met with the principal of the school to explain my study and requested and received permission to conduct my study in her school.

Once I determined my school of study, completed the required paperwork, and received permission from the principal to proceed, I met with the teachers during a staff development day, explained my study, and asked for volunteers. Eight teachers volunteered, seven classroom teachers (Kindergarten, first, second, third, two fourth, and fifth) and the English Language Learner (ELL) teacher, although the fifth grade teacher and the ELL teacher later dropped out before any data were gathered.

The teachers signed their consent forms, filled out the Teachers' Technology Use screening tool (Appendix B) and the Computer Efficacy for Teachers screening tool (Appendix C) during the next few weeks. I first interviewed the teachers with the structured interview questions, and then observed them either two or three different times teaching lessons in which they used technology, using the Observation Form at Appendix D. After observing the teachers a second or third time, I reviewed their lesson plans to look for evidence of technology integration and analyzed the objectives and goals of using technology. I then met with them individually for the informal, unstructured interview. All interviews were taped with the interviewees' permission. I also interviewed the technology coordinator, the librarian, the principal, and the assistant principal, and observed the librarian once.

Site of Research

The site for my research was a purposefully selected Title I, high achieving elementary school in a large school district in the southwestern United States. This school was a highly integrated technology school based on the criteria listed previously. The school was recommended by three higher-level administrators.

Participants and Selection

The participants were six K - 4 classroom teachers within the school who volunteered to take part in the study. All six teachers indicated through the Teachers' Technology Use screening instrument that they used technology on a regular basis. The results of their Computer Efficacy for Teachers Screening Tool indicated they felt comfortable with technology and believed in using technology with their students.

To protect identities, teachers were identified through the last four digits of their school identification number. Although I needed to know the names and numbers for each teacher for the observations, interviews, and lesson plan review, after I gathered my data, they were identified only by their individual numbers. I had a master list while collecting data in the event I needed to return to a teacher for clarification of information. However, this master list will be destroyed by shredding after the three year limitation.

Researcher Role

My role as researcher during the observations was that of a participant observer engaging in moderate participation. Spradley (1980) described moderate participation as maintaining a balance between being an "insider" and "outsider" (p. 60). As a technology coordinator in the school district, I was an "insider" to the overall culture of the school district. However, not being a staff member of the school

in which I did my research, I was an "outsider" to the culture of that specific school. Based on the participant-observation continuum described by Glesne (1999), I leaned toward observer as participant, in that I was primarily an observer, observing from the back of the classroom, but I had some interaction with the teachers as I observed them when they occasionally discussed with me what they were doing and why. I was immersed in the setting and therefore able to hear, see, and experience the reality of the classroom as the teachers did. I spent a considerable amount of time at the school, and was therefore able to learn from my own observations of the settings (Marshall and Rossman, 1999).

When interviewing teachers for the first time, before observing them, I used a highly structured, standardized form of interviews, with the questions and order predetermined (Merriam, 1998). I wanted to be certain to ask all the teachers the same questions, and therefore used the standardized format. After the observations, I conducted informal, unstructured interviews, asking teachers about events that occurred during the observed lesson, and asked them if there was any other information they wanted to share with me. With the teachers' permission, I tape recorded the interviews with an MP3 player, which was small enough to prevent posing a distraction during the interview.

Risks and Benefits

To protect my participants from risks, I met with the principal of the school before conducting research to establish rapport, and to be certain of no repercussions for teachers who chose to participate in my study and those who did not. The risks to teachers were minimal, although some internal ramifications of

teachers analyzing and doubting their self-efficacy, their methodology, or their technology integration could have been realized.

The benefits to the participants were limited, although some internal enlightenment of teachers understanding their own computer efficacy and pedagogy could be established. The benefit to the educational community was a better understanding of how and why teachers who effectively integrate technology into the curriculum were using technology with at-risk students.

Data Collection Methods

This research was conducted using an exploratory case study design. In my study, the six teachers together were considered one unit of analysis and the data were used to answer research question one, defining technology integration, and research question two, examining the implementation of the technology integration. The second unit of analysis was the school as a whole, and this entity was analyzed to answer research question three, which related to the support and constraints of the school environment.

I gathered qualitative data through observations of the six teachers and the librarian; formal, structured, and informal, unstructured interviews with the teachers, principal, assistant principal, technology coordinator, and librarian; and document reviews of teacher lesson plans, the school's accountability report, and the schools' technology plan. The time spent in classroom observations ranged from one hour, 30 minutes to two hours, 40 minutes per classroom. The variation in time occurred due to classroom schedules involving teacher preparation periods and lunch times. I

developed an Observation Form (Appendix E), which helped me categorize the level at which the teacher being observed was using technology to include computers.

With the individuals' permission, I audio-taped all interviews for aiding in the transcription of the interviews. Potential interview questions and the rationale for asking them were located at Appendix F, and the research questions in the format I used were at Appendix G. When reviewing teachers' lesson plans, when available, I focused on the objectives of the teachers' lessons.

Trustworthiness of Data

The quality of a research design was based on construct validity, internal validity, external validity, and reliability. To meet the test of construct validity in a case study, the researcher must cover two steps. First, the researcher must not only select the specific components to be studied, but also must relate these components to the original objectives of the study. Second, the researcher must demonstrate that the selected measures used to measure these components actually measure the selected components (Yin, 2003).

Internal validity asks was the researcher measuring what she thought she was measuring? Internal validity was controlled by methodological triangulation, or the use of multiple sources of data (Merriam and Associates, 2002). In my exploratory case study I used multiple data sources of classroom observations, teacher interview, and document analysis in the form of lesson plans, the technology plan, and the school accountability plan.

External validity had stimulated considerable discussion and debate in qualitative research. Quantitative research defined external validity in terms of generalizability. However, qualitative research uses small, non-random, purposefully

selected samples because the researcher was attempting to understand the particular situation in depth, and not to determine what was true of the many. Therefore, results from qualitative research were not generalizable to other populations (Merriam and Associates, 2002). Yin (2003), however, described external validity in qualitative research as analytical generalization, in which the researcher generalized the results of a case study to a broader theory.

Reliability referred to the ability of the study to be repeated with the same results (Merriam, 1998). Replication of a qualitative research study may be difficult because of the inconsistency of human behavior. Merriam and Associates (2002) suggested a better question to ask when considering reliability was, were the results consistent with the data collected; did the results make sense. Yin (2003) suggested that the goal of reliability was to minimize biases and errors in a research study.

Ethical and Political Considerations

Possible political considerations involved the administration and teachers. It was critical that I develop a rapport with the administrators to be certain they understood I was not providing feedback to them on any particular teacher. It was also critical that I develop a rapport with the teachers so that they understood I was not reporting any information to their administrators, and the purpose of my study was not to judge or evaluate their teaching. This understanding among the administrators, the teachers, and the researcher was crucial for the trustworthiness of the study.

Descriptive Narrative

In what follows I set the context for the case study at the school by introducing the reader to the setting and to the participants. I first met with the entire teaching staff at a staff development day in November. The principal gave me permission to explain my dissertation study to the teachers and ask for volunteers, but stated the teachers would not have time to fill out the consent form, the Teachers' Technology Use Screening Tool, and the Computer Efficacy for Teachers Screening Tool during the staff development day. Anxiously I waited my turn to speak. Finally, an hour after the meeting began, I was able to address the teachers, explain my study and request volunteers. Over the course of the next five minutes, eight teachers volunteered to work with me. I was elated as I wrote down their names and identifying codes. One teacher even took time to fill out the needed forms.

Later that same week I sent each teacher a consent form, the Teachers' Technology Use and the Computer Efficacy for Teachers Screening Tools, instructing them to fill out the forms and mail them back to me through the school district mail system. Then I waited. One set of papers came back early the next week, and then one more. But that was all. At the beginning of the third week, I emailed the teachers, asking them to please fill out the forms and return them to me. Two more sets of forms came back—I was now at the half-way mark.

As December approached, I decided to email the teachers to set up the first interviews, and collect the forms from the remaining four at that time. Frequent emails followed over the course of two weeks, and I was finally able to set up seven of eight interviews on Thursday, December 18. Finding a day when all teachers were present and willing to spend time with me before or after school, or during their

preparation periods was no easy task. But all were available on December 18, and the interview times were set.

Wednesday, December 17, was Parent-Teacher conferences at elementary schools, and my schedule was flexible. A technology coordinator whom I had mentored called me around 11:00 AM and asked if she could take me to lunch as a thank you. Not one to forgo a free meal, I accepted, and we agreed to meet at a near-by restaurant at noon. The day was unusually cold for the southwest, and during lunch we laughed as we saw first one, then a second snow flake. By the time we left the restaurant at 1:00, it was snowing. My ten-minute drive back to school took 20 minutes, as the snow began sticking to the streets. Outside my school, three young teachers—all native to the state—were standing in front of the building, catching snowflakes on their tongues. They had never seen snow before! As a native of the Midwest, I had had my fill of snow long ago.

By 3:00 the snow was building up, so I decided to leave school for home. My 20 minute commute took almost 45 minutes on the snow covered roads. Once home, I commenced the final preparations for my interviews. At the end of the 6:00 PM news the announcer informed us that the superintendent had declared all schools in the district closed tomorrow, Thursday, December 18, due to snow. The last time school was closed in this district due to snow was in 1979—29 years ago—and this closing now came on the day I was scheduled to interview seven of my eight teachers!

I promptly emailed all eight teachers that I would reschedule interviews in January. However, in January two teachers withdrew from my study. The remaining six agreed to our new day, and my interviews finally began in January.

The Teacher Interviews

As I stood in the school parking lot on that brisk January morning, waiting for my 6:45 AM teacher to interview, I watched the sky begin to glow over the distant mountains. The neighborhood was quiet, with only an occasional car traveling slowly along the residential street paralleling the school. The neighborhood surrounding the school consisted of small, older homes, some of which were in disrepair, while others showed pride of ownership. Across the school's parking lot was the playing field of a church school—quiet in the cold morning air. Although the snow was gone, the cold weather was not.

The school of my research study, built in 1959, was an outdoor school, which meant all the classrooms opened to the outdoors with no internal hallways in classroom buildings. The school campus consisted of five classroom buildings, an administrative building, a multi-purpose building, a teachers' workroom building, and 11 portable classroom buildings. Although the school was nearly 50 years old and had not been remodeled, the buildings were well maintained. I noticed very little litter on school grounds; the areas between buildings were landscaped with young trees, while the area in front and around the administration building was landscaped with grass and large, older trees. A health care facility in a portable building stood off to the side of the school grounds.

At 6:45 AM a car pulled into the parking lot, parking near me as I waited. A teacher jumped out of the car and immediately opened her trunk. This was not the teacher I was to interview, but I approached her nonetheless, asking about the teacher for whom I waited. The teacher, with a box of school supplies in hand, assured me the teacher I needed would be here soon, unlocked the gate for both of

us to enter the school grounds, and invited me to wait in her classroom out of the cold morning air. I thanked her, but decided to wait in front of the teacher's door, so I would not miss her when she arrived.

At 7:00 AM, my 6:45 teacher had not yet appeared. Thinking that perhaps she had called in sick that morning and was not coming to school, I walked across the school grounds to the portable classrooms, to meet with my 7:00 interviewee. Her classroom door was unlocked, but she was not there. I waited on the steps of her portable classroom for a minute or two, trying to decide what to do next. This was certainly not going well, I thought—my first two appointments were no shows. Perhaps my 6:45 teacher had arrived after all. I walked back across the open blacktop area and approached the building that housed the classroom of my first appointment. Near the building I saw two teachers waving to me—the first teacher I had encountered, and the teacher I was to interview at 6:45.

"I'm so sorry!" she called out to me. "I forgot about our appointment, and stopped for coffee along the way." We walked into her cheery, warm classroom, and, after she made sure I was comfortable, our interview began.

The interview I thought would take ten or 15 minutes actually took 25. That was wonderful, but I had a 7:00 AM interviewee out there somewhere, on school grounds, I hoped. At the conclusion of the first interview, I hurried back to the classroom of my 7:00 interviewee, some 25 minutes late. Once again her door was unlocked, but once again she was not there. I waited on her doorstep, and at 7:30 saw her walking toward me.

"Can I help you?" she called out.

"Yes." I responded. "We had an interview scheduled for this morning."

"Oh no! I completely forgot," she gasped. "We can talk now if you like, but I need to sit out here at the table because I have duty right now."

That was fine with me, I told her. We sat down at a picnic table near the playground area where the teacher could observe the students as we talked. My second interview had begun—things were looking up.

The third teacher met me in the teachers' work area, also known affectionately as the teachers' lounge, perhaps because there was an old couch among the tables, chairs, copy machines, and assorted work equipment. Our interview went smoothly, even with the noise of chatter and laughter from others in the room.

The interviews with teachers four, five, and six went efficiently, each in their respective classrooms. I was impressed with the graciousness of every teacher I interviewed, and looked forward to beginning my observations and learning more about this school as a high-achieving, technology integrating school.

The Students

This high-achieving technology integrating elementary school enrolled 815 students in the 2007-2008 school year. Of those 815, 87.9% of the students were Hispanic; whites encompassed 6.6% of the student population, and African Americans comprised 3.3% of the student population. All 815 students were on the free or reduced lunch (FRL) program. Students who were of Limited English Proficiency (LEP) comprised 69.2% of the school population. From these demographics one can determine that this Title 1 school had a lower SES and was primarily Hispanic, a majority of which had Limited English Proficiency. Although

almost one-third of the student population was transient—32.3%–the school's transient rate was below that of the district (34.7%).

Another statistic of interest regarding this Title 1 school was the average daily attendance as compared to the district and state. The school's average daily attendance of 95.7% was slightly higher than both the district and the state, which stood at 94.2% each. The ethnic group with the highest attendance rate was the Asian/Pacific Islander population: 96.9%. The second highest ethnic group was Hispanic with a 95.9% attendance rate. The attendance rate for both of these ethnic groups was higher than the district average.

The student to teacher ratio was higher than that of the district for Kindergarten, first, and third grades. Second and fifth grades were the same ratio as the district, while fourth grade was lower than the average district ratio. School expenditure per pupil ($9,736.46) was higher at this school than the district average ($6,913.14). However, a comparison of six additional Title 1 schools within the district revealed that this school's per pupil expenditure was in the middle of the seven schools: lower than three of the schools and higher than three of the schools. The information for the demographics was found in the 2007-2008 school accountability report.

The School Staff

The teaching staff consisted of one pre-kindergarten class, five kindergarten classes, seven first grade classes, eight second grade classes, seven third grade classes, five fourth grade classes, and four fifth grade classes. Additionally, there were five Autism classes and four Severely Learning Disabled (SLD) classes. Of the

46 teachers, 87% were deemed highly qualified by state standards compared to 86% for the total district.

The Members of My Study

Six teachers from grades kindergarten through fourth grade took part in this study (pseudonyms): Allison, the kindergarten teacher; first grade teacher, Beverly; second grade teacher, Clay; Darlene, the third grade teacher; fourth grade teacher, Emily; and Frank, another fourth grade teacher. Teachers ranged in age from 25 to 61, their teaching experience ranged from two to eleven years, and their years of teaching in this school ranged from two to nine years, as did their years of using computers. Four of the six had careers prior to teaching, and all were using computers before they began their teaching careers. All used computers at home.

Figure 4: Teachers' Summary Chart

Teacher	Grade	Gender	Age	Yrs Teaching	Yrs at School	Previous Career
Allison	K	F	61	9	9	Yes
Beverly	1	F	49	9	7	Yes
Clay	2	M	48	11	9	Yes
Darlene	3	F	24	3	3	No
Emily	4	F	27	4	4	No
Frank	4	M	25	2	2	Yes

Data Analysis

I prepared the data for analysis by first typing up my observations field notes and transcribing the interviews. I then explored the data by reading through all the observations and transcribed data to develop a general understanding of the data,

and developed codes to be used in the database. This was phenomenological reduction (Merriam and Associates, 2002). I then read through the accountability and technology plans, looking for ways they agreed or disagreed with my observation notes and interview transcripts.

The data analysis involved content analysis from the teacher observations both individually (paradigmatic reduction, Merriam and Associates, 2002), and as a group (syntagmatic reduction, Merriam and Associates). In the individual analysis, I compared teachers' responses to their two screening tools, their interview transcripts, and my typed notes of the observations. I looked for consistencies and inconsistencies in teachers' words (interviews and screening tools) and actions (observations), and color coded words and phrases.

In the group analysis I studied teachers' responses to questions to determine how they coincided or diverged. I looked for themes, categories, and patterns across teacher responses. I analyzed the data both of individuals (paradigmatic reduction, Merriam and Associates, 2002), and across teachers' responses (syntagmatic reduction, Merriam and Associates), again looking for themes, categories, and patterns, color coding patterns as I discerned them. I looked for themes, categories, and patterns, while noting whether the themes, categories, and patterns that I identified in the observations were the same in the interviews. I also reviewed the school's technology plan and school accountability plan to find consistencies (or inconsistencies) between the school's plan for the use of technology and the teachers' actual use of technology.

I represented the data through a discussion of the themes or categories I identified, using specific examples from the observations, specific quotes from the

interviews, and specific information from the document review. I presented this information for each teacher, and compared the teachers, using visuals where appropriate in addition to the text. I triangulated the data and was able to build evidence for themes from several sources including: observations, interviews, and screening tools.

Once I organized and analyzed the data, I examined the six teachers' interview responses and observation notes in relation to research question one (how did teachers integrate technology and curriculum) and question two (how did that integration translate into the classrooms).

The analysis of question three (what existed in the school environment that promoted the integration of technology into the curriculum) was described within the context of the school as a whole entity.

Further analysis resulted in a thematic interpretation of the results. Included in the discussion of the definition of technology integration were the teachers' goals for using technology in their classrooms, and their perspectives of the advantages and disadvantages of student technology use at school.

CHAPTER 4

FINDINGS OF THE STUDY

In this chapter I offer the results of the data analysis for the individual teachers, which answered questions one and two, and for the school as a whole entity, which answered question three. Next, I explained the themes identified in my study, and, last, I presented my findings. Throughout the chapter I referenced studies from the related literature review to establish how my study either substantiated the results of those studies or contradicted the results.

Summary of Teacher Findings

I originally designed the Computer Efficacy and the Teachers' Technology Use Screening Tools to be given to several teachers to complete. From these two screening tools, I planned to choose five to seven teachers to include in my study, based on the teachers' answers to the questions. However, the principal of the school would not allow me the time to have teachers complete these forms. I was only permitted to take names and grade levels of volunteers. The screening tools were not validated, as I did not intend to use them statistically due to the small sampling of teachers used in this exploratory case study. The purpose of using these instruments was to give me an idea of what teachers thought about using computers in school, and how they perceived themselves as using computers. Statistical

analysis using such tools was beyond the scope of this study, but could be considered for future research.

The Computer Efficacy for Teachers explored teachers' beliefs (or convictions) that they could successfully execute behaviors required to produce desired outcomes; that the teachers were capable of directing their students to use computers to enhance student academic achievement. This screening tool consisted of 20 questions, and employed a four-point Likert scale from strongly agrees to strongly disagrees, with no neutral position, for a total of 80 points. The questions were designed in both negative and positive statements to force teachers to read each statement, preventing them from answering all statements by going down one column, and from taking a neutral position in any statement. However, items one, four, six, seven, eight, 11, 13, 14, 16, and 18 needed to be reverse coded.

The Teacher Computer Use Screening Tool explored teachers' perceptions about how much and in what ways they were using computers, both in their professional life and in their classroom. This tool requested teachers indicate how often they used computers for specific purposes by use of a five-point Likert scale, with one being never and five being daily.

This screening tool was composed of 30 questions; ten on each of the three levels, totaling 50 points per level. The questions were intermingled so that teachers would not discern a pattern to them. I also included an open-ended question at the end asking teachers in what other ways they used technology at school.

Figure 5: Teachers' Comparison Chart

Teacher	Grade	Gender	Age	Yrs Teaching	Yrs at School	Previous Career	Computer Efficacy Score	Teachers Technology Use Score Levels (50 points per level)			Levels Based on Interviews (What I expected to see) Levels			Levels of Use Observed (What I Saw) Levels		
							80	1	2	3	1	2	3	1	2	3
Allison	K	F	61	9	9	Y	66	29	22	15	X	X		X	X	
Beverly	1	F	49	9	7	Y	70	36	19	10	X	X		X		
Clay	2	M	48	11	9	Y	79	40	27	19	X	X		X	X	
Darlene	3	F	24	3	3	N	69	39	25	23	X	X	X	X	X	X
Emily	4	F	27	4	4	N	77	39	27	20	X	X	X	X	X	X
Frank	4	M	25	2	2	Y	76	33	25	23	X	X	X	X	X	

Scores from the Computer Efficacy Screening Tool ranged from 66 to 79 out of 80. Allison's Computer Efficacy Score of 66 indicated to me that she felt fairly comfortable using computers, that she used computers to make her job easier, and that she felt fairly capable of successfully executing behaviors in technology that were required to produce the desired learning outcomes in her students. However, she did not perceive herself to be as effective as the other five teachers who scored higher than she did. Clay, in fact, with a score of 79, out of a possible 80, perceived himself to be the most comfortable, confident, and effective of all six teachers when using computers for his administrative duties and when using technology in his teaching.

The Teachers' Technology Use Screening Tool indicated all teachers used technology at level one the most, followed by level two, then level three. Allison indicated she used technology weekly to analyze data from tests to see how her students were doing and identify where they were having difficulty. A comment on Beverly's Teacher Technology Use Screening Tool was that her students "were only first graders." It was uncertain whether her comment emanated from low expectations, and, if so, if these low expectations resulted from the students' youth or their lower SES.

Based on the screening tools and interviews, I expected to see level one and two use in the classrooms of Allison, Beverly, and Clay, and level one, two, and three use by Darlene, Emily, and Frank. What I observed was level one use by all six teachers, level two use by five teachers, and level three use by two teachers. (See Appendices K-M for a more descriptive interpretation of the interview and observation data.)

There were two interesting anomalies that I discovered. First was the situation with the first grade teacher, Beverly. She was considered the "technology guru" by the other teachers, and frequently helped them figure out how technology worked. From her interviews, in which she indicated her students used technology about 20 minutes a day, I expected to see her use level two with her students for skill building activities. However, I did not observe any use beyond level one, presentations.

Beverly also noted her students were exposed to technology when she used the ELMO and Smartboard throughout the day. However, by the second interview she had removed the Smartboard from her room because its placement blocked her view of the door, and the setup required wires running on the floor in the front of the room where some of her students sat. I did not understand why she did not move the Smartboard to another location within her room.

During three observation periods, I observed Beverly using only level one technology for math and reading, but that level one use was very effective. She stopped frequently during presentations to ask students questions, and the students responded with enthusiasm.

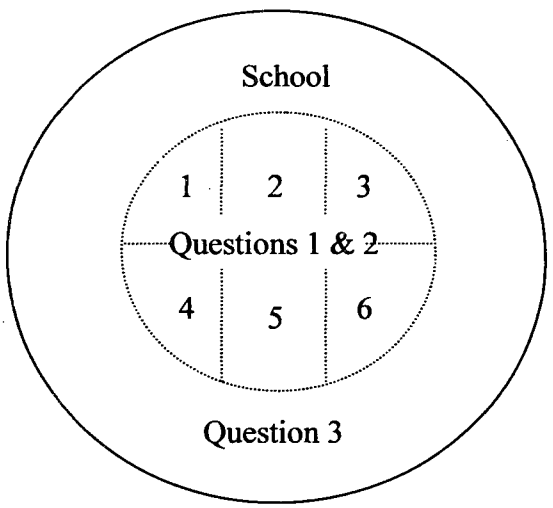
Upon entering her room one morning, just seven minutes after the start of school, I was impressed by the aliveness of the room. Beverly was vibrant and the students were enthused—no morning fatigue in this classroom. She believed learning should be fun, and practiced her beliefs. However some discrepancy seemed to exist as to how often her students used computers compared to how often she stated they used computers. Although identified as the "technology guru," she appeared to be ambivalent to the use of technology beyond level one with her first graders.

The second incongruity was Emily, one of the fourth grade teachers. She stated in her interview that the disadvantage of students using technology was that "it took away some of the thinking the students needed to do." This was an interesting comment coming from a teacher who used technology at level three in her classroom. Unfortunately, she appeared not to recognize the potential for developing higher order thinking skills with level three technology use. There appeared to be a dichotomy between her use of level three and her beliefs about technology's ability to foster higher order thinking skills. She seemed to be thinking only in terms of students' use of technology as skill building and missed the importance of technology use to develop higher order thinking skills—level three use.

Analysis of Questions

To answer the three questions, I analyzed the data for individual teachers, which answered questions one and tow. I then analyzed the data for the school as a whole entity, which answered question three.

Figure 6: Analysis of Questions



Individual Teachers.

The first question in this study was: How did teachers integrate technology and curriculum in this Title I, high achieving elementary school? From the lack of consistency in the definition of technology integration in the curriculum among the teachers, school administrators, and district administrators, it was apparent that this school district had not yet embraced the definition of technology integration as defined by the International Society for Technology in Education (ISTE). This definition described technology integration as "the use of technology...as a tool to enhance the learning in a content area. . . ." (p. 20, National Educational Technology Standards for Students, 2000).

Although the definition of technology integration varied, the six teachers expressed a belief in using technology for skill building, for supplementing and enhancing the curriculum, and for enabling students to have a better learning experience. They further pointed to the need to use computers throughout the curriculum and to mainstream the use of technology into the students' everyday lives.

That all six teachers felt comfortable using technology and believed in using technology with their students was not surprising since all volunteered for the research study. Further, all had previous experience with technology, and, as Goddard (2002) stated, teachers must first integrate technology into their personal lives before they can use technology as an effective tool for educating their students. The six teachers had integrated technology into their own lives before becoming teachers.

The second research question was: How did that integration translate into the classroom of this Title I, high achieving school? The levels of use enabled me to determine how technology was being used—for what purpose.

Whether the teachers' use of technology focused on level one, two, or three appeared to be somewhat dependent on the grade level. Kindergarten, first and second grades focused on skill building, especially for reading and math. Third and fourth grades while continuing level two use for skill building, began integrating technology into the curriculum through the use of research for social studies projects—level three activities.

When technology was integrated at level three, it became a tool that enhanced learning through ways not previously accessible to students. Although Hamilton (2007) stated that technology integration was not the use of managed instructional software, or level two use, my research study found that such programs did have a place in the curriculum of this Title I school to facilitate ELL students' development of basic reading and math skills when the programs were implemented with fidelity.

The pattern of technology use—highest at level one, followed by level two, then level three usage—may be influenced in part by the district's requirements to use mandated grade book and report card programs for grade keeping, progress reports, and report cards; to use the Instructional Data Management System (IDMS) program for analysis of student test data; to use the district email service for communication within the district; and to use the district mandated EnVisions math program which had many technology components built into it. All six teachers indicated use of

technology at level one for activities such as lesson plans, e-mail, and data analysis; five of the six were observed using level one for presentations.

The principal, in her interview, noted the use of higher order thinking skills when she stated that some of the purposes for students using technology were not only conducting research on the internet, but being able to discern whether the information on a website was fact, opinion, or propaganda.

The assistant principal also provided an example of level three use in her interview when she suggested using technology for a social studies project in which the students used the internet to research presidents, write a formal paper about a president, and create a PowerPoint about their president to present to the class. This type of activity, she noted, engaged the students and furthered their knowledge about the presidents. Additionally, it enabled students to use technology to learn at a higher level in relationship to Bloom's Taxonomy in that students would be analyzing and synthesizing information.

The administrators and technology coordinator indicated a comprehension of the importance of using technology to develop higher order thinking skills, but the teachers' actions, interview comments, and use of technology indicated they may not clearly understand that concept. To many of them, technology seemed to be relegated to the level two use of skill building. This agreed with Bebell et al. (2004) and Ertmer (2005) who found that only a small number of teachers used technology for higher order thinking and problem solving skills.

Although skill building was a critical need within the student population, to ignore technology's ability to be used to create higher order thinking skills, especially in fourth and fifth grades, may perhaps put students at a substantial disadvantage in

middle and high school, regardless of their familiarity with and use of technology in the lower grades.

Whole School Entity.

Question three asked: What existed in the school environment that promoted the integration of technology into the curriculum? Within the school environment there were both supportive effects that promoted the integration of technology and constraints that impeded the implementation of technology. Support included people such as the technology coordinator, the principal, the assistant principal, and the librarian. Further support consisted of the new technology equipment the school was receiving.

The administration supported the teachers' efforts to purchase new technology equipment whenever funding was available, and to provide training, such as Smartboard training. The technology coordinator provided support by keeping equipment in repair, by setting up the computer lab, and by encouraging teachers' and students' use of technology in their classrooms and the computer lab. The librarian promoted the integration of technology in his use of the laptop cart and laptops with students, teaching them to use the school's on-line catalogue through the school's library web site. The school further received some new equipment because it was a Title I school.

Several people interviewed mentioned constraints to the implementation of the integration of technology into the curriculum. Teachers mentioned technology breaking down, especially at the most inconvenient times. The principal, assistant principal, and librarian noted the lack of money as a barrier. As the assistant principal noted, technology was ever advancing—something new today is out of date

within two years. However, the money was not available to constantly upgrade technology equipment. Some teachers noted that the inconsistency of performance of the older technology was another problem. An example was the laptops that were only two years old, but the batteries lasted only 20 to 50 minutes. That was not long enough for the students to use the laptops to complete a lesson.

Other constraints voiced by teachers were the potential for some teachers to use technology as time wasters and the unwillingness of some teachers to even try to use technology in their teaching. Yet another constraint was the decision by district-level administrators to eliminate software programs from Title I schools regardless of the effectiveness of the program. Another constraint was, given the age of the building, the electrical infrastructure was not always conducive to adding new technology equipment.

The International Society of Technology in Education (ISTE, 2007) listed 13 essential conditions for effective technology use for learning: shared vision, implementation planning, consistent and adequate funding, equitable access, skilled personnel, on-going professional learning, technical support, curriculum framework, student-centered learning, assessment and evaluation, engaged communities, support policies, and supportive external context. Although not all 13 essential conditions were present, the school did have several conditions that made it unique in its attempts to integrate technology successfully. An analysis of the school of study within the parameters of these 13 conditions demonstrated several shortfalls.

Shared Vision: The leadership—the principal, assistant principal, technology coordinator, and librarian—and the six teachers in this study had a vision as to their technology use; however, that vision was not unified. Further, not all teachers in the

school shared the same vision, as was evidenced by the statements of the librarian and the technology coordinator that not all teachers used technology. For technology to be used successfully to develop higher order thinking skills, the leadership and teachers need to develop a vision of technology use that is feasible for all.

Implementation Planning: The school had implementation planning through its technology plan, but not all teachers were involved in the creation of the plan. It was unclear how the technology plan was being implemented in the school. One drawback to the plan was that it did not specify how it was to be implemented throughout the school.

Consistent and Adequate Funding : Consistent and adequate funding, or the lack thereof, was discussed by the principal, the assistant principal, the librarian, the technology coordinator and one teacher. Several interviewees believed that funding for technology was a barrier to technology use in this school. Although this was a Title I school which received extra funding and additional technology, such as 64 computers and 15 Smartboards, none of the ten people interviewed for this study felt they had enough technology to adequately teach their students.

Equitable Access: The school was lacking in equitable access in that it did not have access to current and emerging technologies and digital resources for all students, teachers, and administrators. The school did have connectivity for current technology for all computers accessed by students and teachers.

Skilled Personnel: The school certainly had skilled personnel for teaching in their technology coordinator. Additionally, at least one teacher was considered a technology guru and was able to provide technology support to teachers when needed.

On-Going Professional Learning: On-going professional learning was available from the district. However, it was not in the scope of this research study to determine if teachers were using these resources. The teachers were given training on use of the Smartboard, but that was not on-going training.

Technical Support: The technology coordinator provided a first line of technical support for technology equipment repair. He was able to call for support at the district level when he was unable to resolve the technical problems. Technical support was available, both locally and at the district level.

Curriculum Framework: Neither the school nor the district used the state's content standards nor digital curriculum resources that constituted the curriculum framework, as described by ISTE's 13 Essential Conditions.

Student-Centered Learning: The teachers interviewed and observed were using technology to facilitate student-centered learning. Every room arrangement fostered collaborative learning. Additionally, several teachers encouraged students to help one another, both on the computer, and in other projects.

Assessment and Evaluation: The continuous assessment and evaluation of the use of technology and digital resources was not in evidence at the school. However, the technology plan would be evaluated during the next school year to assess school goal attainment in technology, which would provide assessment and evaluation, but only on an annual basis.

Engaged Communities: My research study did not explore the possible partnerships and possible collaboration with the surrounding community; however, there were no indicators of such partnerships or collaboration within the school.

Support Policies: Support policies, financial plans for technology, accountability measures, and incentive structures to support the use of technology were very limited at the school, the district, and state levels.

Supportive External Context: The policies and initiatives from the national, regional, and local levels to support the school in its attempts to implement technology integration into the curriculum were also limited.

Of these 13 essential conditions, the school and teachers had access to four of them: skilled personnel, on-going professional learning, technical support, and student-centered learning. Given all the constraints the teachers faced when attempting to integrate technology into the curriculum, it was encouraging that these teachers were able to be as resourceful and successful as they were in this environment of unfunded and underfunded technology resources.

My school of study was in agreement with Ertmer et al.'s (1999) findings that indicated the most typical use of computers was as a presentation tool (level one), followed by skill building activities for individual students (level two). From interview comments with the technology coordinator, librarian, principal, and assistant principal, not all teachers within my school of study used technology. This appeared to be in contradiction to Levin and Wadmany's (2006) finding that teachers who spent three years in a technology-rich learning environment changed their educational beliefs and classroom practices. As the six teachers in my school of study continue using technology successfully, they may provide the technology-rich learning environment that changes the educational beliefs and classroom practices of non-technology using teachers.

Throughout the school there existed a culture of respect. I witnessed several incidents while observing classrooms, such as a fourth grade girl quietly asking a boy to move his chair which was blocking her chair, and he did so immediately; the fourth grade students picking up the pieces of a game left on the floor by others without being asked to do so; the fourth grade students sitting on the floor, to better see the Smartboard, without disturbing each other; the fourth grade teacher quietly asking two quarreling boys to follow him outdoors and talking to them privately; the second grade students handing another student his printed reading report; the first grade boys playing paper-rock-scissors to determine who would use the bathroom pass first. Many times while on campus, I had teachers not in my study asking me how things were going with the research.

The administrators respected the teachers, who in turn respected them. The teachers respected the students, who respected the teachers, the administrators, and their fellow peers. This respect was exhibited toward the school plant and the equipment within, especially the technology equipment. At no time did I witness any type of aggressive or abusive behavior toward technology, such as pounding on keys, or hitting the monitor when the computer ceased functioning.

One morning as I arrived at school for my observations, I noticed one of the outdoor glass-covered bulletin boards had been vandalized and the front glass panel broken, the shattered remains scattered about the sidewalk. Upon seeing the assistant principal, I commented I was surprised to see the vandalized bulletin board, to which she replied that it was some older students who jumped the fence, not students from the school. The vandals' act had been captured on the school's outdoor video security system.

The school appeared to be in a state of transition, progressing from an emphasis on level one and two use, to integration with level three use. Two indicators of this transition were evident in the interviews with the technology coordinator and the librarian. Both indicated that not all teachers in the school used technology, and, of the ones that did, there was room for improvement as to how technology was being used.

The technology coordinator noted his role in trying to encourage this transition of getting the teachers to change the way they used technology by his goal of wanting the teachers to ask him different types of questions, moving from the can you fix this and how does this work phase, to the can you help me plan a lesson which uses (integrates) technology phase.

> I would like to get the teachers proficient enough to where they're asking different kinds of questions of me. To where they are asking, "How can I use this in this curriculum?" instead of, "How does this work?" and, "Can you fix this?" I'd like to get them from where a lot of technology coordinators are– just fix it people; trying, you know, to get to the next step where you're helping out with their brain storming for a lesson plan. "I've got this lesson—I would like to do something with technology on it. Do you have any ideas?" Get in on the ground level when they are coming up with a new lesson [excerpt from interview with technology coordinator, 01-08-09].

The librarian stated he was trying to bring the students up to higher standards in their use of technology. Further indications were evident in the observations of Darlene and Emily who were using technology at level three with students using the internet on computers or a Smartboard to research a subject, and create a culminating project. Although the six teachers had a firm belief in the importance of using technology with their students, not all were using technology on level three, and even one teacher who did use technology at level three expressed a concern that technology would interfere with student thinking.

The 2008-2009 Technology Plan for this school contained three technology goals, which were based on the school's improvement plan. Moersch (1995) stated that too often technology plans failed to establish a link between the need for technology and identifiable instructional priorities. Basing the technology goals in the technology plan on the goals in the school improvement plan creates the link Moersch suggested was missing.

Included in the technology plan template required by the school district were the six strands from the ISTE National Standards Strands: creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem-solving, and decision-making; digital citizenship; and technology operations and concepts. That the district required these strands be included in the format of each school's technology plan provided evidence that the district was attempting to integrate the ISTE National Standards Strands into the curriculum district-wide.

The first technology goal in the technology plan was based on math and called for the teachers to "inject technology" into their EnVisions math curriculum. Four teachers were observed teaching math, three of them utilizing the EnVisions math web site. In addition to the web site, the EnVisions math program included several CDs at each level for teacher-directed student use. Teachers from each grade level had the opportunity to receive training in the EnVisions math at the beginning of the school year. Additionally, the technology coordinator received training by EnVisions personnel to help trouble shoot technology problems that may arise. One provision of this school's math technology goal was additional teacher training provided by the technology coordinator.

The second technology goal was that teachers in grades four and five would "significantly increase" technology integration over the next two years. What was missing from this goal was a definition of technology integration. The goal did discuss action steps for attainment of this goal that began with deploying LCD projectors, Smartboards, and ELMOs, a step that had been accomplished, and the training of teachers, which was in progress. Additional steps involved staff training to develop lessons integrating technology and access to the mobile laptop lab for 12 school days at a time, twice a year.

The two fourth grade classrooms observed were using the LCD projectors and Smartboards provided to them, one at level one and one at levels one and three. Additionally, one fourth-grade had an ELMO being used at level one. The narrative portion of this goal stated that this was a goal "all teachers should have" but the focus on fourth and fifth grade was due to the additional hardware resources they were receiving. The technology plan did not delineate how the third grade I observed also acquired a Smartboard and LCD projector, which the teacher was using at both levels one and three. The third and fourth grade teachers observed appeared to be working toward this goal of technology integration, but did not seem to be aware of teacher only use (level one), student use for skill building (level two), and student use to develop higher order thinking skills (level three). Indeed, one fourth grade teacher felt a disadvantage to technology use by students was that it limited their thinking skills.

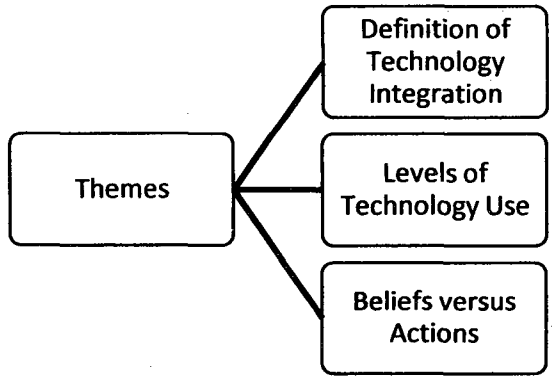
The third goal in the technology plan was a school-wide goal that all students would increase their reading fluency and comprehension. The technological components of this goal were the DIBELS testing by teachers on Palm Pilots: the

software reading skill builder programs of Waterford, Lexia, and Success Maker: and the Accelerated Reading program to motivate students to read through its reward system. The comment in the narrative section noted that in a high ELL school, there was a need to develop basic reading skills to aid in reading fluency and comprehension. All classrooms were observed using at least one of the three software skill building programs, and the results of DIBELS testing was shown to me by Allison who used it weekly. Several students were observed reading AR books, identifiable by the dots on the spine, when they finished their seat work. Additionally, students working on research in third and fourth grades were required to read information from web sites and books, take notes, and create a culminating project.

Themes

An analysis of the data defined three themes: definition of technology integration, levels of technology use, and beliefs versus actions.

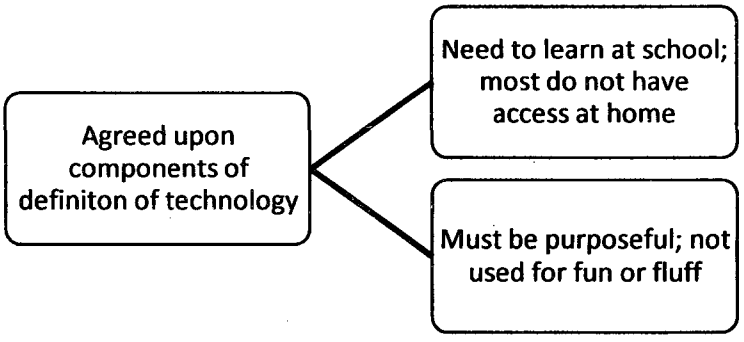
Figure 7: Themes



Definition of Technology Integration

Although the definition of technology integration varied among the informants, I recognized two common threads. First, the students needed to learn to use computers at school because most of them did not have access to computers at home, and the students needed to be familiar with technology because their world would be based on technology—even more so than the world today. Second, as Beverly stated, technology should not be used for fluff. All ten interviewees agreed that technology should not be used as a toy, or a fun activity, but should be used to enhance the curriculum and make lessons more valuable. Learning could be fun, however, while using technology could be fun, it should enhance learning. Its use must have a purpose that corresponded to the curriculum. The technology coordinator, librarian, principal, and assistant principal echoed these definitions.

Figure 8: Agreed Upon Components of Definition of Technology

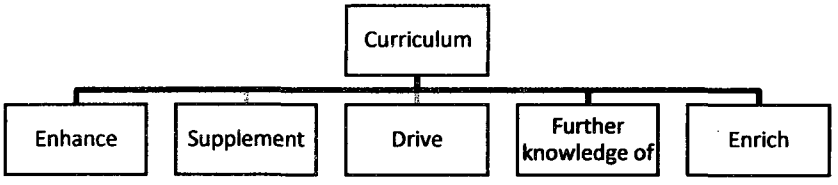


From these two points of convergence, however, the definitions of technology integration diverted. The responses included concepts such as using technology in

different subject areas; mainstreaming the use of technology; advancing technology in general; using technology to enhance, supplement, and drive the curriculum; using technology to make a difference; and using programs that help the students with basic learning. The technology coordinator, librarian, principal, and assistant principal defined technology integration as furthering the teaching of the curriculum (not replacing the teacher); as a tool enriching the curriculum; exciting learners; putting technology into every subject matter; using it not only for school but for personal use as well; having the computers in the classroom, not just in a computer lab; using technology in instruction; using technology to further knowledge (both student and teacher); and using technology to apply what has been learned.

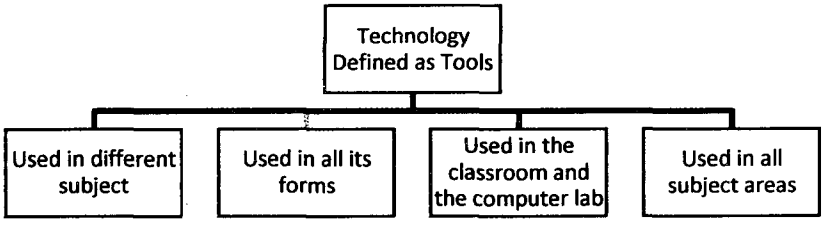
Analysis of these definitions revealed three categories: associated with the curriculum, used as a tool, and results for learners. The definition of technology integration associated with the curriculum created the subcategories of using technology to enhance, supplement, and drive the curriculum; using technology to further the curriculum and knowledge; and using technology to enrich the curriculum.

Figure 9: Subcategories of Curriculum



Subcategories associated with technology as a tool were that it was placed in different subject areas; used in all its forms; used in both classrooms and the computer lab; and used in all subject areas.

Figure 10: Subcategories of Technology as Tools



The category of results for learners was subdivided into the following subcategories: make a difference for learners; excite learners; better learning experience for learners; add value to the lesson for learners; and help learners apply what they know.

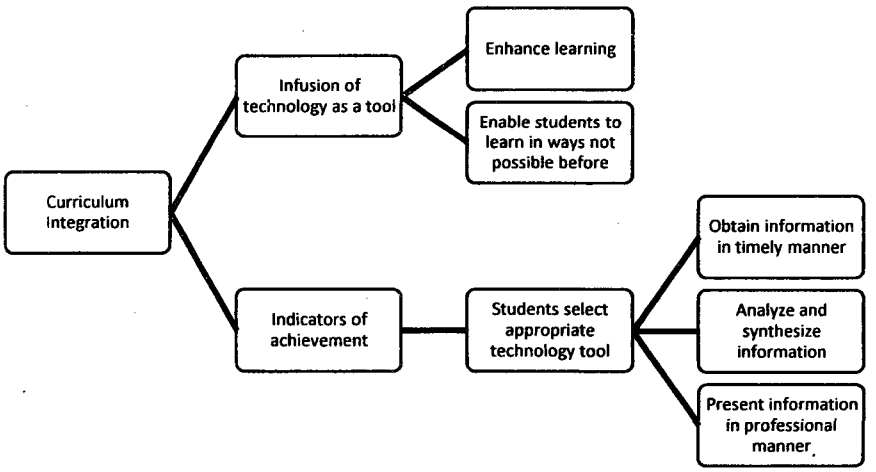
Figure 11: Subcategories of Results for Learners

Of the ten people interviewed (six teachers, principal, assistant principal, librarian, and technology coordinator) no one mentioned the International Society for Technology in Education (ISTE) standards for students. ISTE defined technology

integration as the infusion of technology into the curriculum so that it becomes a tool which, one, enhances student learning in a content area and, two, enables students to learn in ways that were not possible without technology. Another component of the ISTE definition was that students would be able to select the appropriate technology tools that would enable them to analyze, synthesize, and professionally present the information they need (National Educational Technology Standards for Students, 2000).

Although the school appeared to be in a state of transition moving toward level three technology use in that their definitions of technology integration encompassed some of the concepts in the ISTE standards for students, the technology use and actions in the classroom indicated the school had not yet fully embraced the ISTE standards for students.

Figure 12: ISTE Definition of Technology Integration



However, I noted similarities in the ISTE definition and the definitions of the teachers and other staff members. For example, both ISTE and the staff looked at

technology as enhancing the curriculum; both looked at technology as a tool; and both looked at student outcomes. Additionally, Frank, the fourth grade teacher, alluded to the ISTE phrase of enabling "students to learn in ways not possible before" when he stated in his interview that an advantage of students using technology at school was that "it opened up a lot of possibilities for them" and they could research countries they had never seen before. The students "needed to get exposure to things beyond the classroom." Based upon these similarities, the school did appear to be in a state of transition in its definition of technology integration.

Levels of Technology Use

The levels of use enabled me to determine how technology was being used—for what purpose. While analyzing the levels of use, I determined that within each of the three levels is a method for determining the efficiency of use. Each level had its own criteria for determining how effectively it is being used. I called these effectiveness indicators.

The effectiveness indicator for level one was the degree of responsiveness, and was based on adherence to district standards and student responsiveness. The effectiveness indicator for level two was the degree of fidelity and was based on fidelity of implementation and district standards. The effectiveness indicator of level three was the degree of adherence and was based on adherence to ISTE standards and Bloom's Taxonomy.

Degrees of Responsiveness.

In the degrees of responsiveness, student interest and responsiveness were plotted on a vertical continuum, ranging from ineffective to highly effective. This degree was further combined with the curriculum standards, which were placed on a

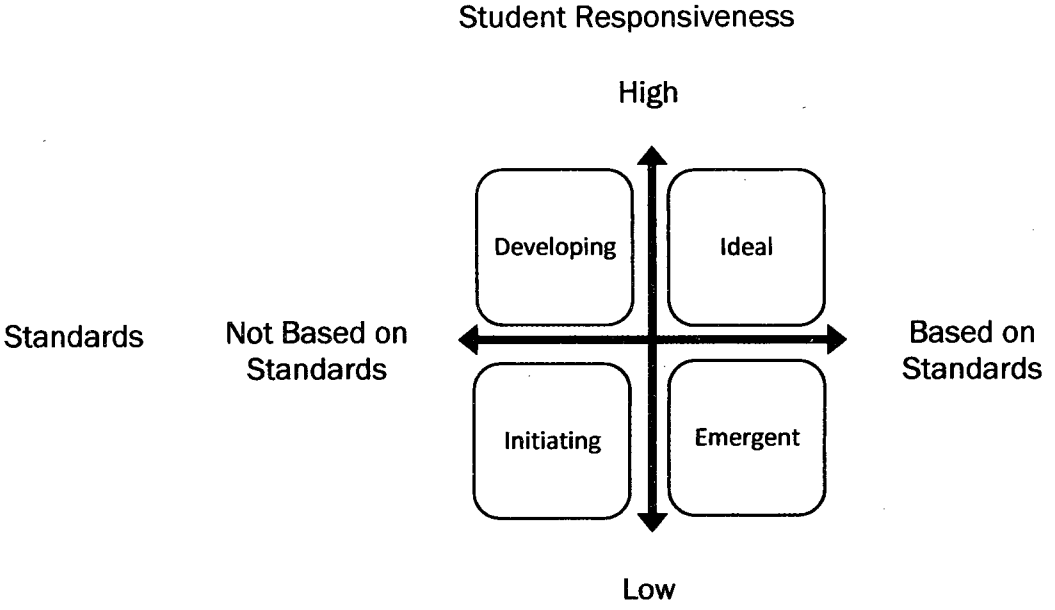
horizontal axis. Thus, teacher presentations were not only effective if they elicited student responses, but additionally, needed to be based on curriculum standards.

Teachers used level one presentation effectively when students were engaged in the lesson, participated in the question-answer sessions, and appeared responsive to the lesson. Questions to ask to determine the degree of effectiveness of a classroom teacher presentation at level one were: Was this presentation based on curriculum standards? Did this presentation provide information the students needed? Did the students' responses indicate they were engaged? A level one presentation would not be effective if the presentation did not relate to standards or did not engage students.

Beverly used presentations effectively in both the math and the reading lessons. In math, her students demonstrated high interest and the presentations were based on the math standards. She effectively used the projected lesson, stopping frequently to check for student understanding of the concepts being taught. In reading, she used the ELMO and projector to create a big book that all students could see. The students followed along in their books and together they read several pages, using various techniques (whole class, group, and alternating teacher and group). Again, the teacher stopped to ask questions, checking students' comprehension. In both lessons, she would be placed in the ideal quad for level one usage.

Both fourth grade teachers, Emily and Frank, used technology at level one for presentations in reading to enable students to visualize the settings of and background of the stories they were reading. They used level one when presenting lessons from the math program, which was projected on the Smartboard.

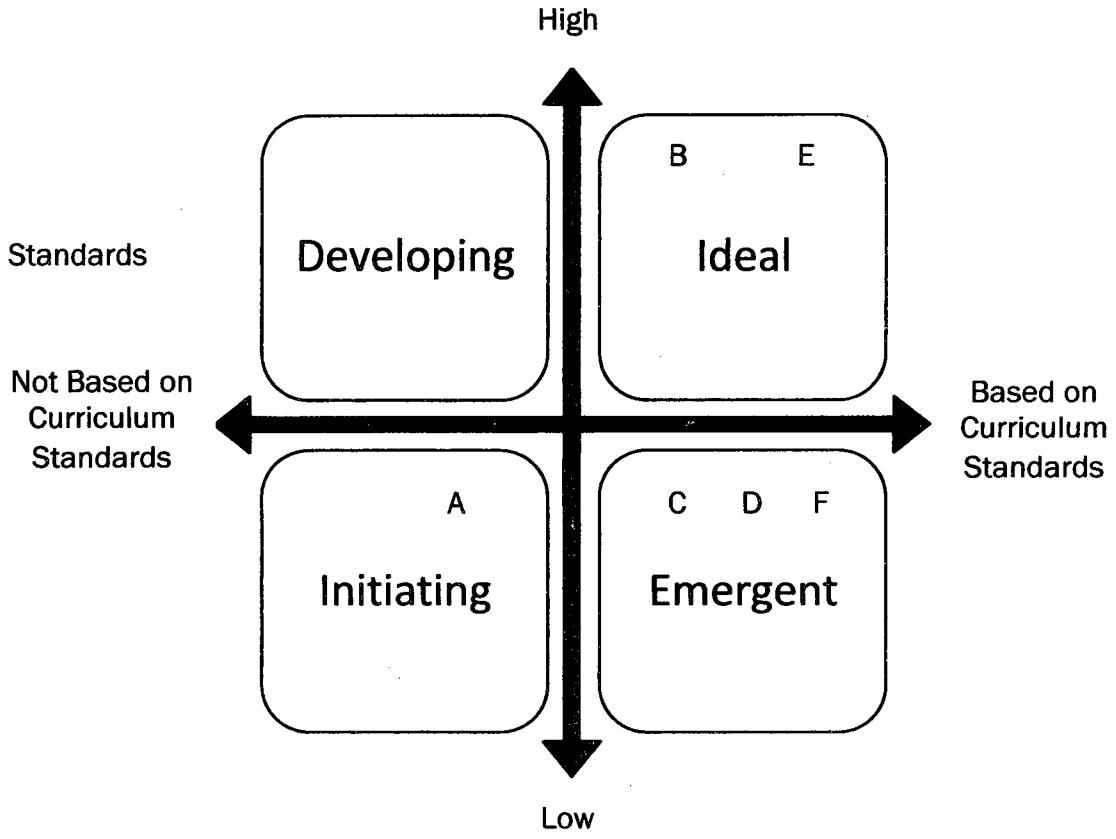
Figure 13: Degrees of Responsiveness



However, in Frank's class, the student responsiveness was not as high as Emily or Allison's class.

Beverly and Emily used level one with high student responsiveness; therefore, they were in the Ideal quadrant. Clay, Darlene, and Frank used level one, but with lower student responsiveness and were, therefore, placed in the emergent quadrant. Allison's level one use was strictly for administrative purposes. She did not use level one with her students; therefore, she was placed in the Initiating quadrant. Her lack of level one as presentation was due to her lack of equipment; she had no equipment, such as an LCD projector, to project a presentation for her students.

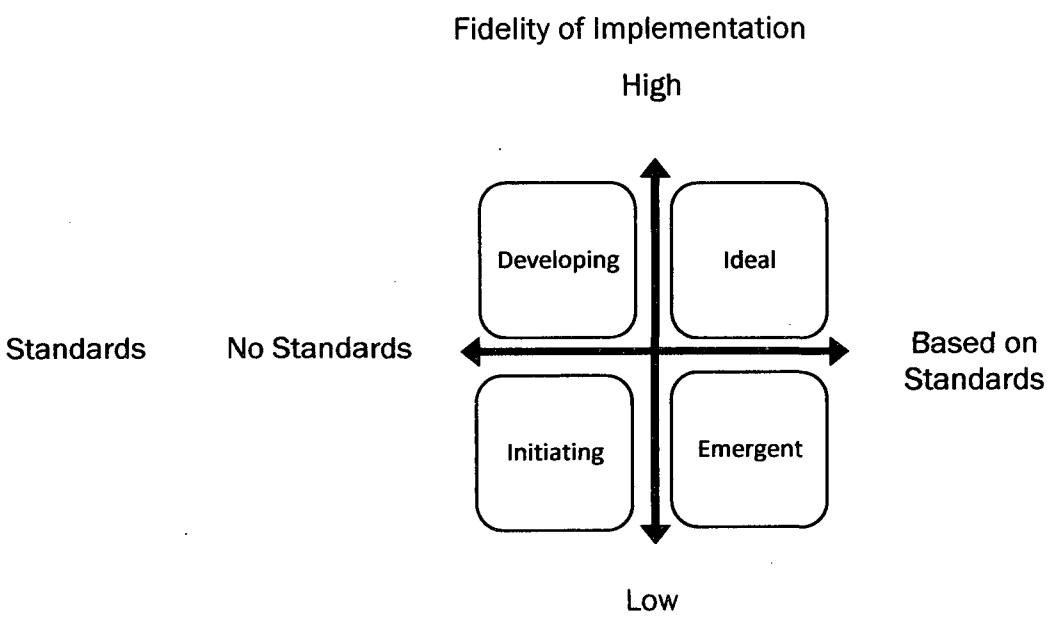
Figure 14: Teacher Placement on Degrees of Responsiveness



Degrees of Implementation.

Level two, by definition, was based on level of knowledge displayed according to Bloom's Taxonomy. The two most important factors in this level were fidelity of implementation and curriculum standards. Fidelity of implementation was the vertical continuum and curriculum standards constituted the horizontal continuum. This degree was determined through direct observation and teacher interviews. Level two skill building programs were effective only if implemented with fidelity and based on district standards.

Figure 15: Degrees of Implementation



Beverly, the first grade teacher, did not use technology beyond level one during the time of observations. If she did use technology at level two, it was not every day. However, everything she taught was based on standards, so if she did use level two, she would probably be in the emergent quadrant.

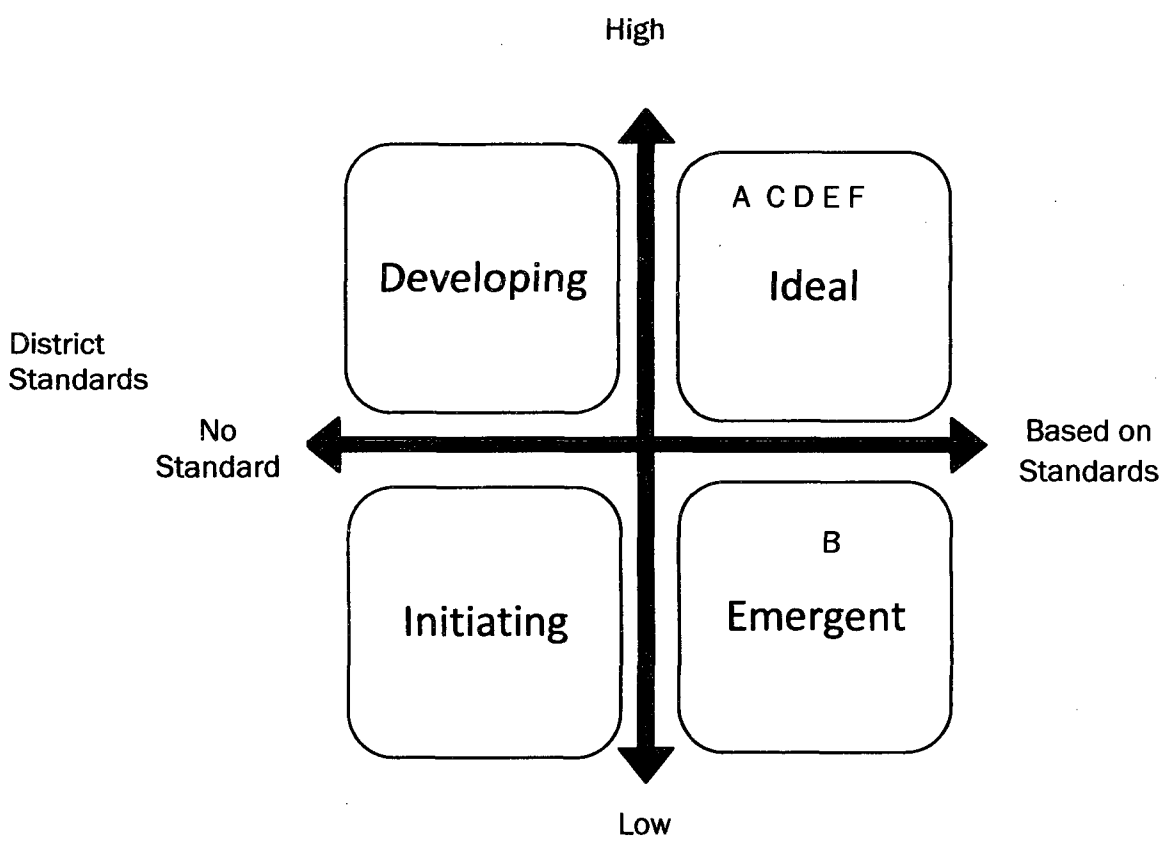
Allison, on the other hand, used the level two skill building Waterford program with great fidelity. Her students used the program once in the morning and once in the afternoon thus ensuring fidelity of implementation. Her students had been trained to quietly tell the next student when it was his or her turn to work on the computer. Her use of technology daily for a program based on reading standards placed her in the ideal quadrant.

Clay also used computers for skill building; in his classroom students used both the Waterford and the Lexia reading programs. As in the kindergarten class, his

students used the programs daily, ensuring fidelity of implementation. The teacher used the computers as centers, and had two additional groups—one that did an independent assignment at their tables and one that he worked with at the reading table. He, too, would be in the emergent quadrant for level two.

Both fourth grade teachers, Emily and Frank, used technology at level two. Level two was demonstrated through the use of the skill-building program Success Maker, which was used daily. On these two levels, both teachers were in the ideal quadrant.

Figure 16: Teachers Placement on Degrees of Implementation



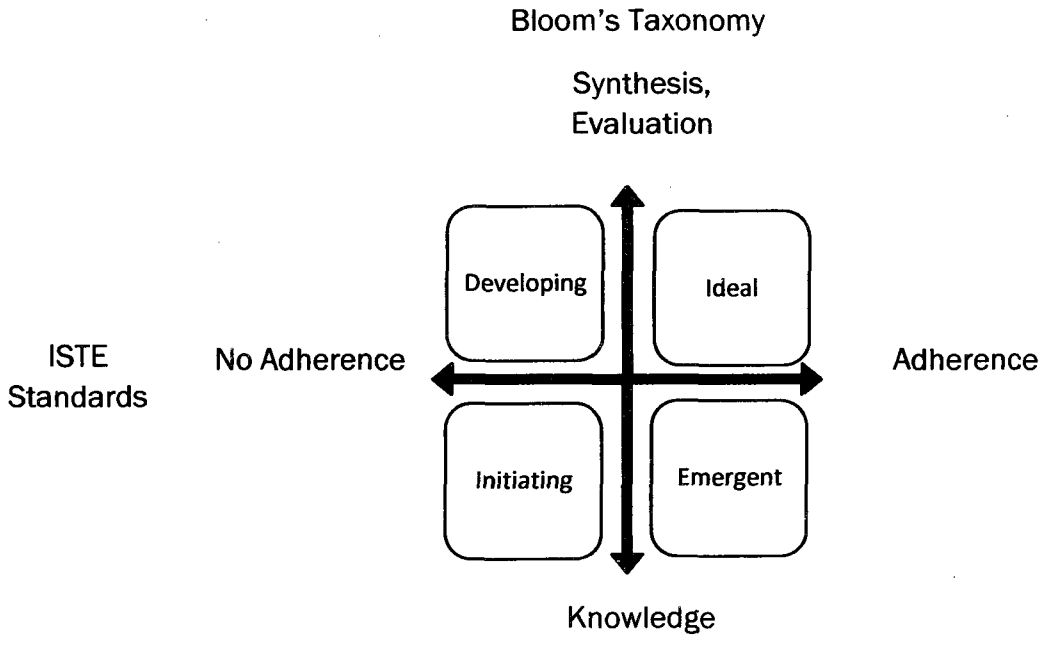
I observed Allison, Clay, Darlene, Emily, and Frank using level two each time I was in their classrooms. Their students used the computers with fidelity and with software programs approved by the district, which would indicate the programs were based on district standards. Beverly, however, did not use level two during my observations, but did teach content based on district standards. Therefore, I placed her in the emergent quadrant based on the low level of fidelity of implementation but using district standards.

Degrees of Adherence.

In the degrees of adherence, the ISTE standards were plotted on a horizontal continuum, ranging from no adherence to complete adherence. Further, this degree of adherence was considered in juxtaposition with the stages in Bloom's Taxonomy, which, when plotted on a vertical axis, contained knowledge at the bottom and analysis, synthesis, and evaluation at the top. This degree was formulated by direct observation and teacher interviews. Level two skill building programs (knowledge on Bloom's Taxonomy) were effective only if they adhered to ISTE standards.

The third grade teacher, Darlene, used technology at level three on a daily (or near daily) basis. Her students were researching various Native American tribes for a typed report they would turn in for a grade. The computers and Smartboard were centers; students not working at one of these two centers used books from the classroom library to research their tribe. This teacher is an example of the ideal quadrant.

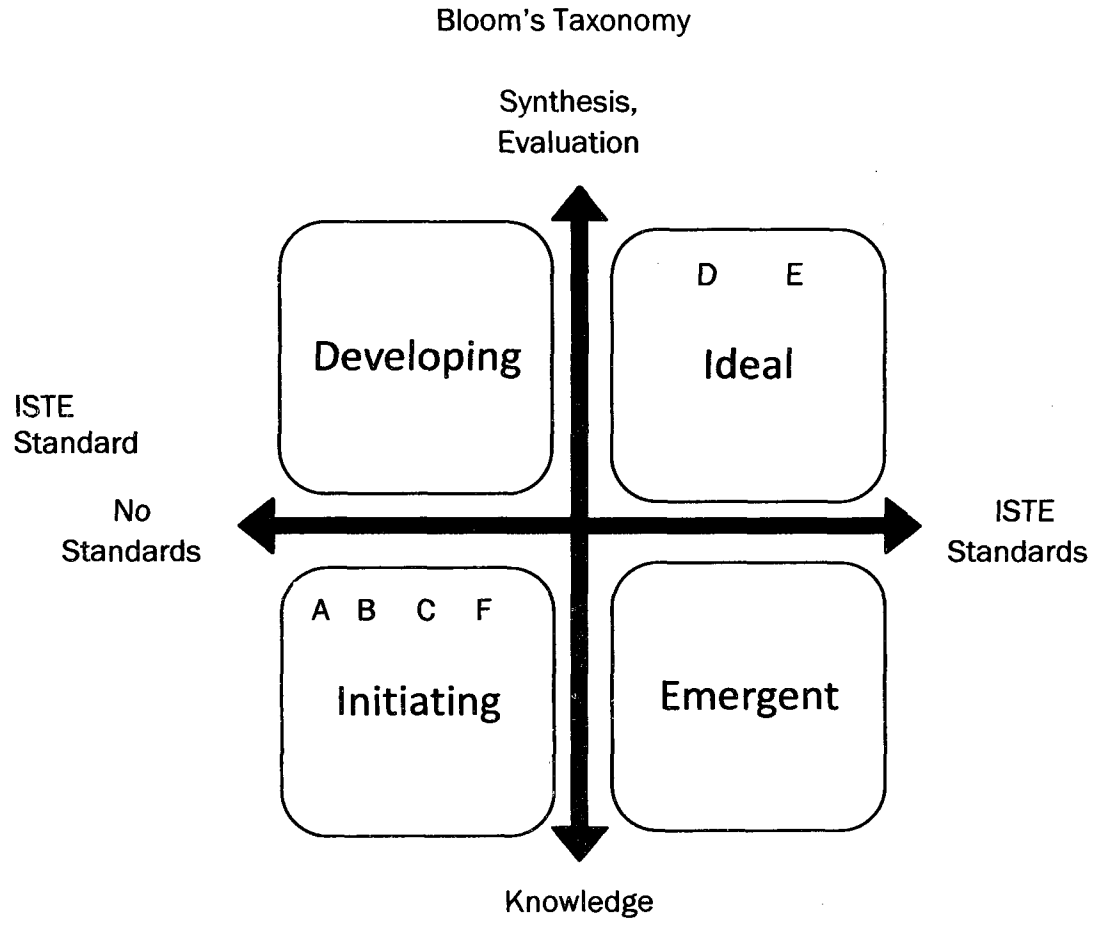
Figure 17: Degrees of Adherence



Emily, too, used technology at level three when her students used computers and the Smartboard to research state explorers. They used books as well as information from the web to create a portrait of their chosen explorer. When she used this level, she was adhering to the ISTE standards and was therefore placed in the ideal quadrant.

Darlene and Emily were using technology at level three and adhering to ISTE standards each time I observed them; therefore, they were in the Ideal quadrant. I did not observe any of the other teachers using level three. They were, therefore, placed in the initiating quadrant.

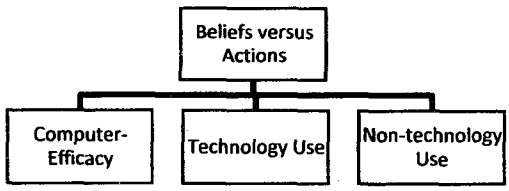
Figure 18: Teacher Placement on Degrees of Adherence



Beliefs versus Action

One criticism of educational research studies, described by both Henson (2001) and Pajares (1997), was that teachers' verbal beliefs did not always correspond to their actions in the classroom. In an attempt to resolve this problem, my research study compared teachers' written beliefs with their oral statements and direct observations. It analyzed information from these three sources in relation to computer self-efficacy, technology use, and non-technology use.

Figure 19: Beliefs versus Actions Subcategories



Computer-Efficacy.

Computer-efficacy holds that the higher the teachers' computer-efficacy, the more they use computers, the more they enjoy using computers, and the lower their anxiety level. All six teachers in my study indicated on the Computer Self-Efficacy for Teachers Screening Tool that they were comfortable using computers, they enjoyed using technology, and they had no anxiety about using technology.

All six teachers had developed computer skills in some form before becoming teachers. Four of them had previous careers and learned to use technology in those careers, while the remaining two teachers began using computers in either elementary or high school. The teachers were adept at using technology before entering the classroom, thus eliminating the need to learn to use technology (levels one and two) while incorporating it into their curriculum in a manner such that it enabled their students to learn with technology (level three). This substantiated the findings of Ertmer et al. (1994) and Hasan (2003) that computer skills and computer experiences were needed before computer performance was possible.

A characteristic of high computer-efficacy teachers was the concept that they tended to experiment with ways of improving their teaching methods (Henson, 2001). The question I asked earlier was would teachers with high computer-efficacy tend to experiment with technology in their classrooms? This was found to be true with the

three teachers who had received Smartboards and ELMOs. Additionally, the teachers observed who had not received any new piece of technology equipment wanted them for their classroom. The exception, however, was the first grade teacher, the "technology guru," who did not like the Smartboard and had it removed from her classroom.

Technology Use.

How teachers actually use technology in the classroom was a question asked by researchers such as Bebell et al. (2004), Jonassen et al. (2003), Li (2005), Warschauer (2006), Waycott et al. (2005), and Wenglinsky (2006). In my study, technology use—the second subcategory of beliefs versus actions–was investigated through the Teachers' Technology Use Screening Tool, the teacher interviews, and the classroom observations.

Observations of five teachers demonstrated that they did use technology to the degree they specified they did in their interviews. Beverly, however, did not use technology beyond level one during the course of three different observations, although she indicated in her interview and Teacher Technology Use Screening Tool that she used technology on level two frequently. All teachers verbalized during interviews that they believed it was important for their students to use technology at school because most of them did not have access at home, and they needed to use technology now to be successful later in life. Observations confirmed all six teachers used technology in the classroom, five of them with their students on levels two or three.

The focus of the teachers technology use on a daily basis was helping their students learn. This high degree of computer-efficacy resulted in significant teacher

computer use in the classroom as Albion (2001), Ashton and Webb (1986), and Busch (1995) predicted. The question is will other teachers begin using technology more after seeing positive outcomes from these six teachers?

Further examples of technology use included Emily who believed technology was a great teaching tool because it provided variety, and the more variety a teacher used the greater her effectiveness as a teacher. This teacher used computers, a Smartboard, an ELMO, and a projector in a variety of ways and at all three levels throughout the day.

Another example was Darlene who verbalized her belief the best way for a student to learn something was for her to teach two or three students a technology skill and have them teach other students. She taught two students a skill involving underlining on the Smartboard, and had these two students show two other students. I observed the students at the computers in her classroom showing others how to maneuver links on web pages.

Non-Technology Use.

Examples of teachers verbalizing their beliefs and their actions consistently reflecting those beliefs also included non-technology examples such as Beverly, who believed learning should be fun, and laughed and played with her students while teaching them to read and write, and teaching math concepts. She shared with me her students' reading scores and it was evident her students were doing very well in reading. Out of 18 students only five were below grade level, and of those, only two were not reading at a first grade level. The majority of the other students were reading at grade level, with two students above grade level.

One other example of non-technology use and teachers' beliefs involved rapport. In all my observations, I saw that teachers and students had excellent rapport. Teachers demonstrated encouragement, which was important for teacher-student rapport, administrative-teacher rapport, and administrative-student rapport. I observed teachers encouraging students with praises such as "good job," and "Tell your partner good job." Teachers laughed with students, respected students, encouraged students, and enabled students to be respectful of one another.

Discussion of Findings

I discussed the findings of my research study in terms of the three themes (definitions of technology integration, levels of technology use, and beliefs versus actions), and in terms of relationships to the school as a whole entity. Throughout this section I referred to studies from the related literature review to establish how my findings either substantiated the results or contradicted the results of those studies.

Definition of Technology Integration

Findings relating to the definition of technology integration began with teachers' definition of technology integration. Allison's use of technology in her classroom for level two skill building was to her integrating technology into the curriculum. However, I would define it as integrating technology into her daily routine. The Waterford program provided needed skill building activities in reading, math, and science to enhance the students' knowledge, but it did not provide an opportunity for developing students' higher order thinking skills.

Clay, Emily, and Frank used similar skill building programs, which to them was technology integration. Beverly's definition involved the use of the ELMO and LCD projector for teacher presentations. While all of these uses of technology did provide opportunities for students to increase their basic skills (knowledge), none of them corresponded to either the International Society for Technology in Education (ISTE) definitions or to level three use.

Another finding of interest concerning the definition of technology integration was the school district's lack of emphasis on the definition of technology integration as defined by ISTE. This was evidenced in district-level administrators' belief that this Title I school effectively integrated technology, when in fact the integration existed primarily at levels one and two with only a few teachers teaching at level three and truly using technology as a tool to learn to develop higher order thinking skills. Further, interview comments by some informants indicated not all teachers at the school used technology.

The examination of teacher lesson plans was not as enlightening as I had anticipated. Only two of the four teachers had included anything in their lesson plans about using technology, and only one listed a purpose: students were to begin research on Native American Tribes using the Smartboard, computers, and books. The other four included technology as a center, but did not delineate technology as one of the centers or enumerate the purpose of using the technology center. On the other hand, if technology use was to be integrated into the curriculum seamlessly, as suggested by Strudler and Hearrington (2008), then perhaps it need not have been listed separately in a teacher's lesson plan. The emphasis appeared to be on using

technology to learn, as one would use a textbook to learn. I thought the teachers' definition of technology would be reflected in their lesson plans, but it was not.

Levels of Use

The levels of use included both quality and quantity. Each level had within it an effectiveness indicator that identified the criteria for determining how effectively the level was being used. Level one had the degrees of responsiveness, level two the degrees of implementation, and level three the degrees of adherence. Several teachers used technology at level one effectively with their students to teach concepts, especially in reading and mathematics. They questioned students at appropriate times to ascertain comprehension of concepts.

Teachers using level two, which by definition was the knowledge level in Bloom's Taxonomy, effectively adhered to fidelity of implementation of the software programs increasing students' skill development. Effective use at level two also included the teacher's recognition of students who no longer needed the drill in a particular skill, and made arrangements for the students to receive additional instruction in a higher grade level classroom.

Level three use included student-centered, collaboration activities which fostered the development of student higher order thinking skills. This level involved true integration of technology into the curriculum.

Considering the quality of technology use, the results of my study disagreed with Rakes et al. (2006) based on the quality of use within each level. Although Rakes et al. in their research indicated at level two use students were not provided with whole, dynamic technology learning, but with limited, arbitrary technology activities, my study found that the six teachers using technology at level two were not

focused on limited, arbitrary technology activities, but rather provided activities that were necessary for student learning, the developing of basic skills.

However, concerning the quantity of technology use, the results of my research study agreed with the findings of Russell et al. (2003), Bebell et al. (2004), and Ertmer (2005), as to quantity of use within each level. Teachers tended to use technology more for preparation and communication (level one), and less for assigning student activities that required the use of technology (level two), and even less for developing higher order thinking and problems solving skills (level three). My findings were based on the triangulation of data and methodology comprised of the screening tools, the interviews, and the observations.

When research findings used a single generic indicator to measure technology use, they masked far more than they revealed about teachers' use of technology (Bebell et al., 2004). My research study demonstrated the feasibility of using the three-level system to determine how teachers were using technology, and avoid the single generic indicator. The three-level system provided an alternative to the single generic indicator of technology use, thus offering an alternative to researchers such as Jonassen et al. (2003), Russell et al. (2003), Bebell et al. (2004), Li (2005), Waycott et al. (2005), Warschauer (2006), and Wenglinsky (2006), who noted the question was no longer was the teacher using technology; rather, the questions now were how was the teacher using technology, and for what purposes.

Beliefs versus Actions

In my study, my observations revealed that five of six teachers did use technology to the degree they said they did during interviews, and in the Teachers' Technology Use Screening Tool. In this regard the concerns of Rakes, et al. (2206)

and Radlick et al. (2006) study were not substantiated. However, one teacher did not use technology to the degree stated in the interviews and on the screening tools.

An additional finding involved Moersch's (1995) LoTi. He developed his Technology Implementation (LoTi) to measure seven levels of teacher use. The seven levels were nonuse, awareness, exploration, infusion, integration, expansion, and refinement. His contention was as teachers progressed from level to level, their instructional methodology changed from teacher-centered to learner-centered and their use of technology increased. My contention was that it was possible for teachers to be in the expansion and refinement categories for their own use, but still be at level one or two for student use.

In my study, I did indeed come across just such a situation. Beverly was considered the "technology guru" of the school, one who knew technology better than any other teacher in the school, and who often helped other teachers learn to use a piece of technology equipment. She was certainly in the expansion and refinement stages of Moersch's seven levels. Nevertheless her use of technology with her students was observed at level one only—an effective level one, but level one nonetheless. She used a projector, ELMO, and laptop effectively to display worksheets for reading and writing as well as lessons from the EnVisions math program. She was effective in working with her ELL students in whole group and small group settings. However, her student computers sat unused during the times of observations. When asked about her students' use of computers, her response was that they were "just first graders."

However, Beverly's lack of technology use on levels two and three could be explored in terms of her beliefs being in a state of transition. Levin and Wadmany's

(2006) study concluded that researchers cannot rely on teachers' statements regarding their beliefs and practices because these beliefs may be in a period of transition without the teacher being aware of their emergent beliefs. This teacher's beliefs did appear to be in a state of transition: she loved technology, felt comfortable with technology, and used technology extensively and effectively at level one. Moreover, she tended to be student-centered in her methodology. As her beliefs about her students' capabilities evolve, she may indeed begin using technology at level two daily, and, later, level three, as least weekly.

Whole School Entity

My study did not substantiate the findings of Esch et al., (2004) whose study found that teachers in lower SES schools tended to be less skilled with technology use, had less training in technology integration, and had less of a vision for technology integration than teachers in higher SES schools. Further, Lubienski (2001) found that the inequity continued with teaching methodology: teachers in lower SES schools tended to be more teacher-oriented while teachers in higher SES schools tend to be more constructionist in their teaching. My research disputed both findings in that the six teachers studied were skilled with technology, were interested in integrating technology, and had a purpose for technology integration. These teachers were not teacher-oriented, but were student-oriented in their methodology in this Title I, lower SES school.

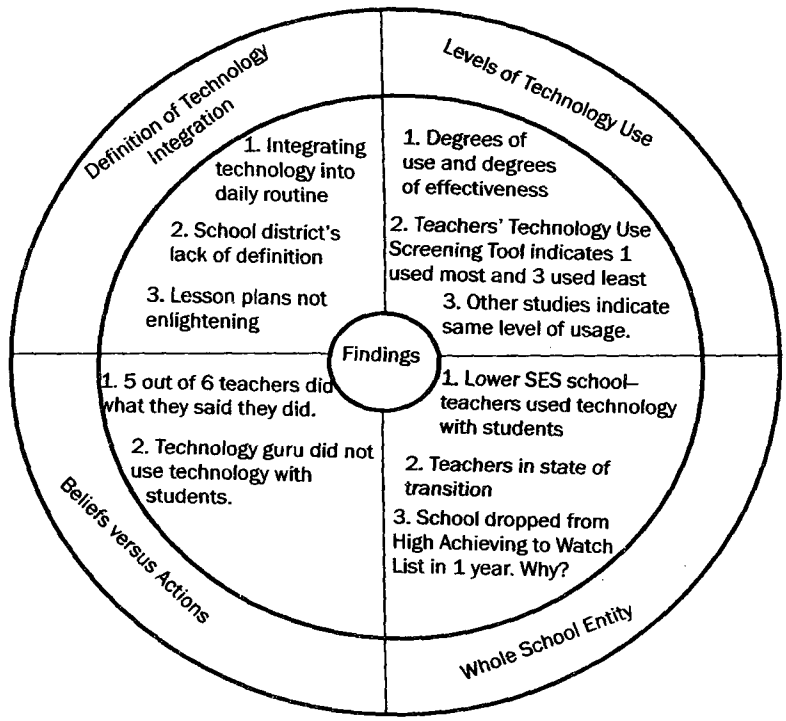
The six teachers in this research study appeared to be in a state of transition as they learned to use the new technology given to them. The school climate, with the support of the administrators and the technology coordinator, had the potential to change teachers' attitudes toward more computer use at levels two and three, by not

only these six teachers, but other teachers at the school as well. This finding would agree with Becker and Ravitz (1999) that teacher pedagogical practices were not static.

This Title I school was ranked High Achieving in the 2006-2007 school year. In the 2007-2008 school year, however, the school dropped to the Watch List. Five of the six teachers, the administrators, the technology coordinator, and the librarian were working at the school both school years. When asked about the importance of technology within the school when the school was awarded High Achieving status, five teachers, the principal, and the assistant principal said they thought technology played an important role, although the principal stated she felt technology was about 20% and the teachers 80% of the reason for success.

When asked why the school dropped last school year, several of the teachers stated they thought technology was not used as effectively in 2007-2008 as it was in 2006-2007 because of pull-out programs instituted in 2007-2008 school year that tended to disrupt the flow of education, to include technology use, in their classrooms. Computer programs were not used with fidelity for all students. The pull-out programs had been discontinued for the 2008-2009 school year, and all teachers were hopeful the school would at least make Adequate Yearly Progress, if not High Achieving once again. One teacher and the librarian did not believe technology played a role in the school's attainment of high achieving, but rather the hard work of the teachers and students.

Figure 20: Major Findings



Another finding of interest was the principal's view of time on task of the students throughout the school. She believed that there was a huge difference between compliance time on task and engagement time on task. Compliance time on task was the students sitting in their seats, looking at the teacher. But their minds could have been elsewhere. Asking the student what he was doing, and the student being able to tell her determined engagement time on task. Technology provided that engagement needed by the students. The principal's comment, though relating to students, was echoed in the study by Ertmer et al. (1994) which found that time on task was not a critical variable in increasing self-efficacy in computer use but rather the quality of computer experiences. The quality of computer experiences could be related to the engagement in computer experiences.

Age did not matter and was not a factor in teacher technology use. Although there was a 36 year age span between the youngest and oldest teachers involved in the study, age did not appear to be a determinate factor in a teacher's willingness or ability to implement technology into the curriculum. My study did not substantiate the concerns expressed by Ma et al. (2006) and Fuller (2000) that, although younger teachers were more familiar with technology, they used it for entertainment and not for learning, and, therefore, they were not integrating technology into the curriculum when they became teachers. My study found that two younger teachers were using technology at level three, while all teachers, regardless of age, used technology effectively at the levels at which they used technology. However, a greater predictor of level three use than age is where the teachers are in terms of their constructivist beliefs and their computer self-efficacy.

How did teachers' computer-efficacy and pedagogy compare to their technological pedagogy? Although I did not attempt to identify teachers' self-efficacy or teacher-efficacy, I did attempt to identify teachers' computer-efficacy. That all six teachers had scores above 60 (the upper fourth) is not surprising, since all teachers volunteered for my study, and knew I would be observing their use of technology. Those teachers who were not comfortable with technology did not volunteer for my study.

Figure 21: Computer-Efficacy, Pedagogy, and Technological Pedagogy Summary

Teacher	Computer-Efficacy	Pedagogy	Technological Pedagogy
Allison	66	Level 3	Level 2
Beverly	70	Level 3	Level 1
Clay	79	Level 3	Level 2
Darlene	69	Level 3	Level 3
Emily	77	Level 3	Level 3
Frank	76	Level 3	Level 2

I judged all teachers' pedagogical skills at a level three based on my observations of their use of student collaboration, their instructional use of question and answer methods, their classroom routine, and their classroom management. I also determined from my observations that their classrooms were student-centered.

The teachers of my study did not employ a totally constructivist methodology as described by Dewey, Piaget, or Vygotsky. For example, they did not allow students' interest to drive the curriculum, which was difficult to accomplish in view of accountability assessments and the required coherence to standards. Teachers did, however, allow students choices within the confines of the standards, such as which Native American tribe or which explorer to research.

Further evidence of constructivist methodology was the use of collaboration. From the arrangements of the classrooms I observed, with students' desks placed in groups or with students sitting at tables, it was evident these six teachers encouraged collaboration among their students. During several observations, teachers told students to check or collaborate with their "shoulder partners" or their "face partners." In first grade the teacher told students to "put your heads together to check your answers" [excerpts from observation field notes, 01-12-09].

This collaboration extended to technology use as well. The third grade teacher told me she encouraged peer coaching by teaching two or three students how to do something on the computer or the Smartboard and then making these students responsible for teaching the skills to the other students. Her belief was that the best way to learn something was to teach someone else. I observed students in her classroom helping each other navigate websites on computers and on a Smartboard.

Comparing their pedagogy with their technological pedagogy, two teachers, Darlene and Emily, were at level three in both areas. These are the two classrooms in which I observed the strongest constructivist methodology. In these two classrooms while the students were working collaboratively, I observed the teachers moving from group to group, coaching students by answering questions and giving suggestions. In these classrooms the teacher role was that of coach or "guide on the side" more than that of "sage on the stage," and the classrooms were student-centered.

The student-centered methodology extended to technology use in these two classrooms in which technology was used at level three. In both classrooms students were working in groups on the computer, the Smartboard, and using books to research a specific subject. The students had to analyze, synthesize, and evaluate information from various sources to create a culminating project—in one case a typed report and in the other case a drawing with important points of information.

A disconnect between methodology and technology pedagogy occurred with Beverly, who was at level three in pedagogy, but was only at level one use in her technological pedagogy. During my observations, her use of technology was limited to level one, presentations. However, she was ranked at level three in pedagogy because of her effective use of collaboration and question and answer methodology.

She stopped at various points in the lesson, asked students questions, and asked them to check their answers with their "shoulder partner." Her students responded enthusiastically.

The teachers who used technology at levels one and two, but not three, may have been depriving their students of opportunities to develop higher order thinking skills in which they used technology to analyze, synthesize, and evaluate information. Perhaps the belief in collaboration and student-centered learning demonstrated by these teachers were indications of the potential for the teachers to transition from levels one and two to level three technology use. Teachers who are constructivist oriented and student-centered also tend to use technology as tools to get their students involved with problem-solving activities.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Discussion of Results

The purpose of this study was to determine how technology was integrated into the curriculum of a Title I high achieving elementary school. Three research questions guided the study: How did teachers integrate technology and curriculum in a Title I, high achieving elementary school? How did that integration translate into the classrooms of this Title I, high achieving school? What existed in the school environment that promoted the integration of technology into the curriculum? Three relevant themes identified through the screening tools, the interviews, and the observations were the definition of technology, the levels of technology use, and beliefs versus actions.

The first theme, definition of technology, also answered the first question of how did teachers integrate technology. What I was seeking were definitive constructs by the teachers of methods to integrate technology into the curriculum. What I found was a nebulous concept among the classroom teachers, the specialists, and the administrators of the definition of technology integration into the curriculum.

Technology integration to the teachers can best be explained through Allison, the kindergarten teacher. In her classroom, the students used the computers for

Waterford software program twice each day. Because the computers were such an integral part of her daily routine, she believed she was integrating technology. However, she was not integrating technology into the curriculum, but rather into her daily routine. One must be certain to distinguish between integrating technology into the curriculum (level three) and integrating technology into the daily routine for skill building activities (level two).

Results of staff interviews demonstrated a lack of consensus among the staff concerning the definition of technology integration in this Title I elementary school. In their discussion of the definition of technology integration, the classroom teachers, specialists, and administrators mentioned the "what" of technology integration, but not the "how." They described technology as enhancing, supplementing, driving, and enriching the curriculum, but not how they would do so. The "why" they integrated technology centered on the need for the students to use technology at school because most of them did not have computers at home. Lacking was the academic advancement capable with technology use when technology was used to develop higher order thinking skills.

The second theme answered the second question: how the integration translated into the classrooms. The results of this study found that teachers used technology at level one the most, followed by level two use, and used level three the least. Both the teacher observations and the results of the Teachers' Technology Use Screening Tool indicated agreement on the quantity of level use. However, to determine the quality within a level necessitated the construction of three effectiveness indicators: the degrees of responsiveness for level one, based on students responses and district standards; the degree of implementation for level

two, based on fidelity of implementation and district standards; and the degrees of adherence for level three, based on Bloom's Taxonomy and adherence to ISTE standards. While use at level three was deemed most desirable, level one and two could be used effectively in the classroom when quality of use was considered.

The third question was answered by the supports and constraints in the environment at the school, district, and state levels. The third theme, beliefs versus actions, was viewed through computer-efficacy, technology use, and non-technology use. The teachers in my research project had strong computer-efficacy beliefs that enabled them to use technology with their students. They also appeared to have strong teacher-efficacy beliefs in that their work with the students indicated the teachers' beliefs that the students were capable of learning the required material to pass the accountability assessments.

This Title I school was attempting to address both the achievement divide and the digital divide in their students' lives. They were addressing the digital divide with their daily use of technology while they worked on the achievement divide, in an attempt to once again attain High Achieving status. The work on the achievement divide included both technology use, such as skill building in early grades and skill building and research in intermediate grades, and non-technology methodology, such as collaborative learning.

Implications and Limitations of Study

This study successfully employed the three levels of technology use to determine how technology was being utilized by teachers within the school. The implication is that this three level method can be used to help determine how

teachers are using technology in education. Moreover, the levels can be used to make teachers aware of their technology use and to teach them methods for truly integrating technology into their curriculum based on ISTE standards, as opposed to just integrating technology into their daily routines.

The administrators within a school need to be aware of how technology is being used in their school. The levels of technology use provide a way to determine technology use within each classroom. The administrators should encourage teachers to use technology at level three to develop higher order thinking skills in their students.

Self-efficacy, teacher-efficacy, and computer-efficacy are important constructs in technology use, even if these three constructs are difficult to measure. Finding disconnects between a teachers' self-efficacy, teacher-efficacy, or computer-efficacy, and technology use within the classroom may indicate a teacher's misunderstanding of the capabilities of technology use at level three. To be successful in technology integration, teachers need to have high computer-efficacy beliefs and an understanding of technology integration.

A limitation to this study is due to the small sample size, and because the participants were not randomly selected, the research results are not generalizable to any larger population.

Recommendations for Further Study

Were I to repeat this study, I would define the types of technology integration I was seeking, such as more active student-centered approaches, when requesting information from higher-level administrators concerning schools that integrate

technology. I would also validate the screening tools to use them as measurement instruments, and conduct a mixed methods research study.

More research is needed to determine if the three levels of technology use can be replicated in other situations to include elementary, middle, junior, and high schools. Are the levels of use a viable way to identify teacher technology use?

The school's success at attaining High Achieving status appeared to be the result of hard work and dedication on the part of the students, the teachers, the administrators, and the support staff. The role of technology in that achievement was inconclusive, and the opinion of the teachers and administrators as to the role of technology in that achievement was mixed. Further research in the form of a longitudinal study is needed to determine if this school continues to transition to level three technology use, and what effect use at level three has on students' accountability assessments.

Research is needed to study the role of school-level administrators in defining and implementing technology integration throughout their school. How does their attitude toward technology integration affect teachers' use of technology? How does administrators' attitude affect teachers' level of technology use?

An additional area in which research is needed is to determine how a school transitions from primarily level one and two use to emphasize level three use? What is needed for teachers to move to level three? What role do administrators play in guiding their teachers?

Research is needed to determine to what extent teachers can be taught to use level three in their classrooms. What is the role of their beliefs about technology and student accountability? How can mentoring teachers help in this process?

Additional research is needed to more closely examine teachers' beliefs about using technology to develop higher order thinking skills in their students. How do teachers view the ability to use technology to develop higher order thinking skills? What enables them to or restrains them from using technology at level three?

Further research is needed to study student reactions to the three levels of technology use. What are their responses at each level? What is their degree of engagement at each level?

Can educators expect young children, such as kindergarteners, first, or second graders, to use technology at level three, specifically in a lower SES school? What would be the affect on short-term accountability assessments of young students using technology at level three; on long-term accountability assessments?

Additional research questions focus on professional software. The EnVisions math program appeared to perpetuate lower levels of technology use. A major component of the program involves technology use for teacher presentations—level one use. Additionally, the technology provides for student skill building activities—level two use. How can these software programs be designed to involve students at level three technology use—developing higher order thinking skills? What would be involved in a math lesson on level three?

Research is needed to answer the question: How effectively does skills-based software reduce the digital divide?

Conclusion

Technology has become more advanced, varied, and ubiquitous in schools. Defining and measuring teachers' use of technology has become an increasingly

complex task. The term "teachers' use of technology" varied widely from one research study to another, and data frequently had been collapsed in a single generic variable, labeled "technology use," ignoring the quality versus quantity discussion.

The creation of the three-level model enabled me to determine on what level a teacher was using technology and for what purpose, thereby resolving the generic "technology use" label when discussing teachers' technology use. It enabled a much needed distinction between quality and quantity of technology use.

The school of study, while not being as technologically integrated as this researcher was led to believe based on the advice of district-level administrators, did provide interesting results in teachers' beliefs, methodology, and technology use. Perhaps the most enduring feature this research uncovered was the dedication of the teachers and the administrators in this Title I school. However, limiting students to level one or two technology use impedes their ability to develop the higher order thinking skills needed to be successful in a highly integrated world.

APPENDIX A

DATA TABLE

Question Number	Key Terminology	Observations	Interviews	Lesson Plans
1	How do teachers integrate technology and curriculum?	X	X	X
2	What does technology integration look like at classroom level?	X	X	X
3	What exists in the school environment that promotes the integration of technology into the curriculum?	X	X	

APPENDIX B

COMPUTER EFFICACY FOR TEACHERS SCREENING TOOL

For each statement, mark how the statement applies to you.	Strongly Agree	Agree	Disagree	Strongly Disagree
1. I do not think that computers are useful to me as a teacher.				
2. I feel at ease working with computers.				
3. With the use of computers, I can create instructional materials to enhance my teaching.				
4. I am not the kind of person who does well with computers.				
5. I can use computers and am therefore a more productive teacher.				
6. Anything that computers can be used for, I can do just as well some other way.				

COMPUTER EFFICACY FOR TEACHERS SCREENING TOOL

For each statement, mark how the statement applies to you.	Strongly Agree	Agree	Disagree	Strongly Disagree
7. The thought of using computers frightens me.				
8. Computers are confusing to me.				
9. I use computers to access many types of information				
10. I do not feel threatened by the impact of computers on teaching				
11. I am anxious about computers because I feel like I might break them.				
12. Computers can be used to assist me with classroom management techniques.				
13. I do not see how computers can help me learn new skills.				
14. I do not see how computers can help my students learn new skills.				

COMPUTER EFFICACY FOR TEACHERS SCREENING TOOL

For each statement, mark how the statement applies to you.

	Strongly Agree	Agree	Disagree	Strongly Disagree
15. I feel comfortable about my ability to work with computers.				
16. Knowing how to use computers is not helpful in teaching.				
17. It is important for my students to use computers at school for learning.				
18. Students do not need to use computers at school because they can play with computers at home.				
19. I am confident I can learn new programs to enhance my students' use of computers.				
20. Computers can enhance my students' academic achievement.				

1. How many years have you been teaching? _____

2. How old are you? _____

3. How many years have you been using computers in the classroom? _____

4. Have you had any other careers besides teaching? _____

5. If so, what was the career? _____

6. Where and when did you first begin using computers?

_____

7. Do you use a computer at home? _____

8. Have you had formal training using computers other than at school? _____

9. If so, where and when? _____

10. Did any of your college courses prepare you to use computers at school? _____

APPENDIX C

TEACHERS' TECHNOLOGY USE SCREENING TOOL

ID Number: _____ Date: _____

In my classroom computers are used–	Daily	Weekly	Monthly	Rarely	Never
1. To take attendance	5	4	3	2	1
2. To take Accelerated Reader tests	5	4	3	2	1
3. To design presentations for students projects	5	4	3	2	1
4. To keep grades in a grade book	5	4	3	2	1
5. For Type to Learn lessons	5	4	3	2	1
6. To gather information for research for projects	5	4	3	2	1
7. To create report cards	5	4	3	2	1
8. For Kidpix activities	5	4	3	2	1
9. For student inquiry-based learning projects	5	4	3	2	1
10. To email colleagues	5	4	3	2	1
11. By students to create Kidspiration projects	5	4	3	2	1
12. By students to find answers to group generated questions	5	4	3	2	1

TEACHERS' TECHNOLOGY USE SCREENING TOOL

	Daily	Weekly	Monthly	Rarely	Never
13. By the teacher to do research on the internet	5	4	3	2	1
14. By students to create PowerPoint presentations to present to other students	5	4	3	2	1
15. By students to create an excel spreadsheet demonstrating math or science concepts	5	4	3	2	1
16. By teacher to create worksheets for my students for them to do at their seats	5	4	3	2	1
17. By students to write book reports	5	4	3	2	1
18. By students to create a lesson which utilizes databases and giving the lesson to other students to complete	5	4	3	2	1
19. By me to create a presentation to present to my students	5	4	3	2	1
20. By my students to practice math skills	5	4	3	2	1
21. By my students to communicate with adults or other students regarding a specific topic	5	4	3	2	1

TEACHERS' TECHNOLOGY USE SCREENING TOOL

	Daily	Weekly	Monthly	Rarely	Never
22. By me to create my lesson plans	5	4	3	2	1
23. By my students to practice reading skills	5	4	3	2	1
24. By my students to create a lesson or project using Inspiration	5	4	3	2	1
25. By me to create quizzes or tests for my students which I give to them at their seats	5	4	3	2	1
26. To give assignments from my web site	5	4	3	2	1
27. By my students to follow a specific project on the Internet (such as weather, butterflies, a scientist's adventure)	5	4	3	2	1
28. By me to type letters or notes to parents	5	4	3	2	1
29. By my students to practice searching the Internet	5	4	3	2	1
30. By my students to develop and complete a class project	5	4	3	2	1

Other ways I use technology in the classroom:

APPENDIX D

TEACHERS' TECHNOLOGY USE SCREENING GUIDE

I use technology to – (Level 1)	Daily	Weekly	Monthly	Rarely	Never
1. take attendance	5	4	3	2	1
2. keep grades in a grade book	5	4	3	2	1
3. create report cards	5	4	3	2	1
4. email colleagues	5	4	3	2	1
5. do research on the internet for me	5	4	3	2	1
6. create worksheets for my students	5	4	3	2	1
7. create a presentation for my students	5	4	3	2	1
8. create lesson plans	5	4	3	2	1
9. create quizzes or tests for my students	5	4	3	2	1
10. type letters or notes to parents	5	4	3	2	1
My students use technology for— (Level 2)	Daily	Weekly	Monthly	Rarely	Never
1. Accelerated Reader	5	4	3	2	1
2. Type to Learn	5	4	3	2	1
3. Kidpix	5	4	3	2	1
4. prepared Kidspiration lessons	5	4	3	2	1
5. creating PowerPoint presentation	5	4	3	2	1
6. writing book reports	5	4	3	2	1

	Daily	Weekly	Monthly	Rarely	Never
7. practicing math skills	5	4	3	2	1
8. practicing reading skills	5	4	3	2	1
9. assignments from teacher's web site	5	4	3	2	1
10. practicing searching the Internet	5	4	3	2	1
My students use technology for– (Level 3)	Daily	Weekly	Monthly	Rarely	Never
1. designing presentations for projects	5	4	3	2	1
2. gathering research for projects	5	4	3	2	1
3. inquiry-based learning	5	4	3	2	1
4. finding answers to group generated questions	5	4	3	2	1
5. creating an excel spreadsheet demonstrating math or science concepts	5	4	3	2	1
6. creating a lesson which utilizes databases and giving the lesson to other students to complete	5	4	3	2	1
7. communicating with adults or other students regarding a specific topic	5	4	3	2	1
8. creating a lesson or project using Inspiration	5	4	3	2	1
9. following a specific project on the Internet (such as weather, butterflies, a scientist's adventure)	5	4	3	2	1
10. developing and presenting a completed class project	5	4	3	2	1

Other ways I use technology in the classroom:

APPENDIX E

TEACHER OBSERVATION FORM

Purpose of Lesson	Level(s) Of Technology Use	Evidence for Use on that Level

Grade Level: Subject:
Length of observation: Notes:
Observer: _____ Date: _____

APPENDIX F

INTERVIEW QUESTIONS

WITH RATIONALE FOR EACH QUESTION

1. How long have you been a teacher at (name of school)?
(If less than three years): Where did you teach before?
   (Purpose of question: Tests Levan and Wadmany's [2006] assertion that a teacher teaching in a technology rich environment for at least three years will change their beliefs and practices to align with the school community.)
2. How do you define technology integration?
   (Purpose of question: Looks at teacher's definition of technology integration.)
3. How did you become proficient in technology?
   (Purpose of question: Looks at issues concerning how teachers become experienced in the use of technology.)
4. In your opinion who has the greatest effect on your use of technology and why?
   (Purpose of question: Looks at the role of individuals such as ECSs, principals, assistant principals, fellow teachers, and college course work in determining who helps teachers become technology oriented.)
5. What are your goals for using technology in your classroom?
   (Purpose of question: Looks at teacher's goals and beliefs which will be compared to results of observations as suggested by Ertmer et al., 1999.)
6. Describe for me how you develop a lesson using technology.
   (Purpose of question: Looks at teacher's underlying goals for using technology as discussed by Ertmer et al., 1999
7. Estimate how much of your school day your students use technology.
   (Purpose of question: Looks at fidelity of implementation of technology as discussed by Radlick, Stefl-Mabry, and Theroux [2006]).
8. What, in your estimation, are the advantages of students using technology in school? (Purpose of question: Looks at teachers' beliefs about technology use with students as discussed by Ertmer et al., 1999.)
9. What, in your estimation, are the disadvantages of students using technology in school? (Purpose of question: Looks at teachers' beliefs about technology use with students as discussed by Ertmer et al., 1999.)
10. How important is the accessibility of technology to you?
   (Purpose of question: Looks at accessibility issues as suggested by Becker and Ravitz, 2001; and Ertmer et al., 1999.)
11. Do you think you would be able to integrate technology as effectively if you did not have the accessibility you have now? Why or why not?
   (Purpose of question: Looks at accessibility issues as suggested by Becker and Ravitz, 2001; and Ertmer et al., 1999

12. Is there anything else you can tell me about your experiences with technology or beliefs about using technology? (Purpose of question: Open-ended for more information.)

APPENDIX G

INTERVIEW QUESTIONS

1. How long have you been a teacher at (name of school)?

   (If less than three years): Where did you teach before?

2. How do you define technology integration?

3. How did you become proficient in technology?

4. In your opinion who has the greatest effect on your use of technology and why?

5. What are your goals for using technology in your classroom?

6. Describe for me how you develop a lesson using technology.

7. Estimate how much of your school day your students use technology.

8. What, in your estimation, are the advantages of students using technology in school?

9. What, in your estimation, are the disadvantages of students using technology in school?

10. How important is the accessibility of technology to you?

11. Do you think you would be able to integrate technology as effectively if you did not have the accessibility you have now? Why or why not?

12. Is there anything else you can tell me about your experiences with technology or beliefs about using technology?

APPENDIX H

EXAMPLES OF TEACHER OBSERVATION FORM

Purpose of Lesson	Level(s) Of Technology Use	Evidence for Use on that Level
Show students how to use the internet for research.	Level 1	Teacher used projector, laptop, and Smartboard to demonstrate to students how to do a search on Yahoo! Kids. She was getting the students ready to do their research on the computers. They are researching their assigned Native American tribe. (Observation)
Getting students ready to do research.	Level 1	Teacher's lesson plans: "Show students the correct website to search on Yahooligans."
Lesson plans stated that students would begin research using books, computers, and Smartboard	Level 3	Students used computers to begin researching Native American tribes.
	Level 3	Teacher helped a group of 2 students use the Smartboard to use the search engine to research their tribe. Students worked the Smartboard to locate websites. One student underlined words as another student read aloud.

Grade Level: 3rd Grade (Portable classroom) Subject: Social Studies (Research on Native American Tribes)

Length of observation: 30 Minutes (2:10 to 2:40) Notes: See Observation Continuation Sheet

Observer: Barbara Radecki Date: January 12, 2009

EXAMPLES OF OBSERVATION CONTINUATION SHEET

Grade: 3rd
Date and time: January 12, 2009 2:10 to 2:40

Technology Available:
5 computers (Dell GX 745)
ELMO (digital camera)
Smartboard (interactive whiteboard)
Laptop
AV Cart

Layout of classroom
4 groups of desks with 5 students in each group
20 students total with 18 present (2 white, 16 Hispanic)

Teacher discussed the benefit of using an article on the internet rather than a picture on the internet because a picture doesn't always show what all is going on.

Level 1 instruction led to level 3 use. In this case demonstrating learning to use technology is the beginning step to using technology to learn.

Smartboard: teacher and students used the board to bring up Yahooligans web site to do research on Native American tribes.

Students were also using books from the classroom library to do their research.

In a discussion with the teacher, she said the students will research their tribes, and create a book on the computer and a hands-on project as their final projects. They will use the laptop cart when the students begin typing their reports.

Students were not allowed to print the websites; they had to take notes, just as they did when using the books.

The teacher used the concept of students teaching other students on the computers. She pointed out that the best way to learn something is to teach someone else. She teaches a computer skill to three or four students, and then has them teach others.

During the lesson, the teacher was a coach, going from group to group to give suggestions, answer questions, and help students stay on task.

Lesson plans (which were neatly typed up) showed evidence of level 1 and level 3. Evidence of level 1—show students; evidence of level 3—students begin research.

Group work:
2 on Smartboard
2 on each of 4 computers (1 computer not working)
8 students using books

EXAMPLES OF TEACHER OBSERVATION FORM

Purpose of Lesson	Level(s) Of Technology Use	Evidence for Use on that Level
Reading/Writing—word recognition and strengthening oral reading skills	Level 1	Teacher displayed story in reading book by projecting on screen using ELMO. Students read "Words to Remember" together. Then teacher called on volunteers to use the words in sentences.
	Level 1	Teacher displayed story using ELMO and projector. Students did group reading and whole class reading as teacher pointed to words displayed on screen. Teacher helped students get word inflections correct. Teacher pointed out punctuation which helped with inflections (examples: question mark and exclamation point). Teacher had to point out "read" in present tense and "read" in past tenses as used on two different pages.
Math	Level 1	Using projector, laptop, screen, and speakers, the teacher repeated the math lesson from yesterday on calendars by using the math's program web based lesson and projecting it on the screen for all the children to see.

Grade Level: First Subject(s): Reading and Math

Length of observation: Reading: 1 hr 8 minutes (9:07 to 10:15)
Math: 40 minutes (11:25 to 12:05)

Notes: See continuation page

Observer: Barbara Radecki

Date: January 28, 2009

EXAMPLES OF OBSERVATION CONTINUATION SHEET

Grade: First
Date and time: January 28, 2009, 9:07 to 10:15

Technology Available:
Waterford computers still broken

Student Composition
18 students; 2 white, 13 Hispanic, 3 absent

Lesson
9:07: Impressed by the enthusiasm—the aliveness—of the room (music in background—teacher's vibrancy). (Following her own philosophy that learning should be fun.) Reading/Writing—form of making words. Students have paper squares with individual letters that make up their spelling words. Students make spelling words from the letters. Teacher checks their words. If the word is spelled correctly the teacher says, "Write it." And the student writes it on their paper. Students also need to know when to use capital letters. After correctly spelling and writing 10 words, students get one M&M to eat. Students appeared to be enthused. After getting a treat, a student turned the paper over to use the words to write silly sentences. (Spelling words: which, whiz, match, quit, who, quiz, quick.)

On student was helping another student spell a word. The students appeared to enjoy showing their sentences to the teacher, who complemented them on the sentences and suggested needed improvements when necessary: "What comes at the beginning of a sentence?"

9:20: Teacher called students together by saying, "One, two, three, eyes on me." The students responded, "One, two, eyes on you." Teacher: "Put your words away and take out your readers. One, two, three—go."

"Who can give me a sentence using about?" Called on student who said, "About what?"

Students and teacher discussed vocabulary words in story they were about to read: about, books, by, family, grew, read, work, writing, When a student used a sentence with the wrong "by," teacher explained difference between "buy" and "by."

Teacher displayed the page they were going to read on the projector using the ELMO, while the students had the same book open in front of them. The vocabulary words were highlighted in yellow in the book. The teacher pointed to the words as the students read them. The students read aloud the words not in yellow and the teacher read the yellow words. Teacher: "Put your finger on the author." The teacher then pointed to the author's name. One group read the page together out loud. Then the whole class read the next page together out loud. Repeated, using different groups. Read 3 or 4 pages.

9:37: Teacher: "We are going to stop now to do sentences. We will finish reading the story tomorrow."

As teacher went to get students' worksheets, she realized she had not run them off. She asked me to run off 20 copies. The teacher and students finished reading the story while I ran off the 20 copies in the teachers' workroom.

Students and teacher read two sentences teacher had written on the board. Then the teacher covered the sentences and gave the paper with the letters of the words spelled phonically instead of correctly (hu cwit that cwis sou Cwik for Who quit that quiz so quick? and wich wiz wil mach mi crd for Which whiz will match my card?). Students worked in teams to fix the errors.

Teacher projected the paper the students were working on, on the screen.

9:54: three kindergarten children who are reading came into the classroom. They picked up their folders from a counter in the room and sat down at the table where I was sitting. Inside the folder were a list of words (what, no, see, look, come) and a booklet entitled The Box. These students sat quietly, watching the class continue to work.

The teacher corrected the paper being displayed as the students explained what mistakes to correct. (Students were verbalizing in English; they were using proof marks to show errors, then making the corrections.) Spelling and language skills were emphasized throughout this activity. The students wrote the corrected sentences on their paper. Cwit and Cwik (quit and quick) gave students problems. (Teacher and students "raced" to see who could get sentences written first and still be neat and legible. Teacher won.) The kindergarten students continued to watch quietly.

10:05: Teacher: "Put these papers in your green folder. We are going to start numbers." The students' folders were in the pockets of their Seat Sacks on the back of their chairs. The teacher did not use the ELMO and projector as she showed the students the book they would be using in Centers.

The centers consisted of students doing their assignments in their book by teams (which were the tables at which they were sitting). The teacher then began working with the 3 kindergarten children. She had them take turns reading their words to her. Then they read two pages from their booklet.

Two boys wanted to use the restroom, but there was only one pass, so they did rock, paper, scissors to decide who would go first. The boy who won went while the other waited his turn.

As the teacher was working with the kindergarten children, the class got noisy. The teacher made them put their heads down for one minute, but they needed to watch

the clock. After two minutes the teacher reminded them that they only needed to keep their heads down for one minute.

The kindergarten children took turns reading each reading the same page. Then all three read the page together.

10:45: The kindergarten children left. I went on to another class to observe.

11:25: As I entered the room the students were in groups of four seated on the floor and all had small whiteboards and markers. Teacher: "What day comes before Thursday? Write your answer on your board." Pause as students wrote their answers. "Okay—now show your boards in your group. If you don't all have the same day, talk about." Some wrote Wed and some wrote Wednesday. Teacher: "Erase your boards."

Teacher:"Which month comes after May? Write it down." Quiet as students worked. "Ready? Show your teammates." Children's answers from various groups were May, April, and January. Teacher noted to me that students were having trouble with positional words. Teacher asked class, "What month comes after May?" Several responded, "June."

Teacher had math web site ready for log in. She logged in and clicked to the math lesson from yesterday to repeat lesson. The program began with "Words to Know."

Projected on the screen from the math lesson was a calendar of June with day s of the week marked across the top and the month, June, labeled across the top. Teacher: "What day of the week does the month start on?" The program discusses day, week, month in the calendar. Program asks, "How long is one week?" Students guessed different numbers. Teacher: "Tell me one day of the week?" Student: "Monday." Teacher: "Yes, so how many days in a week?" Students guessed 11, 30, 7, 71, 8. (The month was still projected in front of them.) Teacher listed tally mark as students listed days of week. All agreed there are 7 days in a week. Teacher: "How many weeks in the month?" Students had trouble figuring this out—even with the calendar in front of them.

Teacher controls how fast the lesson progresses. Teacher repeated days of the week. Students got terms days, weeks, and months confused. Teacher: "How long is a year?" Student, "12 days." Students could recite months of year together, but still confused terms days, weeks, and months.

Program asked, "How many days does June have?" First student: "30 months." Second student: "30 days."

Teacher: "How do you know how many days are in June?" Calendar of June was still projected on the screen. The students also had difficulty reading the calendar in front of them.

Teacher: "Why do we know the first day of June is a Wednesday?" Five students could not read the calendar. ELL students appeared to have trouble verbalizing.

Program asked: "What is the last day of the month of June?" Teacher: "Who can tell me?" Two students raised their hands. One went up to the screen and pointed to the 30; the second said Thursday.

11:50: Level 1 use: The teacher projected the worksheet using the ELMO ad projector onto the screen. The paper was on Problem Solving using the months of May and June which were printed on the paper. The teacher read the first question, and a student answered correctly. The students circled date and wrote day on the line on their worksheets.

11:55: Teacher handed out lined paper to each student. She told the students to number from one to four on their paper. She asked four questions:
#1: How many days in the week?
#2: How many months in a year?
#3: How many days are we in school in one week?
#4: What day did January start on? (There was a class calendar featuring January on the wall bulletin board.)

Level 1 use: Teacher used a sheet of student lined paper and wrote the questions projecting them onto the screen with the ELMO and projector.

12:03 Teacher began calling on students to answer the questions. First student got number one, 7 (right); second question, one student said 9 and a second answered 12. Third question, student got right – 5. Fourth question, second student answering got day –Thursday. One student called out, "I did it!" Teacher answered, "Good job!"

12:05: Teacher handed out lunch cards and students lined up for lunch.

EXAMPLES OF TEACHER OBSERVATION FORM

Purpose of Lesson	Level(s) Of Technology Use	Evidence for Use on that Level
Reading skill building	Level 1	Used overhead projector to project Question of the Day, "What kinds of foods and songs do you think Chester Cricket and his friends can find by scrounging on the Times Square?"
Reading skill building	Level 1	Used tape player to play recording of story as students followed along in their text books. Narration had different voices for mouse, cricket, and narrator. (Although there was student involvement as they followed along, there was no direct student use of the technology.)
Aid students' visualization	Level 1	Teacher showed pictures of Times Square in New York from the web on the Smartboard. Pictures helped students understand the setting of the story they were reading. Teacher also demonstrated use of Google to research Times Square. Students saw the demonstration projected on the Smartboard.
Develop reading skills	Level 2	Students used the computer and the software program Success Maker to practice reading skills during center time in reading class.

Grade Level: 4th Subject: Reading
Length of observation: 95 minutes (9:15 to 10:50)
Observer: Barbara Radecki

Notes: See continuation sheet
Date: January 26, 200

EXAMPLES OF OBSERVATION CONTINUATION SHEET

Grade: 4th
Date and time: January 26, 2009, 9:15 to 10:54

Technology Available:
5 computers
1 networked printer
LCD Projector
Smartboard
For this session: overhead projector and tape recorder/CD player

Class Composition
6 groups made up of desks—5 desks in 5 groups and 4 desks in 1 group—for a total of 29 students. One student was absent; 28 present. Of the 28, 1 appeared to be while, 2 black, and 25 Hispanic students.

Lesson
9:15: When I walked in the class was working quietly on the Question of the Day. Another adult entered the room and talked to the teacher for over three minutes—the students in the room continued to work quietly.

Teacher told students to discuss their answers in their groups. Students discussed question among their groups, but several students in each group were talking at once. Teacher walked around room, then stopped the class and had one table demonstrate how one student was to suggest one thing while the other students listened, then another student would suggest one thing, and so on, going around the group as many times as they had time for, sharing as many ideas as possible. She then had the class continue sharing their ideas in their groups.

The class is set up to function student-centered. The teacher served as a coach and a guide as she walked among the groups.

Teacher next told the students to take out their reading books and turn to page 328. She asked what the genre was of the story they were reading. Several students answered fantasy. The teacher then asked what fantasy was. The students' responses were that it was made up, unrealistic, not real. During this discussion, one student quietly got up, got a drink, and then sat back down again with interrupting the class.

The teacher began playing the story on the tape recorder/CD player, and the students followed along. As they followed, there was no talking among the students; the simultaneous rustle of pages being turned indicated the students were following along as the narrator read the story. While the students were listening to the story, the teacher was working on the computer attached to the projector, getting ready for the next section of the lesson.

[Student work was on display on the bulletin board.]

All but one of the students appeared to be following along. The one student sometimes looked around the room, and sometimes looked at his book. The room arrangement was pleasant. The story lasted 10 minutes and the students did not talk during that time, but appeared to be following along.

The teacher stopped the tape and asked the students to make a prediction—will the cricket stay in NYC or leave? The students gave their predictions of what they thought the cricket would do. The predictions were given to the whole class, one student at a time.

The teacher then showed the students some pictures of Time Square from the computer (projected onto the Smartboard). She pointed out the buildings, the people, and the traffic. She asked the students if they had a better picture of where the story took place. They responded yes. One student collected the Question of the Day papers and gave them to the teacher.

The teacher then gave them an assignment to pretend they were Chester the Cricket in Times Square. What would they see? The students were to draw a picture of what they would see if they were Chester. (The purpose was to help the students see from Chester's point of view.) The teacher put on classical music and had it playing softly as the students worked. Again, the students were on task; there were no side conversations. The students were drawing in pencils on plain sheets of typing paper.

After all the students were working, the teacher assigned students to three centers: the first group was to continue working on their visualization project; the second set of students were working with the teacher and were to bring their individual white boards and markers; the third groups was to do Success Maker on the five computers.

The students going to the computers walked quickly (there was no running, but no dawdling, either). They sat down and immediately brought up the program. There was some off-task discussion as the students waited for the program to load. Once the program came up, the students began to work. One student helped another with the directions on the screen.

The classroom had the district minimum of six drops per classroom which enabled the five computers and networked printer to be connected directly to the server.

The group of students working with the teacher sat on the floor around the teacher, who was also sitting on the floor. When the telephone rang, and the teacher answered it, all students continued to work. The group of students at the front of the room waited quietly for the

teacher to return. Most students ignored my presence, but two did look at me. I smiled and they smiled back, and then went back to work on their assignment.

The students working at the tables worked quietly—staying on task. A few occasionally talked among their group, but quietly. The students working with the teacher responded in soft voices—a low murmur. The classical music was still audible in the background. Students occasionally left for and came back from special classes. They did this without interrupting the other students.

The students working on the computers sometimes read their screens out loud. (There were no headphones and the computer speakers were turned off; the students had to read the directions on the screen and follow them on their own.) Three students at the computers finished their sessions and went back to their seats. Two students continued working. One finished shortly thereafter and went back to her seat, while the fifth student continued working intently on the program. The four students spent about 15 minutes at the computers, while the fifth spent about 30 minutes.

Students groups were called teams and each team had a name. The teacher assigned students to new centers by their team names. A new group of students went to work with her and a new group of four students went to work on the computers.

10:30: This new group of students got right to work on the computers—there was no talking among them. The students appeared engaged as they worked on the computers.

10:35: There was an intercom call for a student to go to another office. The student did not know the location of the office, so a second student went with him to show him where the office was located. The level of noise remained a low murmur and the classical music was still audible in the background as the students continued to work.

10:45: The first girl from the first group was still working intently on the computer.
10:46: The girl from the first group finished and went back to her sear, and began working on her visualization project.
10:47: A boy from the second group finished work on the computer, followed almost immediately by a second boy.
10:49: Students working on visualization picture began to finish up. When they did they began reading an AR book. (AR was a reading program called Accelerated Reader. Students read books on their level and then take test on their comprehension of the book.)
10:51: The third student finished her work on the computer.
10:53: The fourth student from the second session finished his session on the computer.

Example of the respect the students have for one another: A girl came into the room and went to sit down at her desk, but the chair leg of the boy sitting next to her was blocking her chair leg. She learned over and quietly asked him to move his chair. He did so immediately, allowing the female student to sit down.

(Reading ended at 10:54)

APPENDIX I

EXAMPLES OF FIRST INTERVIEW TRANSCRIPTION

ID: 7679
Location: Picnic Bench on the Playground
Date and Time: January 8, 2009, at 7:30 AM
Length of Interview: 6 minutes, 28 seconds

00:01 Researcher: Okay, this is teacher number 7679.

00:07 Researcher: How long have you been a teacher here?

Teacher: Ahh, this is my third year.

00:13 Researcher: How do you define technology integration?

Teacher: Anything that utilizes, umm, an advancement of (pause), I guess technology in general: ummm, computers, calculators, Smartboard. Anything that has an outlet or is battery operated, I guess, would be considered technology in my eyes.

00:38 Researcher: Okay. And, how did you become proficient in your use of technology?

Teacher: Umm, I'm actually still becoming proficient. Umm, I'm learning something new every day. As a teacher, it is very important to continue learning, and to continue learning about technology because this is the stuff our kids are going to be using in the very near future.

00:58 Researcher: Yeah. In your opinion who has the greatest effect on your use of technology and why?

Teacher: Umm, who has the greatest use?

Researcher: The greatest effect on your use?

Teacher: Umm, both administration and our ECS, our computer person here at school because they, umm, provide us in-services and allow us opportunities to use the technology, and, I guess, that's pretty much—like they help us—I'm sorry—they teach us how to use it and how to integrate it into our classroom, and every day use.

01:31 Researcher: Okay. What are your goals for using technology in your classroom?

Teacher: To become more proficient, to have more opportunities for students to use the technology—umm, more projects, more time coming up to the Smartboard, more time to use laptops to type, and, umm, just to get them more involved with technology than I have in the past.

02:01 Researcher: Okay. Umm, describe for me how you develop a lesson using technology.

Teacher: My lessons? Umm, it depends what lesson it is. If it's a math lesson, I have the laptop set up with a projector, and it's all on the Smartboard. And so, I use the Smartboard and the projector, and the laptop for my math lesson. Umm, if it's a reading lesson, I usually use the ELMO—it's like, umm, it's like a camera and overhead—and I write and stuff, and that's part of the technology in reading. And then the kids go to the computers, and so it just depends on which lesson it is, but I try and get as much technology in it. There's always something to do with computers, and so I see what the lesson's about, what the standards are, and how I can fit technology into that.

02:54 Researcher: All right. Umm, estimate how much of your day your students use technology.

Teacher: I would say at least 50%, because they spend a great deal on the computer and coming up to the Smartboard, and you know I do teach lessons whole group, so they do it in their work, and then they come up and show it on the board, so I try and use as much as possible.

03:17 Researcher: Okay. What, in your estimation, are the advantages of students using technology here at school?

Teacher: Umm, some of the advantages are: when they get to high school and they have to do projects or they have to do powerpoints and they already have that exposure of how to do these things. Umm, computers are everywhere, and it's becoming more of a society that uses computers and uses technology, and so when you go to McDonald's you have to plug everything into the computer. Well, if you don't know how to use the computer, how to turn it on, or how to do that, then the students are going to struggle with a job at McDonald's or whenever they may work. So, (pause) you know, my time, that's–when I went to school in elementary, we started typing. These kids don't get, umm, a great opportunity to type, so it's up to us to provide that opportunity so when they go to high school and have to type all their papers on the computer or word processor or something they have that exposure.

04:15 Researcher: Okay. Well, what, in your estimation, are the disadvantages of students using technology in school?

Teacher: Umm, well math in particular, one of the disadvantages I see is the kids rely on it. They don't know how to do mental math. They don't know how to make change for five dollars unless the computer tells them how to make it. So you have to teach

both with the technology and without. So if the technology does crash or doesn't work, because that happens most of the time when you need it to work, that they're not a fish out of water, they know how to do it even if the technology doesn't work.

4:50 Researcher: Okay. How important is the accessibility of technology to you?

Teacher: Extremely. Without the, without having technology, or without being able to go somewhere to use it, it isn't possible to teach it.

05:04 Researcher: Do you think you would be able to integrate technology as effectively if you did not have the accessibility that you do now?

Teacher: It would be more difficult. I don't know if—it wouldn't be impossible, but it would be extremely difficult. I'd have to find other outlets.

5:19 Researcher: And the last question, is there anything else you can tell me about your experiences with technology or your beliefs about using technology?

Teacher: Umm, the one thing I wish that the students here had, we just got one this year, is a computer lab. But I remember that was one of my specials—that we had to go into the computer lab; they taught us how to type; they taught us how to do searchers; they taught us all these different things, and that was a class. So, like, we kids, we'd go to music and PE and art. We'd also have to go to technology. And the kids don't have as much of an access and because this is a lower income area it is more difficult for, or not as probable, that these kids have a computer at home. so a lot of them do go to the library to use the computer, which is always a plus. So (pause) I just—technology is a great thing, but it seems like it is also a downfall, so you have to find that happy medium in between, for both. That's my goal.

06:22 Researcher: Okay. Thank you.

APPENDIX J

EXAMPLES OF SECOND INTERVIEW TRANSCRIPTION

ID: 7096
Location: Teacher's second grade classroom
Date and Time: January 26, 2009
Length of Interview: 9 minutes, 13 seconds

Researcher: Okay, this is teacher 7096. Two years ago the school made high achieving. What role do you think technology played in that achievement?

Teacher: We've had really good ECS people, we've had good technical support. That was fortunate because they were able to train. I think the training part of it, I don't how I can work that in exactly to that question but the training part that our ECS did was phenomenal. And they're very good like they got these two out here. And so I guess my – – the Title I funds that were available all of these computers have Title I funds, the fact that they were able to provide these – – most of our kids don't have access to this type of thing at home. I have three kids in my class that have parents that can even access their grade book. They make it available but if your parents can't get to it – – I'm trying to better answer this directly. I think it definitely did help a lot that we did have the computers necessary. Sometimes I think it would be nice if we had more, but that's probably not going to happen.

Researcher: I know that they're planning to set up a computer lab. Do you think you will be using it?

Teacher: We definitely will.

Researcher: How do you hope to utilize this?

Teacher: Before we ever get started, and of course they don't know how to type so that you know we're not to be able to teach them to type, but we want, you know, them to know all the different capabilities of the computer: what a computer can do. I'm doing an afterschool program with technology and most of the kids know one or two ways to get the games. And that's about it. They don't know the parts of the computer, how a computer functions, hard drive or anything. The first priority is to kind of let them know what they can do it's like having a toolbox and only knowing how to use two tools and you have 100 tools in your toolbox. So that's the first priority is to get them taught how to access information, how it works. And then to let them

try different things whatever it might be: how to do CDs, DVDs, how to access certain things on Internet, how to do research. It depends on the grade level, too, I kind of in my mind think second-grade as I speak, but I also have to think of fourth and fifth, they would do more research than the younger kids.

Researcher: How do your students respond to using the computers and other technology?

Teacher: The same way they do television and stuff in general. They just, they're magnetic to them. And they're very focused, and when they want to get some where they concentrate
well enough to where they can do it at least as well as some of the adults, and even better sometimes on doing some things. So they're very focused in their attention because it gets them where they want to go.

Researcher: I noticed the other day when I was observing one of the students was being assigned to Waterford he said, yes! (Both laugh) Do you think of the software that the students are using now will help, will help them when it comes time for accountability tests that we have like CRTs and IDMS and stuff like that?

Teacher: In the future do you mean?

Researcher: Well like this year and as time goes by.

Teacher: Oh I see what you mean. I was thinking in terms of utilizing the computers to administer tests. As far as (pause) hopefully I hope it helps to do the synapses and build the bridges and to start to make them think creatively you know if it's done right. So I hope that this will expose them to things they might not have been exposed to. One good example is when I do, this is teacher guided, but when I do use it to show different vocabulary that they might not know because their second language that helps when you can see an ostrich instead of just talking about what one looks like if you've never seen one. It would be nice if I could bring one in the classroom but for those types of things technology certainly has been helpful. Like on the screen I have put ostriches. And on the other screen I actually have bananas becoming ripe and that was one of the vocabulary words too. (He uses pictures as desktops on the computers to help develop vocabulary words.) This week though the vocabulary is a little more difficult to do that with a picture, but sometimes if I can do it, I'll show you my ripening bananas. They had to know what ripening means. So I said are those ripened? But they're like what is that? I said those are bananas.

Researcher: Where do the vocabulary words come from?

Teacher: They come from the Trophies book. They focus in on certain concepts and vocabulary. It's pretty good with vocabulary, there's a lot. There's grammar, and phonics, and those kinds of things so. I can use these two together and make it stronger.

Researcher: Wonderful. I know when I was observing Monday you asked him about energy and the ones that power. So they're getting it. Describe for me what

technology components your ideal classroom would have. If you have anything in the technology world in your classroom what would you want to have?

Teacher: I like to have, this sounds like Lala land, but it would be nice to have I mean you know this is Las Vegas and you've been in the bars where you can actually peek on top of your computer where you some have a game and have video poker, it would be nice if each

desk had a black screen where it looked black most of the time but when you want to utilize the technology that they could easily do so it would be right there underneath the actual desk itself and be part of the desk they wouldn't actually be touching at all of the time because the life of our computers are sometimes diminished because they're a little rough on the usage. That's part of what I do after school is teach them how to be gentle with technology and how to shut it down properly. If I had more control and it was just one big central control and I could shut things down and open it up, it would be wonderful. If I hit a lottery maybe I'll do that for my class.

Researcher: Wow, that sounds like a pretty good idea! I like that. Describe for me what an ideal day in your classroom is like.

Teacher: When everyone shows up, and the behavior is good and focused, and we have a lot of exciting material planned and prepared and I really feel, you know, rested and ready to go. Those are the kinds of days go really, really well. It's because when they're actively engaged and they're interacting with one another and there's lots of interesting things to do which I try to make everything interesting even though sometimes it's just, you know, you got to do the academics. Then the day goes the best and they love being here and they don't want to go home. That's when I feel like I've always done my job if they want to stay.

Researcher: interesting. In your lesson plans do you put technology as a part of them?

Teacher: In there you will sometimes see an SV to be honest with you. They're not always thrilled, sometimes they think they're just movies. So I'm a little gentle in my approach and putting them in my plans sometimes I'll like an SV. Let me see what I have here, on the second page particularly, and that kind of tells me what I'm doing. Like if I'm doing something on the Chinese new year and I pulled this off with technology about the Chinese and the teachers say we have a weekly reader and then we have a streaming video that is also Chinese new year and that SV to me tells me that I want to do a little segment maybe 10 or 15 minutes. They really don't want more than about 15 minutes because they're still thinking in terms of the videos. So you got to be careful about the perception that they don't go home that all they do is watch movies. So and you know that isn't the case, so I usually 15 maybe 30 minutes a day with differing, you know, combined different things, but I don't want to go to

much more than that I see I have CV there which is streaming video. But unless you know what I'm writing.

Researcher: So is there anything else about technology and your use of it or your belief in it or your philosophy of it that you would like to share with me?

Teacher: That's like what you think of the Bible? (Both laugh) I just think it's really exciting and if you can give them the best that you can at the public school. Our computers are couple two or three or four years behind things that are happening out there. For example Google is coming up with a central database server where you'll just have portals, and I don't know if I like this, but you won't actually need a hard drive everything excesses this central brain. There so many new and exciting things that they better be prepared and they better understand where things are going. For them usually they're open-minded enough, that it's the adults that are more impaired and inhibited as far as the technology than it is the kids. So they're excited to find out every single possibility, but they have to know in order to even jump into it. It's like a language—you have to know something about it even be able to jump into it and know, know where things are going, the earlier the better, just like in a language.

Researcher: Well thank you very much.

APPENDIX K

RESULTS OF FIRST INTERVIEWS

My first interviewee was the kindergarten teacher who had been teaching at the school for nine years. The kindergarten was full-day because of Title I. The technology in her classroom consisted of six student computers known as Waterford computers, two printers connected to the computers, and one teacher computer with a connected printer. She also had an overhead projector, but no screen. She described how two years ago she had requested a screen be placed in her room, but when the maintenance personnel came to hang it, they were unable to place it on any wall because she had whiteboards on all four walls, whereas most classrooms had at least one brick wall. Since they would have to move the screen out from the wall, they needed a specialist to hang it. That was two years ago, and she was still waiting. She also had a school-issued television and a DVD player for the television that she purchased with her own money. She believed it was critical for her students to experience technology at school because it was so necessary for their futures and most of them had little or no exposure to technology at home.

She explained the Waterford software program, which taught basic reading and math skills, and exposed the students to basic scientific principles. She further explained her rotation system in which each student was on the computer twice a day for about 15 minutes. When a student finished a session, the name of the next student would appear on the screen as it was spoken to the child. The student then left the computer and got the next student, who began working on his or her session.

The second teacher interviewed was a third grade teacher who had been teaching at the school for three years. Her classroom was in one of the portables and the technology consisted of five computers, a Smartboard, an ELMO, a projector, and a laptop. She began using computers in elementary school and believed strongly in the need for her students to learn to use technology because our society was becoming technology-based and students needed to know how to use technology, even for jobs at McDonald's. These students had very little exposure to technology at home, making it all the more important for them to learn to use technology at school. She estimated that her students used technology about 50% of their day using computers and the Smartboard.

A second grade teacher who had taught at the school for nine years was the next teacher interviewed. The technology in his classroom, also located in a portable, consisted of six older computers, three with Waterford and three with Lexia programs installed; two printers; an overhead projector; a television; and a projector, which he purchased with his own funds. He estimated his students used technology around an hour a day: directly by using each of the two software programs about 15 minutes each, and indirectly through his presentations of video streaming or power points. He, too, believed it was important to expose his students to technology because it

was a vital part of their future, and they did not have many, if any, opportunities to use technology at home.

The fourth teacher interviewed, a first grade teacher, had also been teaching at the school for nine years. She laughingly explained she was considered the technology guru of the school because she loved computers, had always loved computers, and began her "love affair" with computers with an old Mac computer. Further, she enjoyed helping other teachers with computers and other technology. The technology in this classroom consisted of eight computers (five older and three newer), a Smartboard, an ELMO, a projector, and a laptop; however, she explained, she was not happy with the Smartboard because the only place to put it blocked her vision of the door, and there were wires all around the area. She estimated her students used computers about 15 minutes a day: low students on Waterford and the others on Lexia. However, her Waterford computers were down. She also used the ELMO, projector, and laptop throughout the day for presentations. She believed that technology was a great teaching tool because it provided the teacher with variety, and the more variety a teacher used the greater her effectiveness as a teacher. Like the other teachers interviewed prior, she believed the students needed to use technology at school because of their futures, which would be in a technology-based society.

A fourth grade male teacher, the next interviewee, was in his second year of teaching at the school. The technology in his classroom consisted of five newer computers, a networked printer, a Smartboard, an ELMO, a projector, and a laptop. He believed technology use at school could help equalize the disadvantaged students with their more advantaged peers. He understood the importance of technology as a student, with its ability to make his life easier, and he wanted his students to have those same technology skills to make their lives better. He estimated his students used technology about 45 minutes to an hour per day, to include direct computer and Smartboard use, and indirect use watching teacher presentations.

The last interviewee, a female fourth grade teacher, was in her fourth year of teaching at the school. Her classroom consisted of five computers, a Smartboard, a laptop, and a projector. She estimated her students used technology about an hour a day with the computers being part of her center arrangement. She, too, believed the students needed to learn technology because it was going to be a vital part of their future.

Five of the six teachers, when asked about the accessibility of computers, stated they would not be able to use computers as much if they were not in their classroom. The first grade teacher, however, indicated she had used the computer lab before it was dismantled a few years ago, and would be using the computer lab again. To her, it was just as convenient to use the computers in the lab as it was to use them in the classroom.

APPENDIX L

RESULTS OF FIRST OBSERVATIONS

Walking quietly into the classroom of fourth graders ten minutes after the start of the school day, I was impressed with the diligence of the students. They were reading a story about a hiker lost in the woods, and the procedure involved class and group oral reading. The teacher projected a copy of the story using the ELMO and the Smartboard. The oral reading was followed by reviewing questions and locating the answers within the story.

The classroom arrangement consisted of eight groups of three or four student desks, and two work tables. There was no teacher desk. Of the 28 students present, one was white and 27 were Hispanic. The layout of the room facilitated group work, and the teacher occasionally asked students to check answers with their shoulder partner or their face partner. He gave them 30 seconds to check with either the person sitting next to them or the person sitting across from them. Students in groups of three simply discussed with each other for the full minute.

The teacher directed students to take out their reading books and began to prepare them for a story set in Chicago by showing them pictures of the Chicago skyline during the day and night, Lake Michigan, and Wrigley Field. Classical music played quietly in the background as the students prepared to read the story from their textbook.

Walking into the kindergarten classroom, I found the room packed with five year-olds. The teacher, who had just returned from specials, had a double class because another kindergarten teacher was absent and there was no substitute teacher available. This teacher's management skills were amazing. There were 50 five year olds: 49 Hispanic students and one African-American student. The teacher had her class sit at the tables and the second class on the carpet. She assigned six students from her class to begin work on the Waterford computers, placed two additional chairs at each table to accommodate additional students, and then began assigning activities to groups of students at the tables and sitting on the floor.

The students at the Waterford computers worked on their lessons. When students finished their lesson they got up, looked around the room for the student whose name was on the screen (the name was also spoken to them by the computer), went over to that student, tapped him or her on the shoulder, and pointed to the computer. That student walked over to the computer, sat down, put on the headphones, and began the lesson. The students knew exactly what to do and did it without disrupting the class. One student could not find the student he was looking for, and quietly went up to the teacher, waited politely until she asked him what he needed. He told her the name of the student he was looking for, and she called out the student's name. He stood up, the teacher pointed to the computer, and he went

over to the computer to begin his lesson. Watching a kindergarten teacher handle 50 five year olds in a room barely large enough for 25 little bodies was truly amazing!

The second grade classroom I next observed had only eight students present when I entered, as five were at their special education class, and several students were absent. The layout of this classroom consisted of four tables with six students at a table. While six students worked on Lexia and Waterford on the computers, the teacher met with the two remaining students at the reading table. On the back of the students' chairs were "seat sacks" to hold students' belongings such as books, paper, pencils, etc.

The students on the computers appeared to be engaged. One girl helped a boy who had accidentally closed out of his program restart it. Two students on the Lexia computers did not stay on task the whole time, although they did finally get back on task. Keeping them focused appeared to be a problem. The older computers were slow, and one made a funny grinding noise because it had a hard drive going out. The teacher was hoping for new computers. When three of the five students came back from their special education session, they joined the teacher at the reading table.

The first grade students I observed next were getting ready for their math lesson. This classroom had four tables with four students at each and one table with two students for a total of 18, two of whom were white and 16 Hispanic. While the teacher was getting the technology ready (turning the projector on, turning the laptop on, and getting connected to EnVisions math web site), she had her students stand at their table with their individual whiteboards (like small chalk boards) and markers. She asked them a question and students wrote answers on their boards. The teacher told the students to put their heads together and check their answers. When she was ready, she instructed the students to put their boards and markers away, and sit in their seats, being certain they could see the board.

While going through the math lesson from the EnVisions web site, the teacher asked for student input on every screen in an attempt to get them to think. While working on their worksheets, they checked their answers with "their shoulder partner." The teacher reminded the students to tell their shoulder partner, "good job," a task the students appeared to enjoy.

Upon entering the room of the female fourth grade teacher, I was impressed with the diligence of the 25 students present. The students were working in three groups, researching American explorers for a social studies project. There were students at the front of the room working on the Smartboard, using the Google search engine to find information about Joseph Walker. As they looked at web sites, they discussed the information and took notes from the board. The students on the computers, the second group, were researching Kit Carson as they took notes for their social studies project. The other students were working at their desks using textbooks and handouts to do their research. One student went to the library, returning with an encyclopedia volume to look up her explorer. The teacher went from group to group coaching by answering questions giving suggestions. The students were well-behaved, sitting at their desks working. The volume of talking was at a normal level—no one was yelling. No students were out of their seats or displaying off-task behaviors. This classroom layout consisted of six groups of desks with five students in each group, for a total of 30 students, with 25 present.

The third grade classroom, the next class to be observed, was also working on a social studies project: researching a Native American tribe they had chosen. Here again there were three groups of students: two students at the Smartboard, six on the computers, and eight using books from the classroom and the school library. All the students were required to take notes--none were allowed to print out web pages.

In a brief discussion with the teacher, she said the students will research their tribes, produce a book on the computer, and create a hands-on project as their final projects. They will use the laptop cart when they begin typing their reports. The teacher used the concept of students teaching other students on the computers by teaching a computer skill to three or four students, and then having them teach others. Her belief was that the best way to learn something was to teach someone else. During the lesson, the teacher was a coach, going from group to group to give suggestions, answer questions, and help students stay on task. The layout of this classroom encouraged collaborative work with four groups of desks with five students in each group.

APPENDIX M

RESULTS OF SECOND OBSERVATIONS

The second set of observations was of a longer duration and began with the female fourth grade teacher's classroom. When I walked in the students were working quietly on the "Question of the Day," which was projected on a screen using an overhead projector. Another adult entered the room and talked to the teacher for over three minutes—the students in the room continued to work quietly.

After several minutes, the teacher told the students to discuss their answers in their groups. The students attempted to discuss the question among their groups, but several students in each group were talking at once. Teacher walked around room, then stopped the class and had one table demonstrate how one student was to suggest one idea while the other students listened, then another student would suggest an idea, and so on, going around the group as many times as they had time for, sharing as many ideas as possible. She then had the class continue sharing their ideas in their groups.

The class was set up to function in a student-centered format, consisting of six groups of desks with five desks in five groups and four desks in one group. The teacher served as a coach and a guide walking among the groups.

The teacher next told the students to take out their reading books and turn to page 328. She asked what the genre was of the story they were reading. Several students answered fantasy. The teacher asked what fantasy was and the students' responses were that it was made up, unrealistic, not real. During this discussion, one student quietly got up, got a drink, and then sat back down again without interrupting the class.

The teacher began playing the story on the tape recorder/CD player, and the students followed along in their reading books. As they followed, there was no talking among the students; the simultaneous rustle of pages being turned indicated the students were following along as the narrator read the story. While the students were listening to the story, the teacher was working on the computer attached to the projector, getting ready for the next section of the lesson. All but one of the students appeared to be following along. The one student sometimes looked around the room, and sometimes looked at his book. The room arrangement was pleasant. The story lasted ten minutes and the students did not talk during that time, but appeared to be following along.

The teacher stopped the tape and asked the students to make a prediction—will the cricket stay in NYC or leave? The students gave their predictions of what they though the cricket would do and why. The predictions were presented to the whole class, one student at a time.

The teacher then showed the students some pictures of Times Square in New York City, the setting of the story, from the computer (projected onto the

Smartboard). She pointed out the buildings, the people, and the traffic. She asked the students if they had a better understanding of where the story took place. They responded yes. One student collected the "Question of the Day" papers and gave them to the teacher.

The teacher then gave them an assignment to pretend they were Chester the Cricket in Times Square. What would they see? The students were to draw a picture of what they would see if they were Chester. The purpose was to help the students visualize Times Square from Chester's point of view. The teacher put on classical music and had it playing softly as the students worked. Again, the students were on task; there were no side conversations. The students were drawing with pencils on plain sheets of typing paper.

After all the students were working, the teacher assigned students to three centers: the first group was to continue working on their visualization project; the second set of students were working with the teacher and were to bring their individual white boards and markers; the third group was to work on Success Maker on the five computers.

The students going to the computers walked quickly (there was no running, but no dawdling, either). They sat down and immediately brought up the program. There was some off-task discussion as the students waited for the program to load. Once the program came up, the students began to work. One student helped another with the directions on the screen. The classroom had the district minimum of six data drops for technology per classroom which enabled the five computers and networked printer to be connected directly to the school's server.

The group of students working with the teacher sat on the floor around the teacher, who was also sitting on the floor. When the telephone rang, and the teacher answered it, all students continued to work. The group of students at the front of the room waited quietly for the teacher to return. The students working at the tables worked quietly—staying on task. A few occasionally talked among their group, but quietly. The students working with the Results of Second Observations teacher responded in soft voices—a low murmur. The classical music was still audible in the background. Most students ignored my presence, but two did look at me. I smiled and they smiled back, and then went back to work on their assignment. Students occasionally left for and returned from special classes. They did this without interrupting the other students.

The students working on the computers sometimes read their screens out loud. There were no headphones and the computer speakers were turned off; the students had to read the directions on the screen and follow them on their own. Three students at the computers finished their sessions and went back to their seats. Two students continued working. One finished shortly thereafter and went back to her seat, while the fifth student continued working intently on the program. The four students spent about 15 minutes at the computers, while the fifth spent almost 30 minutes.

The students' groups were called teams and each team had a name. The teacher assigned students to new centers by their team names. A new group of students went to work with her and a new group of four students went to work on the computers. This new group of students got right to work on the computers—there was

no talking among them. The students appeared engaged as they worked on the Success Maker software program.

There was an intercom call for a student to go to another office. The student did not know the location of the office, so a second student went with him to show him where the office was located. The level of noise remained a low murmur and the classical music was still audible in the background as the students continued to work.

As students finished their session on the computer, they walked back to their desks and began working on the visualization project. Some students working on their visualization
picture finished and began reading an Accelerated Reader book (AR), identified by the colored dot on the spine of the book. Students worked independently and quietly, so as not to disturb others working around them.

An example of the respect the students have for one another: a girl came into the room and went to sit down at her desk, but the chair leg of the boy sitting next to her was blocking her chair leg. She learned over and quietly asked him to move his chair. He did so immediately, allowing the female student to sit down.

I returned to this classroom later in the morning to observe the math lessons. The teacher told the students to put away their reading materials and take out their math notebooks and textbooks. She wrote the words "Congruent Figures" on the board. The students reviewed their last three lessons involving movement of figures such as slides to the left and right; reflections or flips, which resulted in mirror images; and rotations.

The teacher had students stand up and showed them "translations" of up, diagonally, right, and mirror images by having students move their whole bodies. The teacher answered a student's question, and then asked the class what congruent meant. The students answered as they were called on and the teacher wrote down their answers on the board. The class decided that congruent meant figures that were the same size and shape. The teacher drew examples on the board of two squares that were congruent, and two triangles that were not because they were of different sizes. The students had some difficulty with the vocabulary: "Are figures related by a translation congruent?" The answer was yes, because the figures maintained their size and shape as they moved.

Shortly after I entered the second grade classroom, the teacher read off the names of the three students who would work on the Waterford computers. One student responded, "Yes!" Two more students were assigned to work on the Lexia computers. The teacher worked with the remaining students at the reading table. These students were reading out loud, one at a time. The teacher asked questions to check their comprehension. (This teacher spoke Spanish and did so to help a student who did not comprehend an English phrase.)

This classroom was set up to be more student-centered than teacher-centered, with the four tables with six chairs at each table. The reading table was at the back of the room, and the teacher's desk off to the side, piled high with stacks of papers and books.

The Waterford computer program printed out reports automatically for the students and teachers. The printer printed out a report for a student working on the Waterford computers. When the report printed out, the girl sitting next to the printer

handed the report to the girl sitting in the middle, who then handed it to the boy sitting on the end farthest from the printer. The boy took the report and put it on top if the computer while continuing to work. This is another example of the courteousness and helpfulness displayed by the students. While one student was working on Lexia, the computer froze up. The teacher had to restart the computer, and then restart the program for the student. The students on the five computers seemed engaged.

Three students came into the room noisily and the teacher reminded them to come in quietly. A girl asked me if she could sharpen her pencil—I told her to ask her teacher. (He said no, get another one already sharpened.) Two of the three students who came in had to be told to move to a different table because they were being disruptive. The students at the tables began working on an assignment that involved coloring a picture they had drawn.

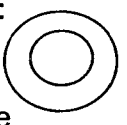
The computer programs were part of the reading program through a student rotation system. The three students on Waterford finished the session after 20 minutes. The teacher then put these three students on the Lexia computers, and called on three more students to start the Waterford computers. As the two students on the Lexia computers finished their sessions, three new students began their sessions. One girl in this new group was having trouble getting the reading program started, so another girl on the computer helped her. The girls switched computers so the girl having trouble could get on the program, which she was able to do, and the girl who traded computers got her program up and running. This was another example of the respect and helpfulness found throughout the school.

The students at the reading table talked about the picture on the front of the booklet and the story they were going to read about desert plants—specifically the saguaro. As the teacher finished the reading lesson with the students at the reading table, he asked the group the meaning of the word energy. One student answered, "Power."

A female staff member entered the room and introduced herself to me as the writing coach. The writing coach asked the students on the Lexia program and then the Waterford program to explain the program they were using. The students were able to do so.

The teacher ended the reading group, and got the students ready for writing. The students on the Lexia computers closed out of the program and returned to their seats. The students on the Waterford computers returned to their seats but did not close out of the program.

The teacher drew two circles on the whiteboard, one inside the other:



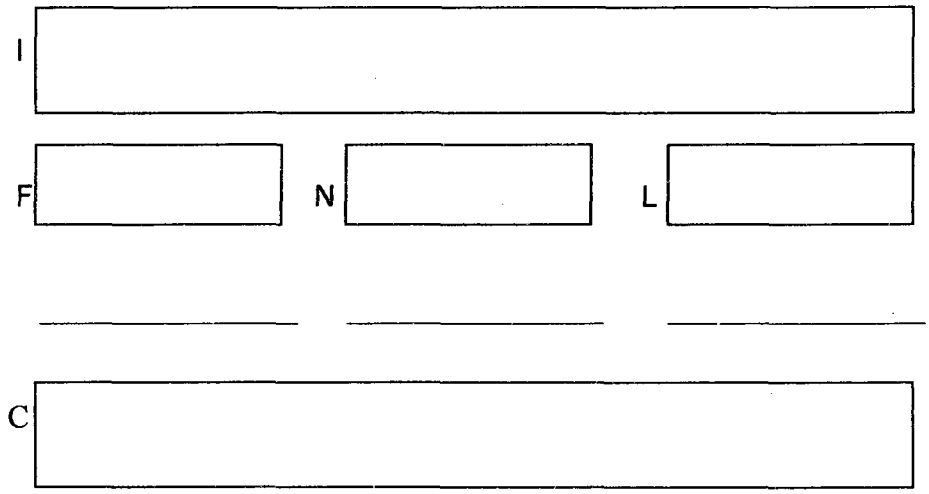
In the center circle he wrote the word music. He proceeded to ask the students about the music class they had attended that morning. The students were excited because the music teacher had just gotten a Smartboard (that had been in the first grade teacher's room). The teacher listed the five W's on the board: who, what, where, when, and why. The writing coach talked quietly with the teacher as he presented the lesson, giving him suggestions.

The writing coach handed out papers to the students with the two circles on them. She told the students to put the word music in the center circle, and then write down just a word or two that described something they did or saw or learned in music class. She reminded the students to just use words, not sentences, and to just get their ideas on paper, and don't erase.

The Smartboard was the big event in music class. The coach had to remind the students again not to use sentences, but just words—at least five. The students wrote down words in the outer circle. The coach explained to me that they were using flow maps and this one was the circle map. The purpose of this structured writing program was to help students develop their writing skills. The students had five minutes to write down their ideas. The teacher set a timer by using the timer function in the computer.

After the five minutes, the students began sharing their ideas and the teacher wrote them in the outer circle: Smartboard, partners, rhythm sticks, songs, rhythm patterns, dancing, magic, swinging. The teacher told the students to choose three ideas. The coach said to circle the three ideas they choose.

The teacher handed out blank sheets of paper to each student and told them to write their names and dates on the paper, but nothing else. The coach said they were going to make a writing tree, and the teacher drew the writing tree on the board:



The teacher printed a capital I in front of the first long rectangle, an F in front of the first small box, an N in front of the second, an L in front of the last small box, and a C in front of the bottom box. The teacher and writing coach helped students who were having trouble drawing the boxes. The teacher then said, "Give me five and give me your eyes." All students stopped and watched the teacher. He told the students to write their first idea word in the first small box, their second idea word in the second small box, and the third idea word in the third small box.

The coach and teacher walked around the room encouraging and directing students. The class had to stop because it was lunch time. The coach and teacher reminded students to be sure they had their name on both papers. The teacher handed out paper clips for students to paper clip their papers together. The teacher called out students' names to bring their papers to him, get their lunch card, and line up for lunch.

The kindergarten room was functioning normally this day, in that there were just the teacher's 25 students. When I entered the classroom, six students were working on the computers and the other students were working at their seats on papers that involved coloring, cutting, and pasting. The computer use was "built in" to the daily schedule. Student interaction with the program was critical and all the students appeared comfortable using the computer program. The lower SES students and English Language Learners (ELL) students needed to master basic reading and math skills and the Waterford program appeared to help in these two areas. The students working on the Waterford program were engaged; one boy left to go to the bathroom, then returned and continued working. When the students sat down at the computer, they put on the headphones and clicked on the green arrow to get started.

When one boy finished his session, he looked at the name on the screen, walked over to the boy, tapped him on the shoulder, and told him it was his turn on the computer. That student then walked to the computer, sat down, put his earphones on, and began working. These five year olds appeared to be very responsible. When a second boy finished his session, he too went to the next student who then started his session.

Occasionally a student would verbalize (sing) what they were hearing on the computer. One girl was counting from one to 20. Later that same girl was singing the months of the year. No one around her seemed to hear her, and no one objected to her verbalization. One boy left the computer before his session was over and the teacher called him back to finish. He seemed to be able to do the activities with no trouble.

This software program had number recognition, counting, letter recognition, letter and sound combinations, and much more. The students using the program were learning how to use computers as well as hand-eye coordination when they moved the mouse and pointed to various items on the screen.

When one boy finished his session, he went to get the next student who was playing on the art easel. I watched to see if the easel would take precedence over the computer, but it did not. The student stopped what he was doing, erased his drawing, and went to the computer to start his session. One boy who had not completed any work was taken off the computer by the teacher to do his seat work. He had not been concentrating on the computer, but frequently bothered the girl sitting next to him.

The teacher sat at a table checking the work of the students when they completed their seat work. Once their work was completed the students were able to choose a game or toys with which to play. After most students had finished their seat project, the teacher called the class to come together. Those on the computers continued to work there. She sat in the rocking chair in the front of the room and the students sat on the floor in front of her. She held up various 3-D and 2-D shapes and the students reviewed the names of the shapes. When a boy finished on the computer, he went over to the group, tapped the next student on the shoulder, who then went to the computer and started his session. Since the students always work on the same computer, they knew which computer to go to. The class continued with the teacher working with most of the students in the front of the classroom and the students at the computers continuing to work on their Waterford lessons.

Watching the students on the computers, I saw a boy begin his session with numbers from one to 20. The program proceeded to the January calendar with the

date highlighted. This was followed by the days of the week. At this point, the kindergarten teacher called me to another computer to see the science program. This session was on life sciences and was about mammals. Another boy then started another science session, which was the physical world. This program started with views of the earth from Google Earth, then came to the country level, then state, followed by city, and then the community.

There did not appear to be any differences between the ways boys and girls approached and used the computers. Are computers the great equalizer as Hamilton (2007) has suggested?

This day's observations began with the first grade classroom. Arriving in the classroom just seven minutes after the start of class, I was impressed by the enthusiasm—the aliveness—of the room. Lively music was playing in the background and the students responded to the teacher's vibrancy with an enthusiasm not frequently seen so early in the morning. This teacher was following her own philosophy that learning should be fun. The students were engaged in a reading, writing activity by forming spelling words from paper squares with individual letters on them. The spelling words were which, whiz, match, quit, who, quiz, quick. The teacher checked each word when the student was ready. If the word was spelled correctly the teacher said, "Write it," and the student wrote the spelling word on a piece of lined paper. After correctly spelling and writing ten words, the students were rewarded with one M&M to eat. After getting their treat, students turned their paper over and used their words to write silly sentences. One student was helping another student spell a word. The students appeared to enjoy showing their sentences to the teacher, who complimented them on the sentences and suggested needed improvements when necessary: "What comes at the beginning of a sentence?"

To get the children ready to begin reading a story, the teacher called them together to begin discussing their vocabulary words and using them in sentences. When she asked one boy to give her a sentence using about, the student responded, "About what?" Included in their discussion of vocabulary words was an explanation of the difference between buy and by necessitated after a student used the word buy for by.

The teacher displayed the page they were going to read on the screen using the ELMO and projector, while the students had the same book open in front of them. The Smartboard that had been in the classroom on my first observation had been removed at the teacher's request. The vocabulary words previously discussed were highlighted in yellow in the book. The teacher pointed to the words as the students read them. The students read aloud the words in black and the teacher read the yellow words. Teacher: "Put your finger on the author." The teacher then pointed to the author's name. One group read one page out loud together. Then the whole class read the next page together out loud. They repeated this procedure, alternating groups, for the next three pages, while the teacher projected the pages on the screen.

The next activity involved the spelling words again. The students and teacher read two sentences together that the teacher had written on the board. Then the teacher covered the sentences and gave the paper with the letters of the words spelled phonetically instead of correctly (hu cwit that cwis sou Cwik for Who quit that quiz so quick? and wich wiz wil mach mi crd for Which whiz will match my card?). The

students worked in their table teams to fix the errors, while teacher projected the paper on the screen.

While the class was working on this activity, three kindergarten children who were reading on a beginning first grade level came into the classroom. They picked up their folders from a counter in the room and sat down at the table where I was sitting. Inside the folder were a list of words (what, no, see, look, come) and a booklet entitled The Box. These students sat quietly, watching the class continue to work.

The teacher corrected the paper being displayed as the students explained what mistakes to correct. The students were verbalizing in English, using proof marks to show errors, then making the corrections. Spelling and language skills were emphasized throughout this activity. The students wrote the corrected sentences on their paper. Cwit and Cwik (quit and quick) gave them problems. The teacher and students then "raced" to see who could write the sentences correctly first and still be neat and legible. The teacher won. The kindergarten students continued to watch quietly.

When preparing to start the math lesson, the teacher stated they were going to start numbers. The teacher did not use the ELMO and projector as she showed the students the book they would be using in their centers. The centers consisted of students doing their assignments in their book by their table teams. Two boys wanted to use the restroom, but there was only one pass, so they did rock, paper, scissors to decide who would go first. The boy who won left the room with the pass while the other boy walked back to his seat and awaited his turn—another example of the respect evident throughout the school.

The teacher then began working with the three kindergarten children. She had them take turns reading their words to her, then taking turns reading, each reading the same page. Then all three read the page together. As the kindergarten children left, I went on to another class to observe, planning to return later to observe the math lesson.

When I returned, the students were seated on the floor in groups of four and all had small whiteboards and markers. The teacher asked, "What day comes before Thursday? Write your answer on your board." The students wrote their answers. "Okay—now show your boards in your group. If you don't all have the same day, talk about it." Some wrote Wed and some wrote Wednesday. Teacher: "Erase your boards."

The teacher asked, "Which month comes after May? Write it down." Quietly the students wrote their answers. "Ready? Show your teammates." Children's answers from various groups were May, April, and January. She noted to me that the students were having trouble with positional words. She asked the class, "What month comes after May?" Several responded, "June."

The teacher had the EnVisions math web site ready and repeated the math lesson from yesterday. The program began with "Words to Know." Projected on the screen from the math lesson was a calendar of June with the days of the week marked across the top and the month, June, labeled at the top. She asked, "What day of the week does the month start on?" Several responded with the correct answer. This math lesson discussed days, weeks, and months in the calendar. The interactive program asked, "How long is one week?" The students guessed different

numbers. The teacher responded, "Tell me one day of the week." Student: "Monday." Teacher: "Yes, so how many days in a week?" Students guessed 11, 30, seven, 71, and eight. (The month was still projected in front of them.) The teacher then listed tally marks as students listed the days of the week. All agreed there are seven days in a week. The teacher then asked, "How many weeks in the month?" The students had trouble figuring this out—even with the calendar in front of them. One of the problems appeared to be that the students did not understand how to read a calendar.

The EnVisions program asked, "How many days does June have?" The first student responded, "30 months" and a second student replied, "30 days." The teacher asked, "How do you know how many days are in June?" The calendar of June was still projected on the screen. The students appeared to have difficulty reading the calendar in front of them. The teacher asked, "Why do we know the first day of June is a Wednesday?" Five students could not read the calendar, and the ELL students appeared to have trouble verbalizing in English.

In the EnVision technology component, in which the teacher projects the lesson onto a screen using a projector and computer, the teacher controls how fast the lesson progresses. Thus, this teacher was able to repeatedly ask the number of days in a week, the number of weeks in a month, and the number of months in a year. The students continued to confuse the terms days, weeks, and months. She asked, "How long is a year?" One Student responded, "12 days." The students could recite the months of the year together, but still confused the terms days, weeks, and months. Continuing with the EnVisions website, the program asked: "What is the last day of the month of June?" Two students raised their hands, one went up to the screen and pointed to the 30; the second said Thursday.

After the website program finished, the teacher projected a worksheet onto the screen using the ELMO and projector. The paper was on Problem Solving using the months of May and June which were printed on the page. The teacher read the first question, and a student answered the question correctly. The students circled date and wrote day on the line on their worksheets. They continued in this fashion with the next three questions.

The teacher handed each student a piece of lined paper and told them to number from one to four on their paper. She then asked four questions:

#1: How many days in the week?

#2: How many months in a year?

#3: How many days are we in school in one week?

#4: What day did January start on? (There was a class calendar featuring January on the wall bulletin board.)

Using the ELMO and projector, the teacher used a sheet of student lined paper and wrote the questions, projecting them onto the screen. After several minutes, the teacher began calling on students to answer the questions. The first student got number one correct. On the second question, one student said nine and a second answered 12. The third question was answered correctly by the first student. On the fourth question, the second student to respond answered correctly—Thursday. One student called out, "I did it!" and the teacher responded, "Good job!

When I arrived at the male teachers' fourth grade classroom during reading class, there were eight students working at a table at the back of the room, three

students on the computer using Success Maker, and ten students working at their desks. After a few moments, the group at table went up to the Smartboard where the teacher displayed a map of NE USA projected on the Smartboard using a laptop and projector. He showed them pictures of churches from Europe and they talked about who came to the USA from England. The teacher used a wall map to show the location of Europe. He used Wiki to discuss the New England area and what buildings looked like there; and talked about notable places in the NE: harbors, big cities, Harvard University. He gave them an assignment and they went back to the table to continue working. The entire class worked quietly with everyone on task.

As students finished their Success Maker sessions, they went back to their seats and the teacher assigned other students to work at the computers on Success Maker. The group at the table began softly discussing their assignment. One student said, "Everybody go to manufacturing." One student appeared to read the section out loud while others took notes.

The students on the computers appeared to be on task; they were reading the screen and responding. Students signed out and in to leave to go to the bathroom and return without disturbing the class or other students. Some boys at the table began talking loudly and two girls responded, "Sh-h-h" to get them to talk softer.

At 10:48 the teacher said to the class, "At 11:05 be finished with reading—have everything put away—and be ready for math. The teacher explained quietly to me that the table group was the high reading group who read in their social studies book and did projects in social studies during reading.

The students on the computers finished Success Maker and went back to their seats. One student at the table said, "It's 10:55," and they took their chairs back to their desks, and gathered on the floor in front of the Smartboard. They discussed what they had learned in their reading with the teacher. The teacher continued to show them pictures and pointed out facts about New England. He discussed a few notable people from the area which he found on the Wiki site. At 11:00 he sent them back to their seats to start the math lesson.

The teacher projected the math lesson onto the Smartboard using the laptop and projector. The lesson was on quadrilaterals: angles and number of sides. The EnVision math website program asked a question and the teacher and students discussed it, followed by the next slide in which the program provided the answer. The students wrote answers in their math notebooks. One brief question requested the students to describe the sides of a parallelogram and write the answers; students wrote their answers in their notebooks. During this discussion several students brought pencils, books, and notebooks to sit on the floor in front of the Smartboard for a better view. There was no pushing or shoving. These students stayed on task as well as the students at their desks.

In another section of the lesson the class discussed the qualities of parallelograms. The teacher reviewed parallel and other qualities using the projected page from the math program. The math program displayed a picture of a rectangle and asked questions concerning the qualities of parallelograms and rectangles. The students wrote answers in their math notebook. One question asked by the math program: Why can a rectangle also be called a parallelogram? The answer: The sides were parallel and the top and bottom were parallel to each other. So it had four lines, two sets of which were parallel to each other.

The students shared their answers with others at their table. Some students added to their answers in their notebooks after discussing the question with their teammates. The teacher asked a student to explain why a rectangle could also be called a parallelogram. When he could not, the teacher called on another student who did explain.

I returned to the classroom after lunch and as I entered the room, the students were in groups of twos, threes, and fours in various locations throughout the classroom. Two groups were practicing multiplication facts using flash cards. Three students (one girl and two boys) were at the computers working on a math skills site on the web called Attribute Trains, which required logical thinking. The girl appeared to be very engrossed—more so than the two boys, who occasionally talked to each other. One of the boys frequently turned around to look at the rest of the class, then went back to work on the computers. Other groups were playing math games.

At 1:10 the teacher announced to the class, "At 1:20 centers need to be cleaned up." Two boys began arguing that each was cheating. The teacher walked over to them quietly, told them to follow him, and took them both outside to talk to them. When he and the boys entered the classroom, one boy went back to the game, but the other wandered around the room. The teacher spoke to him quietly asking, "What are you supposed to be doing?" The student went back to the game and the two played quietly until clean-up time.

At 1:20 the teacher said, "Freeze. What time is it?"

A student responded, "1:19—no—1:20."

The teacher asked, "What's supposed to happen?"

A student replied, "We should be cleaned up and ready to go."

"You know what to do. Silently put away the games and take your seat," was the teacher's response. The students responded quietly and quickly.

The two boys who had been arguing left their game sheet out on the floor. A third boy picked it up and handed it to the teacher. A girl picked up the bag and a game piece and handed them to the teacher. No one argued about who had been playing with the game; these two students just saw something that needed to be done and did it.

The teacher gave the assignment for math. He then met with a group of four students who sat down in front of the Smartboard. The teacher asked them to draw different quadrilaterals on the Smartboard. The students drew various four figure quadrilaterals. The teacher instructed a boy to put the math CD in the CD player. The CD, which turned out to be the wrong one, began playing very upbeat marches which were not very conducive to math. The teacher changed the CD to the correct one and soft classical music became audible in the background.

The students sitting at their desks worked quietly while the teacher and the students at the board discussed and drew eight sided figures. While the students were drawing the figures on the board, the teacher walked around the room, checking the progress of students at their seats. One student at the board drew a hexagon when he should have drawn an octagon. He tried again, but drew a pentagon, which he erased. A girl helped him draw the octagon. The teacher came back to the board, drew a pentagon, and they discussed the sides of this drawing. The teacher frequently knelt down when talking to the students at the Smartboard.

The students drew rectangles on the board as they continued their discussion of quadrilaterals—comparing them to triangles and other multi-sided figures.

The group at the Smartboard went back to their seats. The teacher walked over and spoke to a boy who was not on task. The boy went back to work. An intercom announcement asking for his attendance—which he had already sent to the office—interrupted the quiet of the room. The teacher had to call the office on the phone to talk to them and tell them his attendance had already been sent to the office.

Three students who had been working at the table during reading finished their math assignment and went to the computers to research New England on the internet. The teacher guided all three to the Wiki website on New England where they did further research from the morning's Social Studies lesson.

The next teacher of my second observations was the third grade teacher. When I arrived in this classroom, four students were at the computers doing research on the internet for their Native American social studies report, two students were working on the Smartboard doing research on the Cherokee tools for their report, and the others were working at their desks. Within minutes of my arrival, the teacher told the students to clean up and get ready to go to the computer lab (which had just opened on Monday of that week).

I walked with the teachers and students to the computer lab, which was housed in a small classroom in one of the permanent buildings, just a few yards from the portable classrooms. Once in the lab, the teacher walked the students through the following procedures: "Log in to the server (51.rooms; password was school name); click on the start button; move your mouse to the word programs; move your mouse over to Type to Learn; click on Client for Type to Learn." The students needed to enter their names by clicking on Third Grade, clicking on their teacher's name, typing in their first and last names, and clicking okay.

The students' reactions were interesting. Some started right in to work; others were willing to experiment to figure out how to continue; while still others were uncertain of how to proceed and needed help. Both the teacher and the technology coordinator helped students get started on the program. Once they got started, the students were focused on their computers, but were frequently verbalizing what they were seeing and hearing on the computers. (The lab did not have headphones.) The technology Coordinator showed several students how to click on icons; I helped a student read a section on Susan B. Anthony. The
teacher and technology coordinator kept busy answering students' questions about the program.

As the individual lessons continued, some students wanted to show the teacher what they had accomplished. The program gave students instructions that they had to read. Several students were beginning to read the directions out loud and then follow them which meant they were applying reading skills as they read the instructions that appeared on the screen.

There was no apparent difference between the reaction of boys and girls and how they approached this new (to them) program. The teacher checked the students' progress on their computers as the students continued to work. At the appropriate time, the students shut down the computers, following the teacher's instructions.

The last teacher I observed was the librarian. The library work area contained six tables with six chairs at teach table, three on a side. A wireless laptop cart stood just to the right of the library entrance. His first class of the morning was a fifth grade class whose teacher did not use technology in the classroom. As the students entered the library, they picked up a laptop, carried it to their seat at a table, and plugged the laptop into the plug on the table, opened the laptops, and logged onto the school server. The laptops had to be plugged in to be used because the batteries, which were over two years old, would only hold a charge for 20 to 30 minutes—not long enough for a 50 minute class. The librarian asked several students to bring additional laptops to the table and plug them in for use in the next class. The students complied with the librarian's request.

After they were logged in, the librarian directed the students to open the school's library page. He also encouraged the students to help one another get logged on and navigate to the web site. Once all students were on the school's library web site, the librarian reviewed with the students how to search for Accelerated Reader (AR) books by points and grade level. He asked, "What do the stars stand for?" The students answered that they were book reviews. The librarian reminded students that they could write a book review after they had read the book.

"You need more than the title to know about the book," the librarian continued. He showed them how to use the green arrow to go back to the previous page. He explained the visual search button, and reviewed for them how to use the on-line catalogue using the visual search. He told the students to look at the person next to them to be sure they were on the right page, and to help them if they needed help—don't do it for them, but help them.

The students were instructed to use the on-line catalogue and visual search to find an AR book of interest to them. Once they had located their book, they had four choices: read the book and take an AR test; work on Type to Learn; work on Ticket to Read; or write a review of the book they just read.

The students spent the remainder of their library period researching and locating an AR book, and working on one of their four choices. Most of the students chose to work on Type to Learn, which required earphones, stored in a basket in the front of the library work area. The students got their earphones and began working without disrupting others. The students were able to function independently, and indeed did when the principal and assistant principal entered the library and spoke with the librarian for several minutes. While working, some computers froze up, and other students came to their aid to help restart the computer.

The librarian used level one when he reviewed the procedures for locating books through the points and the visual search. The students used level two as they worked on Type to Learn and Ticket to Read. Reading an AR book and taking a quiz was also level two use. Although researching and locating a book was level two in this instance, it was certainly preparing students to work at level three when they would be searching for a book from which to gather information for a project.

APPENDIX N

RESULTS OF SECOND INTERVIEW

During the course of the second interview, the fourth grade male teacher stated he was not interested in using the computer lab when it opened because he felt it was more effective to use the mobile laptop cart in the classroom for whole class technology projects. He indicated he did not believe his students had any special reaction to using technology because they were used to having computers in the classroom and technology use was second nature to them. He used technology with his students not in a conscious effort to raise test scores, but to provide them with the exposure to and experience with technology to be confident using it, both now and in their futures. His lesson plans did not contain specific references to technology because it was part of his center rotation.

The female fourth grade teacher believed her students loved using technology, which in her room consisted of the computers and the Smartboard. She said her students asked her almost daily to use computers and the Smartboard, and she did use them daily, but not always when the students wanted to use them. She believed using technology would help students improve their reading scores because they had to read what was on the screen and process that information. She believed that when the school was classified High Achieving two years ago, technology played a part because she was able to use it to focus on developing students reading and math skills. One reason the school dropped from High Achieving to the Watch List, she believed, was due to a pull-out program that was adapted last year which prevented her students from using the computers as before. She was glad the school dropped the pull-out program for this year. When asked if there were any other pieces of technology she would like to have in her classroom, she said a few more computers and an ELMO.

The third grade teacher also believed technology helped the school make High Achieving two years ago because the students used Lexia to develop their reading skills, and believed they would at least make Adequate Yearly Progress, if not High Achieving, this school year with their current emphasis on using technology. Her students were very excited about using both the computers and the Smartboard and seemed to understand the importance of technology in their lives. She described an ideal school day as one in which the students were able to use the computers for complete sessions of Success Maker during reading, and all technology components functioned perfectly during math so she could show the EnVision math lesson on the Smartboard using the projector and the computer. She believed that technology was a very important part of education, regardless of what level a teacher was teaching, kindergarten through college. She was able to complete her entire Master's program on-line—a concept unheard of just a few years ago.

The second grade teacher was looking forward to using the computer lab when it was opened. He stated he wanted his students to learn to type for starters, but then wanted them to learn about the different capabilities of the computer and what it could do. He said not understanding what all a computer could do was like having a tool box with 100 tools, but only using one or two tools because that was all you knew how to use. He did not want his students to be limited to those one or two tools. He stated his students were focused when they used technology because they were drawn to it like magnets. He wanted to see
technology developed to the point where the computers were an integral part of the table, like the poker machines in a Las Vegas bar. He would press a button and panels would slide open on the tables, and the students would look down at the computer screen, which would be a touch screen. That concept would allow every student to have a computer at the push of a button, but the computers would not take up space in the classroom as they do now. When I asked him if there was anything else about technology or his use of it or his beliefs about it that he would like to share with me, he laughingly responded, "That's like asking what you think of the Bible?" He said his students were open-minded about technology and they would not be intimidated by technology in their futures.

The first grade teacher thought it was the hard work of the students and teachers that enabled the school to achieve the High Achieving classification and not the use of technology. She believed that the way educators push children in grade school created burn-out by middle school. It was difficult to make school fun because the students were pushed to learn so much to keep up with the information our society required. She hoped to use the computer lab when it opened. When the school had a computer lab in the past, she used it with her students for academic internet game sites. She said it was interesting to watch her students when they were trying something new on the computers because the low children were used to being frustrated—that was their comfort level– and did not have any problems learning to maneuver around the internet. They could usually figure things out. The high students, however, were not used to being frustrated, and if they could not figure something out immediately, they "freaked out." Some of her highest students were actually crying in the computer lab because they could not figure out how to do something right away. She had a concern about educational software, but felt it was getting better, especially when it came to the accountability part. If the student knows a concept, the teacher knows to move the student on, but most computer programs were not able to do that. Students had to go through lesson one, then lesson two, then lesson three, even if they knew the concepts. This, she felt, could lead to the drill and kill concept. One of her goals in the classroom was to push her students to keep doing better. For her, an ideal day in the classroom was one without interruptions, where the students were moving forward academically all day, and everyone enjoyed the day. She said she frequently told her students there were four things they needed to do in school every day: make the teacher happy, make the teacher happy, make the teacher happy, and make the teacher happy.

The kindergarten teacher believed the Waterford program helped the students being tested do well on the Criterion-Referenced Tests (CRT) because the program taught them the basic math and reading skills they needed to be successful in later grades. She explained that, as a kindergarten teacher in a Title I school, she spent a

large amount of time testing her students. They were tested on DIBELS weekly for children at grade level, and more frequently for children below grade level, and IDMS three times a year. DIBELs provided instant feedback through its website, but the IDMS results took weeks to come back. To solve that problem, she recorded every student's answers on a piece of paper, and then recorded the answers on a spreadsheet. Using the test as a guide to determine correct answers, she was able to score her students, and use that information to plan lessons. When asked about a possible language problem, she said she almost always had at least one student that could interpret. However, last year she did not have anyone that was fluent enough vocabulary-wise in both languages to interpret. She had a child that did not speak English so she just had the student talk to the entire class, and the class, among them, talked about what the child said and how to best answer her. If they knew a word that would fit in they would say it. And it worked, the teacher explained. It was wonderful. Her students were really very helpful and that was another thing she liked about kindergarten, the students were not afraid to help each other. "They are so good about helping," she sighed.

The assistant principal believed technology helped the school make high achieving because it assisted the students in firming up their knowledge and gave them an opportunity to practice what was taught by the teachers. The reason the school dropped so badly from one year to the next was due to the rise in the special education population. She defined technology integration as using the technology to further the students' knowledge, and to apply what they have learned. She stated most of the teachers were pretty tech savvy, and her goal for technology with the teachers was to make technology work for them because it could make their lives so much easier. She wanted the students to learn the "nuts and bolts of technology." She wanted them to know how to navigate a computer, how to work with a computer, how to type, how to use technology to the optimum level so they could be successful in life. She stated the disadvantage of students using technology in school was a teacher that allowed technology to be the point of instruction. Teachers should not take the teacher out of the classroom; she did not want the teachers to think the computer was going to teach the students everything they needed to know. It was that human element that really sparks that curiosity needed for learning. The biggest barrier toward implementing technology in school was money. Technology was constantly out of date, and the money was not there to replace older, outdated equipment.

The principal also thought technology played a role in the school making High Achieving because the technology was structured for small group instruction, and had just begun using the Lexia software program, although she also thought the teachers accounted for 80% of the effort and the technology programs 20%. Her motto was "Don't take the teach out of teacher." She defined technology integration as "having technology at the point of instruction which is in the classroom." She thought that in a lab setting students worked on things such as keyboarding skills and "doing Internet research so they knew how to do that." In the classrooms the programs were instructional in nature that supported whatever the teacher was doing. Use in the classroom was usually done through some kind of rotation basis during small-group. Most of the students had exposure to computers daily at some point in time. The students in kindergarten were called up randomly to take their turn

on the computer. She believed the students should learn keyboarding skills while in grade school.

Her goals for technology for the teachers were for them to utilize technology on a daily basis, and use it to track student progress to see if students were getting from point A to point B. She mentioned programs that support language foundation for the ELL students, the Smartboard, and the new math program as examples of technology she wanted her teachers to use daily. The technology portion of the new math program would make the teachers' job easier, and was very engaging for the students.

She believed that students' use of technology in school was not an advantage but a necessity. Some of the purposes for students using technology were not only conducting research on the internet, but being able to discern whether the information on a website was fact, opinion, or propaganda. One of the drawbacks was students' reliance on technology so that when it went down, they could not function. She gave the example of her son who, when he was small, knew that a relative's telephone number was star six on the speed dial. However, he had no idea what the number actually was because he just used star six to call the relative. She wanted to be certain the students at school did not fall into the "star six" mode. The barriers to implementing technology were money and training. She explained to me that she looked at time on task differently—that there was a huge difference between compliance time on task and engagement time on task. Compliance time on task was the students sitting in their seats, looking at the teacher. But their minds could have been elsewhere. Engagement time on task was determined by asking the student what he was doing, and the student being able to tell her. Technology, she said, "engages kids."

The librarian was the second person who believed technology did not play a role in making high achieving two years ago. For one thing, the school did not have that much technology then, and the technology they did have was not used by all the teachers. However, the present technology coordinator was working hard to get technology into all the classrooms and get teachers using it. He defined technology integration as putting technology into every subject matter. He had not learned to use technology in school, and was learning to use it now. He wanted the students to get into it, touch it, use it every day, not only for school work, but for personal use as well. He wanted to see the teachers all use technology, but realized some of them would not touch it with a ten foot pole. Because there were teachers who did not use technology, the librarian felt it was important for him to use it every time the students came to the library. He felt it was important for the students to learn to use technology at school so they could keep up in the world; not get ahead, just keep up. The biggest disadvantage was getting into the computer too much, and ignoring other people. The example he gave was two people sitting across from each other in a restaurant and each talking to someone on their cell phone, ignoring the person sitting right across from them. The biggest barrier toward implementing technology was money and the long time it took to get anything accomplished through the district. He tried to get the library wired so he could plug in the laptops for student use throughout the day. He was unsuccessful in getting district maintenance personnel to do the job, so he did it himself. His motto for teaching was that he would

show the students how to do something once, review it once; after that they need to find another student to show them how to do it.

The technology coordinator was not at the school the year they achieved their High Achieving status. He defined technology integration as using technology as a tool to further the teaching curriculum. Technology should not take over for the teacher, but should be available to enrich the curriculum and excite the learners. He began using computers as a child, and, even though he became an art teacher, enjoyed working with computers. Friends of his suggested he become a technology coordinator when he tired of being an art teacher. His main goal for using technology was to get the teachers to a point where they would ask him different types of questions: rather than can you fix this and how does this work to can you help me develop a lesson using technology. He thought the students in the school were using technology quite a lot, and, while it could always be more, he felt most teachers were using technology daily, thus giving their students opportunities to use technology daily. The school got 64 new computers and 15 Smartboards this school year because they were Title I. They also had a 30 laptop cart that roved between fourth and fifth grade. The main advantage for using technology at school was that most of the students did not have computers at home and by using technology at school, they could become familiar with computers. The disadvantage was the dependence on technology, which stopped working at the most inopportune times.

APPENDIX O

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