2007

The relationship between technology integration and achievement using multi-level modeling

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The Relationship Between Technology Integration And Achievement

Using Multi-Level Modeling

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
Department of Secondary Education
College of Education
University of South Florida

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Date of Approval:
December 12, 2007

Keywords: Florida, longitudinal research, public schools, secondary data, student outcomes

Dedication

To my parents, who have always encouraged me to be a lifelong learner by their example and with their support. Thank you for always encouraging me to pursue my dreams.

To my children, who encouraged me to finish this Ph.D. program and dissertation, because it is personally meaningful to me. I love you.

To my friends, who provided the emotional support that kept me focused even when obtaining the goal was difficult. I am truly blessed.

Acknowledgements

This dissertation is the culmination of many learning experiences and supports provided by very special people at the University of South Florida. Dr. Ann E. Barron, my major professor, provided both personal and professional guidance. Dr. Barron has the keenest insight into finding the most advantageous and expeditious path to accomplishing tasks or solving problems. She also has the knack for providing that just-in-time encouragement that makes all goals possible. Dr. James A. White offered positive encouragement, professional guidance, and feedback. Dr. White always promotes the thorough examination of all perspectives and possibilities for every research question. He consistently provides that right mix of challenge and assistance that supports each learner's deepest understanding. Dr. Jeffrey D. Kromrey inspired me with his joy in conducting research. Dr. Kromrey is the most patient teacher that I have ever observed both as a student and as a teacher. He makes all students believe that they are capable of accomplishing important work. Dr. Kromrey always provides the support and assistance needed to solve every research question or SAS programming problem. Indeed, without Dr. Kromrey's guidance the research questions in this dissertation and my other research projects would never have been answered. Dr. Elizabeth Shaunessy supported and encouraged my desire to learn how technology can be used to empower and to support the learning of all students. In particular, she models the best practices for promoting and supporting a productive on-line learning community that stimulates high levels of inquiry through student discussions. Other people at USF also need special recognition. Dr. John M. Ferron and Dr. Robert F. Dedrick introduced me to multi-level modeling statistical analysis for educational research as well as provided on-going support as I applied this method during my dissertation. All of the students, staff, and faculty in the College of Education with whom I have had the opportunity to interact and learn have made my experiences at USF enjoyable and worthwhile. Last, Dr. Kate Kemker, Bureau Chief of Instruction and Innovation at the Florida Department of Education, provided the vision and resources to conduct this research with Florida data.

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ABSTRACT

The purpose of this longitudinal study was to examine the relationship between technology integration indicators and school level achievement. Four years of school level secondary data from publicly available databases maintained by the Florida Department of Education were combined for all public elementary, middle, and high schools in the state. This study examined approximately 2300 schools that participated each year in the Florida Innovates Survey about technology integration between 2003-04 and 2006-07.

Complexity theory supported the use of multi-level modeling to examine the relationships between technology integration and outcomes. Three achievement outcomes (reading, mathematics, and writing) and two mediating behavioral outcomes (attendance and misconduct) were investigated. Moderating variables controlled in the model included school level, demographics, and learning environment. After data preparation, all composite variables were developed using factor analysis. Models were progressively built with significant variables at each level retained in subsequent levels of the study. A total of 94 models were estimated with maximum likelihood estimation using SAS 9.1.3 statistical software.

The integration of technology is only one of the many factors that impact student learning within the classroom environment. Results supported previous research about the relationship between the moderating variables and school level achievement and confirmed the need to include moderating variables in the model. After controlling for all the other moderating variables, technology integration had a significant relationship with mean school achievement.

Although the percent of teachers who regularly use technology for administrative purposes was consistently significant in the models for four out of five outcomes studied, the interactions with time, $time^2$, and $time^3$, resulted in curvilinear trends with inconsistent results. These inconsistent significant findings make drawing conclusions about the integration of technology within Florida's public schools difficult. Furthermore, the small changes observed in mean school achievement over the span of this study support the concept that time is a critical factor for school level learning and change. Therefore, continued analyses of the longitudinal trends for Florida schools in the relationship between technology integration variables and school achievement, while controlling for moderating variables, are recommended.

Chapter 1: Introduction

Due to the multiple demands on schools for allocating their resources, the return on investment of technology for improving student achievement is an extremely important consideration for responsible decision-making. However, the variety of factors that impact achievement within the complex school environment makes the study of educational phenomena difficult. The many variables at the individual, classroom, and school levels that moderate student achievement cause the assessment of the isolated effect of technology to be problematical (Bryk & Hermonson, 1993). Multilevel models and special statistical computer programs allow for simultaneous analysis of the disaggregated impact of several levels of contextual factors on achievement (Luke, 2004; Raudenbush & Bryk, 2002). However, scant research has been conducted using these methods on longitudinal data to examine the relationship of the integration of technology on student achievement. Indeed, the State Educational Technology Directors Association, a national organization of all state technology directors, has called for this type of research to be conducted using state-wide data (Lemke, Wainer, & Haning, 2006)

> With 61% of states now requiring [Local Education Agencies] LEAs that receive competitive grants to "report findings based on improvements as compared to baseline data," it is only a matter of time before states will be able to report statewide summaries of correlational results. In addition, nearly 25% of states report that they have commissioned or funded research studies on the impact of technology on learning (Lemke et al., 2006, p. 5).

Florida is one of the first states to create a data warehouse to help inform state policy makers, district and school planners, and other stakeholders about the current status and progress of the state's educational initiatives. Within this system, trend data on both student performance and technology indicators has been systematically collected from all of the schools by their districts in order to study the impact of specific programs on student performance (Bureau of Instruction and Innovation, Florida Department of Education, 2007a; Technology Counts, 2006). This study used multilevel statistical analysis with longitudinal data collected by the Florida Department of Education to investigate the relationships between technology integration and overall school achievement (related to mathematics, reading, and writing).

Background Information

According to the *2006-07 Florida State Government Technology Investment Forecast*, Florida allocated over 17.5 million dollars to the State Board of Education to spend on educational technology initiatives during fiscal year 2007 (pjmathison, 2006). In addition to receiving state funding, the Florida Department of Education also obtained over 88 million dollars over the past three years from the No Child Left Behind, Title II, Part D Enhancing Education Through Technology program (Lemke et al., 2006). While many reformers of education believe that technology will transform the way students are educated, provide equitable learning opportunities for all students, and improve children's competitive advantage (Dede, Korte, Nelson, Valdez, & Ward, 2005; Ringstaff & Kelley, 2002), others believe that any benefits from the purchase of technology will not outweigh the tremendous investment (Cuban, 1986, 1998, 2001; Oppenheimer, 2003; Tyack & Cuban, 1995). Consequently, it is crucial to determine if Florida's investment in technology has had a positive impact on student outcomes.

Noteworthy, despite the huge increases in access to computers and the Internet both at school and at home for most students, the digital divide has continued for many students based on their socio-economic status and ethnicity (e.g., DeBell & Chapman, 2006 and Parsad & Jones, 2005). It was imperative that the investigation of technology integration on student outcomes also examined the equity of the results across various subgroups. Thus, socio-economic status and ethnicity variables were included in the analysis of this study.

Theoretical Framework

Complexity theory can be used as a framework to explain the dynamics that occur during the schools' change process as they integrate technology into their curricula. Complexity theory has been used to study and explain the workings of complex systems in many disciplines, including physical sciences, biology, business, and sociology (Jacobson & Wilensky, 2006; Morrison, 2002). All of these systems have multiple levels of organization and heterogeneous components (Caldwell, 2005; Jacobson & Wilensky, 2006). Complexity theory perspective allows the simultaneous examination of phenomena on both the micro and macro level (Caldwell, 2005; Jacobson & Wilensky, 2006). These modeling techniques and new computer statistical programs allow educational systems to be examined to understand the effect of policy decisions and to inform subsequent policy (Jacobson & Wilensky, 2006; Luke, 2004; Raudenbush & Bryk, 2002; Wenglinsky, 2005).

Applying complexity theory to educational organizations fits well on all levels (Morrison, 2002; O'Day, 2002). On the micro level or within the classroom, the students and teachers are independent agents that interact with each other. Sometimes individual students or teachers change and are replaced by new agents; however, the dynamics of that particular classroom environment continues to impact all participants or agents within it. On the macro level or at the school or district level of the organization, there are multiple variables that impact the activities of the organization such as the mission and goals, strategic plan, budget, curriculum, and management style.

On the micro-level, the process of teaching and learning is also complex and has many confounding variables from both the individual students and teacher as well as from the classroom and even the school. Carroll's Model of School Learning (1963, 1989) can be used to explain the dynamics of the learning process within this complex environment. This model has two main categories of factors that impact school learning: time needed in learning and time spent in learning.

By examining Carroll's Model of School Learning through the lens of complexity theory, the factors can be separated into two levels – the individual level and the classroom level, which Carroll calls individual and external conditions (Carroll, 1963). The factors at the individual level are aptitude, ability to understand directions, and perseverance, while the factors at the classroom level include quality of instruction and opportunity for learning. These factors at both levels interact through the dynamic process of teaching and learning. Thus, an important contribution of this model is the explanation of the importance of time in learning. Carroll presents a formula that calculates the degree of learning as being the function of the time actually spent learning divided by the time that is needed (Berliner, 1990; Carroll, 1963). Maximum degree of learning occurs when a student actively engages in learning for the time that the student needs when all other conditions are optimal. When conditions are not optimal, such as when the instruction delivered is not organized in the most accessible manner for the student or when the student does not have the prerequisite learning required for understanding, then the time needed to learn increases. If the time allowed for leaning is not equal to the time needed, then the amount of learning is decreased.

The dynamic process of teaching and learning within the classroom resides within yet another level, the macro level of school. Within this level, there are also agents (teachers and administrators) who interact with and have impact on the classes and staff within this macro level, as well as have interactions with students on the micro level. These nested levels continue to expand, because schools interact within the district, thereby creating another set of impacting variables within the school organization.

The organization as a whole has a common mission of educating students and communicating the methods through the strategic plan at the district level and school improvement plans at the school level. Communication and interactions are reciprocal and iterative; that is, the micro level components impact the macro level components and vice versa. Ultimately, the organization exchanges information with the outside community and other school organizations, and, in turn, responds and adapts as an organization. When new technology is added to the environment at multiple levels, technology becomes one of the agents that stimulates change and adaptation (Coughlin & Lemke, 1999; Culp, Honey, & Maninach, 2005; Wenglinsky, 2005).

When the Carroll Model of School Learning is applied to the organization level of school, with multiple teachers learning to integrate technology into their curriculum, it is apparent that the opportunity to learn or time will be the critical factor required for change to occur. Consequently, the technology integration change process must be continuous, as it requires extended time for teachers to progress through several stages -- entry, adoption, adaptation, appropriation, and invention (Apple Computer, Inc., 1995; Coughlin & Lemke, 1999; Dwyer, Ringstaff, & Sandholtz, 1990), while they learn to use and incorporate technology into their lessons. Because teachers need time to progress through the stages of integration of technology, the impact of their curricular plans that integrate technology into their daily instructional practices on their students' learning also will take time. Thus, the relationship between technology integration and student achievement must be studied over time.

Technology Integration

Essential Organizational Conditions for Technology Integration

Fundamental conditions have been identified among schools that have successfully integrated technology and improved student outcomes. These factors at the organizational level include broad-based educational reform efforts and long-range plans, while the influential factors at the school level include readily accessible technology, adequate and appropriate staff development, ongoing support, changes in teachers' beliefs about teaching and learning, and technology integrated into the curricula along with other teaching methods (Ringstaff & Kelley, 2002). The International Society for Technology in Education (ISTE) designated these components as *essential conditions* for technology-enriched learning environments (ISTE NETS Project, 2007). These essential conditions include access to contemporary technologies, technical assistance, skilled educators, community partners, and political and financial support for technology. In all of these recommendations, accessibility and use of technology are crucial ingredients within the context of the other nested levels of school variables.

School Level Factors that Impact Technology Integration

Within the school learning environment, the impact of the integration of technology on student achievement is complicated by many dynamic factors on multiple levels. The variables overlap, interact, and moderate each other on a daily as well as long-term basis during teaching and learning. These multi-levels of the technology integration factors and contextual variables are depicted in Figure 1. The sections that follow delineate these variables.

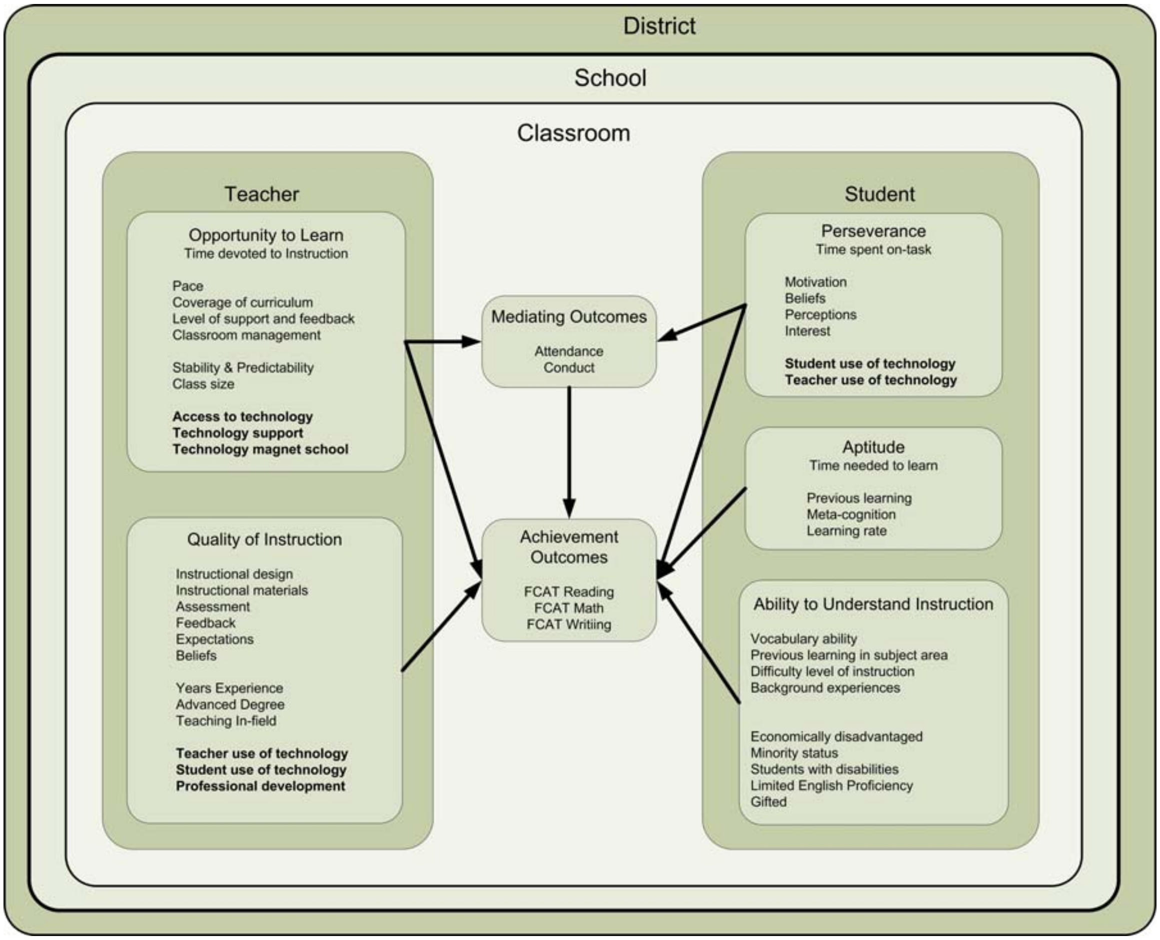

Figure 1. Model of Technology Integration with Contextual Variables in Multi-Levels

Note: Technology integration variables are in bold text.

Uses of Technology

In order to become proficient users of technology, both students and teachers must have opportunities to utilize computers (Dwyer et al., 1990; ISTE NETS Project, 2005b, 2007). Thus, the school must make computers and software available. Notably, another ongoing issue is how to efficiently educate students so they are both literate and proficient technology users (Barrnett, 2003). This debate about how to effectively integrate technology for the support of improved achievement revolves around pedagogical philosophies at the school level.

Instruction delivery.

On one side, many educators believe the power of technology should be used for delivering instruction to the student by providing efficient and patient delivery of individualized instruction aimed at mastery learning at the appropriate level (e.g., curriculum-based software such as tutorials and individually administered learning packages). West Virginia incorporated Integrated Learning Systems (ILS) in a large state-wide reform initiative in all elementary schools. Results of a longitudinal study about this initiative indicated that students made significant gains in basic skills of reading and mathematics (Mann, Shakeshaft, Becker, & Kottkamp, 1999). Meta-analyses are research studies that statistically combine the results of individual experimental or quasi-experimental studies conducted on a particular intervention to establish an overall effect size. A meta-analysis examining the impact of ILS on mathematic achievement found educationally meaningful and statistically significant positive effects (Kulick, 2003). In addition, control studies of tutorial programs in all subjects almost always had an educationally meaningful and significantly positive effect (Kulick, 2003).

However, not all research supports the effectiveness of using technology to deliver instruction. Lockee, Moore, and Burton (2004) reported in their research synthesis on programmed instruction, which is the foundation for computer-assisted, computer-based tutorials, and web-based tutorials, that almost all research conducted was of poor quality so that the results could not be generalized beyond that particular study. The results of poor quality research cannot be used to support the effectiveness of using technology. In addition even when the quality of the research was adequate, there were still contradictory results for how to use technology to deliver instruction (e.g., Hill, Wiley, Nelson, & Han, 2004; Mory, 2004; Park & Lee, 2004; Shapiro & Niederhauser, 2004). In a recent study about the effects of math and reading software products, no significant difference was found between the test scores of students using the products and control students who were not (Dynarski, Agodini, Heaviside, Novak, Carey, Campuzano, Means, Murphy, Penuel, Javitz, Emery, & Sussex, 2007).

Product creation.

On the other side of the debate, many educators believe the power of technology should be used as a creative tool by students to support their construction of concepts and knowledge, higher order thinking skills, and problem solving (e.g., word processing, concept mapping, spreadsheets, and databases).

Research conducted by the Apple Classroom of Tomorrow (ACOT) program found that students who used computers as tools in the classroom not only performed well on standardized tests, but also exhibited other skills such as collaborating with peers, presenting information in a variety of way, communicating well about complex processes, and learning independently (Apple Computer, Inc., 1995). Similar results have been found by three meta-analyses about the impacts of using word processors on student writing (Goldberg, Russell, & Cook, 2003; Kulick, 2003; Penuel, Kim, Michalchik, Lewis, Means, Murphy, Korbak, & Whaley, 2002). In addition, Lowther, Ross, and Morrison (2003) conducted a mixed method study comparing using laptops vs. computers in the classroom on middle school students' writing achievement gains and found significant positive results when using laptop computers. Furthermore, with multi-level modeling statistical analysis, O'Dwyer, Russell, Bebell, and Tucker-Seeley (2005) found significant positive relationships between elementary school students' writing achievement and their use of a computer in school to edit papers.

Jonassen and Reeves (1996) recommend that computers be used as cognitive tools that support learning and concept formation. For example, students can practice higher order problem solving skills by working with computers as tools for researching and for creating products. Taylor, Casto, and Walls (2007) compared the achievement results of two groups of students, one with technology, and the other without technology, engaged in the same units of study. They found that using technology had a positive impact on student achievement at both the elementary and secondary levels. Kulick (2003) reported educationally meaningful and statistically significant effects when integrating the use of word processing in the instruction of writing. These and other researchers propose that using computers as cognitive tools supports students' higher-level thinking skills and deeper understanding of content. For instance, computer-mediated communication or the threaded discussion is another important tool used to support learning through writing, especially within distance-learning courses. However, Romiszowski and Mason (2004) report that research about effectiveness of computer-mediated communication for supporting learning has been scarce and inconclusive.

Assessment.

Technology can be used for measuring learning. However, most standardized tests do not use technology as an assessment vehicle. Thus, traditional standardized tests may not sample all of the skills and abilities that these students have learned from the integration of technology (Russell & Higgins, 2003; Wenglinsky, 2005).

Student Achievement

Student achievement is impacted by many interacting factors at various school levels, in a variety of ways, and within different content areas. To investigate the relationships of specific technology integration variables, all of these interacting factors must be identified and then included in each of the models that examine relationships between technology integration and each outcome.

School Level Factors that Impact Achievement

Teacher.

The use of technology is one of many instructional strategies that must be woven together by teachers to enhance students' learning opportunities. Integrating technology that engages students within a nurturing and motivating learning environment requires both art and skill on the part of the teacher. Furthermore, the teachers' attitudes and comfort level with technology as well as their technology skills impact the effectiveness of their technology instruction (Becker, 2001). The skill level of the teachers and quality of their interactions with students is impacted by their previous teaching experiences, their level of formal education and expertise within their field, and their ongoing participation in professional development (Marzano, 2003; National Center for Education Statistics, 2005).

Classroom.

Besides the teacher, other factors impact the dynamics of the learning environment and the process of the teaching and learning. Students learn best with daily exposure to the curricula materials within a learning environment that has predictable and consistent procedures (Marzano, 2003). School-wide attendance and stability impact the consistency of the learning environment and the amount of curriculum that is covered. The number of students within the classroom impacts the time the teacher has to give each student individual attention and meet each student's learning needs. Students' positive and negative interactions also affect the quality of the learning environment. School climates that are not conducive to learning have more incidents of non-academic student behavior and student misconduct (National Center for Education Statistics, 2005). Using technology at school has been related to improved attendance and better conduct (Barron, Hogarty, Kromrey, & Lenkway, 1999). Improving attendance and increasing on-task academic behavior could increase achievement. This study investigated attendance and student conduct as both outcome and predictor variables.

Student demographics

Education is a complex phenomenon. Students at different developmental levels may respond differently to different modes of technology integration. Young elementary students learn the prerequisite skills (e.g., how to read; how to do arithmetic computations; and organizational skills) that older students use as tools for learning new information and concepts (Bruning, Schraw, Norby, & Ronning, 2004; Marzano, 2003). Hence, the method of technology integration may interact with the predominant kinds of learning tasks that students must accomplish and differentially impact students' achievement.

Overall school demographic factors (i.e., socio-economic level, and proportion of minorities and special populations) may moderate the dynamic learning process, and, in the end, the mean academic attainment of the organization (National Center for Education Statistics, 2005). Researchers have reported differential instructional methods used in schools based on high and low socio-economic status (Becker, 2001; Lubienski, 2006; Wenglinsky, 2004).

Ultimately students' achievement, attendance, and conduct are impacted by numerous experiences in multiple classrooms with many teachers within a school. Although many studies investigating technology use in elementary and secondary education have demonstrated positive gains in achievement (e.g. Kulik, 2003; Slavin, 2005; Taylor et al., 2007; Wenglinsky, 2005); other researchers have reported inconclusive results or no gains (Gredler, 2004; Hill et al., 2004; Lockee et al., 2004; McLellan, 2004; Metri Group, 2006; Mory, 2004; Park & Lee, 2004; Rieber, 2004; Romiszowski & Mason, 2004; Shapiro & Niederhauser, 2004). However, these studies may have not utilized the statistical methods that can examine the multilevel variables that are nested within the complex educational environment (O'Dwyer, Russell, & Bebell, 2004, 2005; Wenglinsky, 2005). Wenglinsky (2005) provides recommendations to enhance the analysis of his previous studies with NAEP data by using multi-level modeling statistics with the nested data.

> Another cautionary note about the methodology of the study. The study utilizes SEM, a regression-type technique. While the technique possesses many advantages over conventional regression it does not directly take into account the multiple levels of analysis involved in the analysis of school data. The NAEP data occur at multiple levels; many of the independent variables are at the school level, whereas the dependent variable is at the student level. While the use of design effects takes the clustered nature of the sample into account in adjusting standard

errors, it does not explicitly model this clustering. Thus, some techniques that both had the advantages of SEM and took into account the multilevel nature of the data would be preferable (Wenglinsky, 2005, p. 89).

Unlike Wenglinsky's (2005) study that used cross-sectional data from National Assessment of Educational Progress (NAEP), this study utilized longitudinal data that tracked technology and achievement of the same schools over four years. Examining the large longitudinal datasets of Florida with multilevel modeling statistical analysis allowed the examination of the relative proportion of the impact of technology (Luke, 2004). Furthermore, statistical adjustments were made for the differential impacts of student demographics and the attributes of the school learning environments on achievement (Raudenbush & Bryk, 2002).

Research Questions

The following research questions were investigated:

1. What is the relationship between indicators of technology integration and changes in mean school achievement (FCAT NRT scaled scores for reading, mathematics, and FCAT rubric score in writing) when controlling for school level (elementary, middle, and high), school socio-economic status, percent of minority students, percent of limited English proficiency students, percent of students with disabilities, teacher qualifications, and learning environment quality?
2. What is the relationship between indicators of technology integration and changes in mediating outcomes (attendance rates and student conduct)?

The following hypotheses were used to answer these questions:

1. After controlling for school level (elementary, middle, and high), school socio-economic status, percent of minority students, percent of limited English proficiency students, percent of students with disabilities, teacher qualifications, and learning environment quality, mean school achievement (FCAT NRT scaled scores for reading and mathematics and FCAT rubric scores for writing) will have a positive relationship with indicators of technology integration.
2. After controlling for school level (elementary, middle, and high), school socio-economic status, percent of minority students, percent of limited English proficiency students, percent of students with disabilities, teacher qualifications, and learning environment quality, mean school absence rates will have a negative relationship with indicators of technology integration and mean school level of student misconduct will have a negative relationship with indicators of technology integration.

Research Plan

To investigate the research questions and test these hypotheses, this study used repeated measures with 2-level modeling to assess the relationships between technology integration factors and changes in attendance, conduct, reading, mathematics, and writing achievement at the school level. This study was conducted using four points of time (2003-04, 2004-05, 2005-06, and 2006-07 school years) as the repeated measures in the first level in the model and school-level variables at the second level. The following categories of predictor variables were included in the model: school level demographics; school level learning environment, school level teacher qualifications, and school level technology integration. Outcome variables were school level Florida Competency Assessment Test (FCAT) Norm Referenced Test (NRT) scaled scores in reading and mathematics and the FCAT rubric scores in writing. In addition, school level changes in attendance and student conduct were used in the model as both outcome variables and moderating variables. Multilevel modeling allowed the disaggregated analysis of technology integration within the nested data by statistically controlling for the effects of the other confounding variables in the multi-level models. (Luke, 2004; Raudenbush & Bryk, 2002). Table 1 delineates the predictor and outcome variables that were used in this study, their type, how they are measured, and their source.

Variables

Table 1.

Variables by Category, Type, Measurement, and Source in the 2-Level Model

Variable	Type	Measurement	Source
Technology Integration Predictor Variables			
Technology Support	rank	"Our school-based technical support is provided by:" + "Our school-based instructional technology specialist is:" + "How dependable is the Internet connection at your school?" + "How often do you experience delays when using the Internet at your school?" + "What is the average length of time at your school for a technical issue to be resolved?"	STAR Survey
Teachers regularly use for delivery of instruction	continuous	"Approximately what percentage of your teachers regularly uses technology in the following ways?" Percentage ranges are converted to average for the range and then all percentages for the all uses will be averaged	STAR Survey
Teachers regularly use for administrative purposes	continuous	"Approximately what percentage of your teachers regularly uses technology in the following ways?" Percentage ranges are converted to average for the range and then all percentages for the all uses will be averaged	STAR Survey

Variable	Type	Measurement	Source
Student access to content software	continuous	"What percentage of student computers at your school has the following software types available on them?" Percentage ranges are converted to average for the range	STAR Survey
Student access to office/ production software	continuous	"What percentage of student computers at your school has the following software types available on them?" Percentage ranges are converted to average for the range	STAR Survey
Student access to advanced production software	continuous	"What percentage of student computers at your school has the following software types available on them?" Percentage ranges are converted to average for the range	STAR Survey
Frequency that students use content software	ordinal	"How often do students at your school use the following types of software?"	STAR Survey
Frequency that students use tool-based software	ordinal	"How often do students at your school use the following types of software?"	STAR Survey
Technology Magnet School	categorical	School was designated as a magnet school or program with a specialty in technology in 2005-06	Master School Identification File
Learning Environment Predictor Variables			
Learning Environment	continuous	Students Absent 21+ Days; Stability Rate ; proportion Suspensions and Incidents of Crime and Violence, Offenses per Number of Students	Florida School Indicators Report
Teacher Qualifications	continuous	Average Years of Experience; Master's Degree or Higher; Classes Taught by Teachers Teaching Out of Field – for analysis proportion in field will be used	Florida School Indicators Report
School Level			
Elementary	categorical	binary	MSID files
Middle/ Junior	categorical	binary	MSID files
High	categorical	binary	MSID files
Demographic Variables			
Free or Reduced Lunch Status	continuous	Economically Disadvantaged Students	AYP Report
Minority	continuous	FCAT Reading/ SSS Results – Number of Students - White, Black, Hispanic, Asian/Pacific Islander, American Indian/Alaskan,	AYP Report

Variable	Type	Measurement	Source
Limited English Proficiency (LEP)*	continuous	Limited English Proficiency/ ESOL	AYP Report Florida School Indicator Report*
Students with Disabilities*	continuous	Students with Disabilities	AYP Report Florida School Indicator Report*
Gifted*	continuous	Gifted* Elementary & Middle School	AYP Report Florida School Indicator Report*
Outcome Variables: Achievement			
Reading	continuous	Reading FCAT (NRT) scale score	Assessment and School Performance
Math	continuous	Mathematics FCAT (NRT) scale score	Assessment and School Performance
Writing	continuous	Writing FCAT rubric score	Assessment and School Performance
Outcome Variables: Mediating Variables			
Absence Rate*	continuous	change in percentage of Students Absent 21+ Days	Florida School Indicators Report Florida School Indicators Report 2003-04 to 2005-06*
Student Misconduct*	continuous	change in proportion Suspensions and Incidents of Crime and Violence, Offenses per Number of Students	Florida School Indicators Report 2003-04 to 2005-06*

* Florida Indicators Report is only available until the 2005-06 schools year

Definitions

Technology for this study included computer software and associated hardware (i.e., scanners, printers, DVD players, projectors, mp3 players, personal organizers, and digital cameras).

Technology integration occurs when technology is used as an integral component together with other instructional methods to support students' learning of the designated curriculum. For this study, technology integration referred to using the computer to support student achievement with either curriculum-based software or tool-based software.

Socio-economic status (SES) designates the level of access family access to resources. Typical measures include family income, parents' education, parents' occupation, and educational resources in the home (Lubienski, 2006). For this study, the proxy for school SES was measured by the percent of students with free or reduced lunch status as reported by the school.

Teacher qualifications was measured with three variables obtained from the on-line Florida Indicators Report: average years of experience, advanced degree attainment, and teaching in certified field.

Positive student learning environment was measured by six variables obtained from the on-line Florida Indicators Report: Absent 21+ Days (Students); Stability Rate; Suspensions both in-house and out-of-school; and Incidents of Crime and Violence, Offenses, Student Membership (Division of Accountability, Research and Measurement, Florida Department of Education, 2007b).

Content software included specially designed software that is organized to systematically deliver instruction to the student in order to teach specific concepts, skills, or information. As students interact with this curriculum-based software, their responses are analyzed by the program to determine the specific content to be presented next. Examples of these programs are Integrated Learning Systems, tutorials, simulations, and on-line textbooks with integrated exercises and answers.

Tool-based software included production software that is used to create products that communicate or present information to others (e.g., word processors, presentation programs, or video-editing programs); software used to locate information and conduct research (e.g., browsers with search engines, electronic encyclopedias, Internet archives, electronic databases, and virtual libraries); and software used as a cognitive tool to organize information, support problem solving, and facilitate the deeper understanding of concepts (e.g., databases, spreadsheets, graphic organizers).

Office/ production software includes the traditional programs included in an office suite (e.g., word processing software, spreadsheet software, presentation software, and graphics software).

Advanced production software includes more advanced editing and authoring software used to create products (e.g., multimedia authoring software; video editing software; concept mapping software; web authoring software).

Florida Comprehensive Achievement Test (FCAT) is a series of standardized tests that are used to measure student achieving and school achievement progress in Florida. All students enrolled in public schools are required to participate in these tests from grades 3 through 10 (Florida Department of Education, 2005a). For this study, school mean scaled scores on the FCAT norm referenced tests for reading and math were used to measure reading and math achievement. The mean school rubric score for the FCAT writing was used to measure writing achievement.

Florida School Indicators Report (FSIR) is an interactive on-line database with longitudinal data about school-level factors such as aggregated student demographics, attendance, student conduct, teacher variables, student membership, and staff characteristics (Division of Accountability, Research and Measurement, Florida Department of Education, 2007b). Data for variables used in the study were available through the 2005-06 school year. For this study, the data used for the outcome variables for absences and misconduct was obtained from this database. In addition, all of the student demographic variables and positive learning environment variables were obtained from this database.

Average Yearly Progress Reports are available on the Florida School Grades website (Division of Accountability, Research and Measurement, Florida Department of Education, 2007c). These reports provided demographic information about the school proportions of low socio-economic status, minority, and Limited English Proficiency students, as well as, proportion of students with disabilities (Florida Department of Education, 2007b).

Digital divide is the gap between schools that have high levels of student access to technology and high levels of instructional methods that integrate technology and schools that have low levels of student access to technology and high levels of instructional methods that integrate technology.

Delimitations

This study was conducted using four points of time (2003-04, 2004-05, 2005-06, and 2006-07) as the variables in the first level in the model and school-level variables at the second level. Accordingly, all student variables were aggregated and their average scores for the school were added to the school-level of the model. By using this procedure, information was lost, and the results of the analysis can not connect the impact of integration of technology variables to the gains in individual students' achievement. This method of analysis was chosen because Florida does not provide public access to student-level data due to requirements for student confidentiality. Although using longitudinal student data would have been more informative, the school-level longitudinal data connected the impact of technology indicators with the changes in schools as measured by changes in mean achievement scores, mean attendance scores, and changes in numbers of reported student misconduct incidents.

In addition, this study only looked at variables at two levels of the model. Additional variables that may impact the outcomes, such as leadership, funds available, and technology plans were not included in the model. All variables in the model were selected because they can directly impact the learning environment of the students.

Limitations

The results of this study will have to be interpreted in light of the limitations as well as the delimitations. This study was conducted using existing data that were collected by the Florida Department of Education. Technology has undergone rapid change over the last three years, thus the design of the Florida's technology surveys has been modified slightly over time. Clarification of the items, movement of the items within the survey, and variations in specific respondents may have impacted the data. Further, the degree of accuracy of these measures may be questionable since all of the technology indicators were reported by the principal and/or a designated technology specialist. Data were not collected directly from students or teachers within each school about how they used the technology, so the responses used may not accurately represent their views.

Other contextual variables used in the model may not adequately measure the constructs. The use of the percentage of students who have free or reduced lunch status as the only proxy for socio-economic status of schools may not accurately represent this population of schools. The professional qualifications of teachers that impact the teachers' ability to weave together the dynamic variables during the teaching and learning process may not be captured by measuring their years of experience, advanced degrees, and teaching in their field of expertise. Certainly staff development measures would be an important variable to include with this factor. However, due to the changes in the technology survey, the amount of professional development can only be measured through the variable proportion of the technology budget devoted for technology training, which may not adequately measure this construct.

Other variables may have been left out of the model that impact students' achievement. Education is a complex phenomenon, and there are many factors and contexts that influence student achievement.

Moreover, it is important to emphasize that this study examined relationships among predictors and school level achievement. It cannot determine causality.

Educational Significance

These findings add to the data available for supporting responsible decisions by educational leaders for investing in and implementing technology initiatives in Florida schools that support equitable digital opportunities. This study also supports the research community by adding to the technology integration knowledge base from longitudinal research with large databases. As researchers continue to add to this knowledge base about technology integration from research conducted with other states' longitudinal data, policy makers will be able to compare Florida technology integration initiatives with technology initiatives in other states. As a result, confirmation of best practices of technology integration will be accomplished at the national level. Another outcome from this study was recommendations for revisions and new items in the survey to better measure the integration of technology in future research.

The results from this study have been shared with the Bureau of Instruction and Innovation, Florida Department of Education, so it can support the dissemination of important information needed by schools for planning technology initiatives and staff development programs that support technology integration to enhance student achievement. If this information is used for responsible technology planning and the implementation of technology initiatives by schools and districts, it may indirectly expand the educational opportunities of over 2.67 million students in Florida public schools (Florida Department of Education, 2007a).

Chapter 2: Literature Review

This chapter begins by examining the various factors that impact student achievement through the framework of the Carroll model of school learning and contrasts this model with other proposed conceptual frameworks. Next, school reform or organizational change is discussed within the theoretical framework of complexity theory. Then the connections between school reform and standards-based education, especially as technology is used as an agent of change, are highlighted. Essential conditions necessary for technology integration, along with the confounding factors at each of the multiple-levels of district, school, classroom, and student are discussed. Last, research evidence for the relationships between technology integration and student outcomes of achievement, attendance, and student conduct are reviewed.

Theoretical Frameworks

The design of this study is based on two theoretical Frameworks. The first framework, the Carroll Model of School Learning explains the dynamics of student achievement within the teaching and learning environment over time. The second framework, Complexity Theory, explains how organizations adapt and change over time.

Carroll Model of School Learning and Student Achievement

According to the Carroll model of school learning the degree of learning is the proportion of the amount of time spent learning to the amount time of time needed to learn, which he delineates in a mathematical equation (Carroll, 1963, 1989).

$$Degree\_of\_learning = f\left(\frac{time\_actually\_spent}{time\_needed}\right)$$

These two categories are measured by five variables. The numerator, time actually spent learning is determined by the interaction of the opportunity to learn and perseverance, while the denominator, time needed to learn, is determined by the interaction of the student's aptitude, quality of instruction, and ability to understand instruction. Carroll defines opportunity to learn as the amount of time set aside for instruction of selected curricula with specific outcome goals. Perseverance is the amount of time that the student is willing to engage in the learning activities about the curricula. Optimal leaning occurs when these two variables match; however if the student needs additional learning opportunities and is willing to engage in more on-task learning activities than are offered, then the degree of learning will be decreased. When the conditions are reversed and the student does not have the perseverance to remain on-task for all of the activities, learning also will be reduced. Aptitude is a measure of the student's rate of learning, which is impacted by the previous learning experiences as well as individual characteristics. The amount of time needed to learn can be decreased when the quality of instruction is not optimal or when the student does not have the verbal ability to understand the instruction. On the other hand, poor quality instruction can be mediated when the student has high ability to understand the instruction or a high aptitude. Although students may have low rates of learning, they can still maximize their learning if they have high degrees of perseverance and are given the opportunity to learn. The expanded equation for the degree of learning includes the interaction of these five variables.

$$Degree\_of\_learning = f\left(\frac{(opportunity\_to\_learn)\times(perseverance)}{(aptitude)\times((quality\_of\_instruction)\times(ability\_to\_unders\tan d))}\right)$$

The degree that a student learns is the overlap of the time spent learning, which includes the overlap of opportunity to learn and perseverance, with the time needed to learn, which includes the overlap of aptitude, quality of instruction, and ability to understand the instruction (see Figure 2). Maximum learning occurs when the interaction of all of these variables balance so that the time needed to learn is exactly the same as the time actually engaged in active on-task activities. However, optimal learning occurs when aptitude, quality of instruction, and ability to understand, exactly match with the student's perseverance and the pace of the opportunity to learn (see Figure 3).

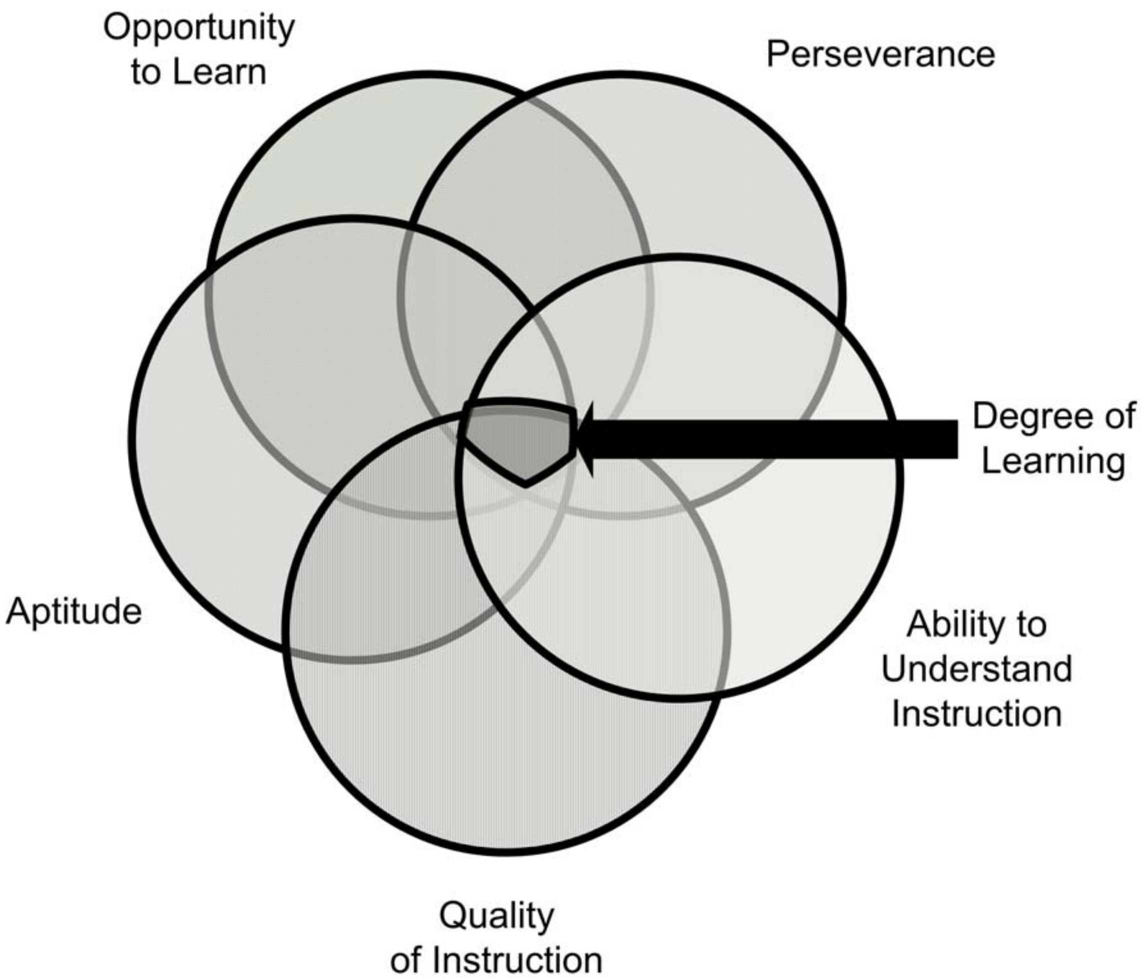

Figure 2. Degree of Learning Carroll Model of School Learning

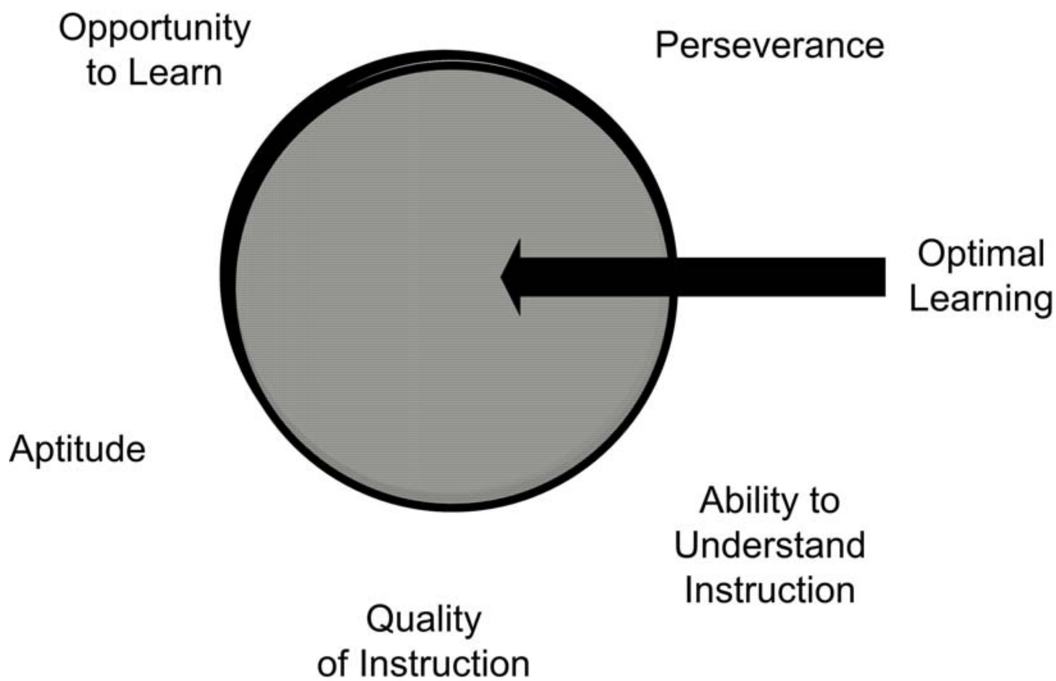

Figure 3. Optimal Learning in Carroll Model of School Learning

The most important concept provided by the Carroll model of school learning is the importance of time, as measured by three of the variables in the dynamic learning process. This concept changes the focus of aptitude from a limiting innate ability of the student to an enabling ability that is under the control of the student through perseverance during the amount of time required to learn. Carroll states that increasing student motivation does not increase the learning rate or the amount of learning when time is held constant (Carroll, 1989). Consequently, this model supports the delivery of equality of opportunity, but not the equality of attainment for all students.

Bloom (1968, 1976, 1984) on the other hand, proposed that learning could accelerate after students acquired the cognitive entry behaviors and affective entry characteristics. Once the limiting condition of not having the prerequisite skills, knowledge, and attitude has been corrected, students can accelerate their achievement so that 80 – 90% of students can attain what is usually realized by only 20% of students (Guskey, 2001). In order to accelerate learning, students must be actively engaged in appropriate levels of instruction with embedded formative assessment, feedback, corrective activities, and reassessment that is aligned with the skills taught. Bloom proposed that acceleration was possible because differences in entry level cognitive skills accounted for 50% of the variance in school achievement (1968, 1976), while differences in affective characteristics accounted for 25% of the variance (1968, 1976); however, because they are correlated, 65% of the variance in school achievement can be accounted for with both (1984). The addition of quality instruction could explain another 25% of the variance for a total of 90% of student achievement (Bloom, 1976; Guskey, 2001). By providing multiple high quality instructional methods and activities, students could attain improved achievement of two standard deviations in a group setting (Bloom, 1984).

Slavin (1987, 1994) focused on aspects of learning that the teacher controls in his Quality, Appropriateness, Incentive, time model (QAIT). When overlaying the QAIT on Carroll's model of school learning, Slavin delineated additional tasks for the teacher that support factors Carroll attributed to the learner (see Figure 4). For example, Slavin added that the teacher provides incentives in order to promote student motivation or perseverance, and the teacher delivers instruction at the appropriate level in order to assure that students have the ability to understand the instruction. For maximum learning, all factors in the model must be present, as each can be the bottle neck that limits learning. Slavin proposes that improvements in all QAIT factors will yield greater achievement than improvements in only one because each factor has a ceiling.

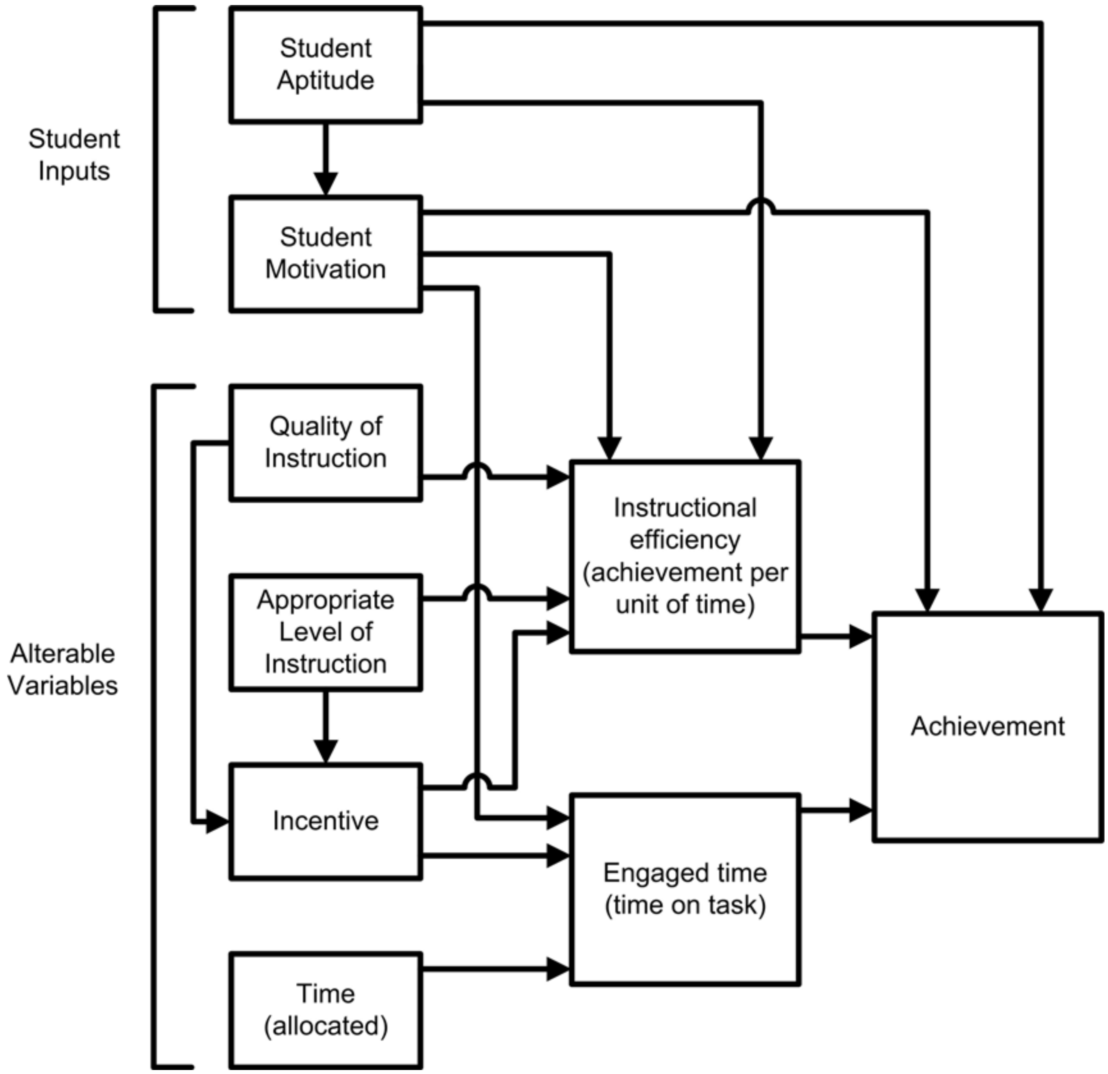

Figure 4. Quality, Appropriateness, Incentive, and Time (QAIT) Model of instructional effectiveness relating alterable elements of instruction to student achievement (Slavin, 1987).

As models become more complex, they include more levels of the organization. The Carroll model of school learning delineated two levels, student and teacher. Although Slavin also suggests two levels, he puts students and teachers in the class level, and then adds school as the next level. Marzano (2003) organizes the factors that impact student achievement into three levels – student, teacher, and school – and situates these levels within the school district level. According to Marzano, there are three factors at the student level: home atmosphere, learned intelligence and background knowledge, and motivation; three factors at the teacher level: instructional strategies, classroom management, and classroom curriculum design; and five factors at the school level: guaranteed and viable curriculum, challenging goals and effective feedback, parent and community involvement, safe and orderly environment, and collegiality and professionalism (p. 10). When examining the impacts of factors at various levels, Marzano reports that 13% of the variance in student achievement is from the teachers' activities and 7% is from the factors at the school level. The opportunity to learn was the most important factor that impacts student achievement and time was the second most important factor. Both of these factors are grouped together into a guaranteed and viable curriculum school-level factor. Taken together, school and teacher effectiveness have an immense impact on student learning. When students entered the school at the 50th percentile of achievement and have participated in two years instruction at that school, students in the least effective school with the least effective teacher had achievements at the 3rd percentile, while students in the most effective school with the most effective teacher had achievements at the 96th percentile (Marzano, 2003).

Another important contribution of the Carroll model of school learning is the ability to use student perseverance to measure the student's motivation to learn. Marzano (2003) explains motivation as the reason that students do things. This creates the link between students' affective attributes and their activities at school. Students have direct control over their achievement by the duration of the time they spend attending to the instruction (Berliner, 1990). When students find activities interesting, they are more likely to participate for longer periods of time. Thus the most motivating activities would be long term projects that students are passionate about and find personally meaningful (Marzano, 2003). Ringstaff and Kelley (2002) reported that research has found that when students use technology to learn with student centered project-based methods, their attitudes, self-confidence, attendance, and time-on-task increased. Increased perseverance could also explain the relationship between academic performance and student conduct and attendance. As students increase their perseverance or motivation, they decrease the amount of time spent in off-task behaviors or misconducts. Increased motivation to engage in personally meaningful learning activities could also lead to improved attendance. Perseverance requires that the student have the opportunity to learn meaningful material and the time to spend learning it.

Instructional time becomes the most critical variable that impacts student achievement (Berliner, 1990; Bloom, 1968, 1976, 1984; Caroll, 1963, 1989; Marzano, 2003; Slavin, 1987, 1994). Berliner (1990) defines the multi-faceted components of time as allotted time, engaged time, time-on-task, and academic learning time (ALT). ALT is the amount of allocated time that the student is engaged in time-on-task with activities that are aligned with the curriculum and the evaluation instruments used to measure the learning. ALT is directly related to the amount of learning and achievement. ALT, and as a result achievement, is adjusted by transition time, wait time, success rate, aptitude, perseverance, and pace. Berliner used success rate as a measure for the quality of instruction and ability to understand factors in the Carroll Model of School Learning. High success rate was above 70%, while low success rate was below 30%. Nevertheless, achievement may not be demonstrated if the instrument used to measure learning does not align with the activities and curriculum (Berliner, 1990; Russell & Higgins, 2003; Wenglinsky, 2005). Given that learning requires time (Berliner, 1990; Bloom, 1968, 1976, 1984; Carroll, 1963, 1989; Marzano, 2003; Slavin, 1987, 1994), multiple measurements of student achievement need to be conducted over time. School level achievement is the mean of all student achievement within a school. Meaningful change in school level achievement requires time for documentation. Thus, research examining the changes in school level achievement must be longitudinal.

Complexity Theory and Organizational Change

Within the business sector, complexity theory has been used to explain the functioning of organizations. Utilizing complexity theory, organizations are viewed holistically as systems that have independent agents or elements organized in structures and nested at different levels (Caldwell, 2005; McElroy, 2000). These agents and levels interact, become interdependent, and produce collective behavior, as the organization evolves and adapts to achieve its purpose (Holland, 2006; O'Day, 2002; Wilensky & Resnick, 1999). Systems have boundaries that separate them from their outside environment. Information is exchanged through feedback loops among the elements within the organization and with the environment outside the organization (Caldwell, 2005; McElroy, 2000; Morrison, 2002). This exchange of information is essential to the adaptation of the organization (O'Day, 2002; Wheatley, 1999). The degree to which information is exchanged among the elements and the outside environment delineates whether the system is open or closed (Caldwell, 2005; Wheatley, 1999).

Previous researchers have noted the prevalence of nested contextual factors in educational settings and the difficulty these cause for finding answers to research questions about the impact of instruction on student outcomes. Bronfenbrenner (1976) proposed that the ecological structure of the educational environment consists of many nested and interacting levels, all of which have impact on how children learn. Weick (1976) suggested that school districts and schools work well because they are loosely coupled organizations within these nested levels. That is, organizational change is influenced on both the micro level by students and teachers, and on the macro level by schools and districts. Thus, school systems are usually very stable organizations, and change occurs very slowly, if at all (Cuban, 1986, 1998, 2001; O'Day, 2002; Tyack & Cuban, 1995).

When change occurs within an organization, it is not always smooth and linear (Caldwell, 2005; Jacobson & Wilensky, 2006). Time is a differentiating aspect of the change process at the macro and micro levels (Weick & Quinn, 1999). At the macro level, the change response can be episodic and non-linear as when an organization responds to a specific event (e.g., No Child Left Behind (NCLB) laws for accountability or the acquisition of new technology), while at the micro level, change is usually continuous, such as the teachers' response to the access to new technology resources.

The key component included in complexity theory is the impact of the dynamic flow of information between agents and levels of the organization on the organization's ability to adapt (O'Day, 2002; Wheatley, 1999). Without information, the organization stagnates and cannot change. If information flows freely, then new important information can be received and utilized to improve organizational functioning. All agents within the organization need access to the new information, an understanding of the goals of the organization, and iterative information about the results of the organization's responses for the organization as a whole to successfully adapt (Wheatley, 1999).

Complexity Theory, explains how schools adapt and change in response to information obtained from outside the school as well as information obtained from inside the school. On the macro level districts and schools receive information from the state and federal government in the form of legislation, from Universities and Research Centers in the form of reports and recommendation, and from the local community in the form of resources and requests. This information is translated by agents in the organization into curriculum and resources supplied to teachers and students. The Carroll Model of School Learning explains how at the micro-level the dynamics of the teaching and learning process support student achievement. At all organizational levels the examination of the continuous flow of information that triggers the responses, adaptations, and changes in the dynamic processes of the organization must be conducted over time.

Changes in School Organization and Instruction

The accountability movement has resulted in the delineation of new standards in each curriculum area. This information from outside of the organization has pressured school organizations to change. The responses by some schools systems in order to meet the new standards and accountability requirements have resulted in school reform. The integration of technology has been an important component in this change process.

Accountability and Standards

The goal of the accountability movement is to provide the crucial information needed for the school organization to adapt and improve student achievement. This professional accountability is achieved not only through communication of standards from within the professional community, but also from outside the boundaries of the specific organization. Additional information is provided by the results of state assessments. Several conditions are necessary for the accountability systems to support improved instruction and learning: (1) principals and teachers must have access to the right amount of accurate and valid information; (2) they must have the motivation to use the information; (3) they must know how to interpret the information; (4) they must have the resources needed to implement the changes; and (5) all teachers and administrators must share information about instructional process and student learning as well as share responsibility for student outcomes (O'Day, 2002).

Professional organizations in all content areas have made recommendations about what should be taught in all subject areas as well as how the content should be taught. The first standards were for mathematics by the National Council of Teachers of Mathematics (1989) followed by other organizations (English and Language Arts Standards by the National Council of Teachers of English (NCTE) and the International Reading Association (IRA) in 1994; social studies standards by the National Council for the Social Studies (NCSS) in 1994; science standards by the National Committee on Science Education Standards, and Assessment & National Research Council (NSES) in 1996, and even the position statement on Technology and Young Children—Ages 3 through 8 by the National Association for the Education of Young Children (NAEYC) in 1998).

Embedded in these standards for all subject areas are recommendations and implications for technology. For example, the following recommendations for technology have been offered by professional organizations:

> Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge (NCTE & IRA, 2006).
>
> Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations (NSES, 1995, p. 148).
>
> Technological advances connect students at all levels to the world beyond their personal locations (NCSS, 1994, Thematic Strands III).
>
> Appropriate technology is integrated into the regular learning environment and used as one of many options to support children's learning (NAEYC, 1998, p.2).

Technology is an important, integral, and integrated component in all domains of learning. As a result, the International Society for Technology in Education (ISTE) developed the National Education Technology Standards (NETS) for students in 1998, for teachers in 2000, and for administrators in 2001 (ISTE NETS Project, 2005a, 2005b, 2007). Since then, individual states have used the recommendations from these professional organizations to write their curriculum standards in each subject. To date all states except Iowa have adopted, adapted, aligned or referenced the NETS in the standards or curriculum that they have set for accountability (ISTE NETS Project, 2005c). Indeed, Florida even provides on-line supports at Sunshine Connections (http://www.sunshineconnections.org/home.htm) for teachers to use for developing curricula that meets these standards.

School Reform

In order for schools to meet these state standards of accountability, school-wide reform programs have been initiated to raise the academic standards for all children, especially those who are at risk due to high levels of poverty. Successful school reform programs leave the process of school change to the schools as they adapt to meet the state standards (Borman, Hewes, Overman, & Brown, 2003). Philosophical models that usually include new instructional methods with specific curricular materials and ongoing professional development underpin successful reforms. Another key component is reform support by both the teachers and administrators. Berends, Kirby, Naftel, and McKelvey (2001) conducted a longitudinal study with observation points in 1997 and 1998 using multi-level modeling statistical techniques to examine the effects of teacher, school, and design-team factors on implementation of school reforms and student performance. They found the following factors related to successful implementation and student achievement: (1) supportive district environment; (2) teacher support of clearly communicated reform design plans; (3) strong principal leadership; and (4) adequate resources. Of note, findings from the meta-analysis of comprehensive school reform and student achievement conducted by Borman et al. (2003) demonstrated that the impacts of school reform benefited all schools regardless of their poverty levels and that the strongest effects were achieved after the fifth year of implementation. Therefore, other important factors in successful reform implementation include the duration and fidelity of the program.

Tyack and Cuban (1995) attribute the success and failure of school reforms to the teachers' and the public's ideas of what constitute "real school." Reform movements often fail or are short-lived because they counter beliefs about purposes of education and methods of instruction. For reforms to be successful, schools must enlist the support and dialogue of the community. This needed exchange of information between the organization and the outside environment is explained by complexity theory (Morrison, 2002; O'Day, 2002; Wheatley, 1999). However, since schools are loosely coupled organizations, within the complex school environment, teachers are the key to the adoption of reforms (Cuban & Tyack, 1996). Teachers may not embrace changes unless they see that the implementation will make their job of educating students more efficient and productive. Thus, adaptations of the school organization occur gradually as teachers alter and adapt reforms in order to improve the teaching and learning process while maintaining the basic structure of "real school."

Accountability and standards influence school change from outside of the organization, while teachers influence school change from within the organization. The pressures and information flow from without and the resistance and acceptance from within allow the school organization to adapt while maintaining its integrity and common purpose. The school change process requires time and free flowing communication of relevant information. Technology can be a key element in this process.

Essential Conditions for Integration of Technology Initiatives

ISTE has delineated a list of ten essential conditions for the successful implementation of the NETS (ISTE NETS Project, 2005a). This list can be mapped to the multi-level factors that interact in a complex school organization. At the boundary of information flow between the agents within the organization and the outside environment are Community Support and External Conditions. At the school or district level are Shared Vision and Support Policies. At the teacher or classroom level are Skilled Personnel, Professional Development, Technical Assistance, Content Standards and Curriculum Resources, and Student-Centered Teaching. At the student level are Equitable Access and Assessment and Accountability. Technology impacts the successful implementation of new technology integration initiatives at each of these levels.

District and School Level Factors

Communication. Adequate communication is essential between the school system and the local community and other external agencies, such as the state and federal departments of education, as well as professional organizations. These communications provide the feedback loops that support organizational adaptation. Technology has impacted the access of information by individuals and the flow of information between the local community and outside agencies. Information about federal, state, and professional organization funding for technology initiatives is disseminated through the Internet (e.g., Grants.gov at http://www.grants.gov/index.jsp and Bureau of Grants Management at http://www.firn.edu/doe/grants/grantsdev/compgrants/cgmain.htm). In fact, the Federal Funding Accountability and Transparency Act of 2006 (PL 109-282) established a ‘‘searchable website’’ with free access by the public that lists information about all federal financial assistance awarded that is over $25,000. The Internet has also impacted the dissemination of information, data, and resources for accountability standards (e.g., ISTE NETS Project at http://www.iste.org/inhouse/nets/cnets/index.html). These sponsored initiatives guide the implementation and direction of school reform. In turn, the data collection methods and analyses involved in follow-up evaluation of schools' technology integration programs have also been impacted by technology. Web surveys are conducted on-line, data is stored digitally, and the analyses of results are conducted using statistical software (e.g., STAR Survey at http://www.flinnovates.org/survey/). Schools communicate with parents and the community through school websites and e-mail (Bureau of Instruction and Innovation, Florida Department of Education, 2007a).

Leadership and vision. Leadership at the school or district level is essential for creating a shared vision and developing support policies for technology integration. To facilitate change, communication must be eased so that administrators, teachers, and students maintain active involvement. Technologies such as e-mail, listservs, websites, and wikis provide the vehicle for disseminating timely, accurate, distributed, information needed for collective vision (Morrison, 2002). The integration of technology throughout a school system as a school reform must be consistent with the district's overall educational mission, vision, and strategic plan (TSSA Collaborative, 2001).

The School Technology Plan formally articulates the district vision and blueprint for the technology integration initiative. An effective plan considers the needs of agents at all levels within the school and provides resources and supports to adequately meet these needs. Involving all stakeholders in creating the technology plan affords the best chance for a successful technology integration initiative (Barnett, 2001; Fulton, Glenn & Valdez, 2004). Anderson and Dexter (2001) identified six important categories of decisions that are made during the planning process and specifically delineated in the technology plan: strategic planning and goal setting, budgeting and spending, organization, curriculum, evaluation, and external relations. They also recommend that for best results the school must become a learning organization with distributed leadership. In fact, teachers who are more professionally involved in sharing instructional practices are more likely to use and have students use computers (Becker, 2001). Imperative for the success of the technology integration initiative is on-going funding support for infrastructure, hardware and software upgrades, technology support personnel, and staff development (Anderson & Becker, 2001; Fulton et al., 2004). Indeed, one study found that schools with the highest levels of software investment over five years had the greatest proportion of teachers assigning computer work in class and students using computers (Anderson & Becker, 2001), and districts in Texas that spent the most on hardware and software had the highest positive correlation with average student tests scores (Christensen, Griffin, & Knezek, 2001).

School-level differences. The integration of technology has been implemented differently for various levels of schools. Findings from the Technology Integration in Education Initiative Statewide Survey Report (2002) indicated that in Texas the most frequent location for students to engage in technology activities was different depending on the level of school. Most frequent locations in Texas were computer labs in middle schools (51%) and technology classes in high schools (67%), while Chicago's public schools had more computers in the classroom at the elementary level (77%) than the high school (52%) (Hart, Allensworth, Lauen, & Gladden, 2002).

The results from a survey of teachers in a large school district conducted by Barron, Kemker, Harmes, and Kalaydjian (2003) demonstrated that computers are used differently in elementary, middle, and high schools. Computers in elementary schools (29%) were used significantly more often for problem-solving than in middle (23%) and high schools (20%). Computers used for a communication tool varied by school level with most use in elementary (59%), then middle (54%), and finally high schools (48%). In contrast, computers were used significantly more often as research tools in high schools (40%) than elementary (32%) or middle schools (40%). Wenglinsky (1998, 2005) also found school level differences in the way students used computers for math instruction. At the fourth grade level, students used computers more often for learning games (54.5%) than drill and practice (35.9%) or simulations and applications (7.5%), while eighth grade students used computers more often for drill and practice (34.3%) than learning games (29.2%) or applications (27.2%).

Classroom Level Factors

Teacher. At the classroom level or teacher level, the teacher has the greatest impact on the implementation of any school reform, including the integration of technology (Cuban, 1998; Tyack & Cuban, 1995). First, teachers impact the classroom learning environment and student achievement through their primary responsibilities of coordinating instructional strategies, classroom management, and classroom curriculum design (Marzano, 2003). Second, while they implement the instruction of their curriculum with integrated technology, they facilitate students' acquisition of the NETS standards (Barron et al., 2003).

Knezek, Christensen, and Fluke (2003) identified two teacher factors, will and skill, along with access to technology that impact technology integration through structured equation modeling analysis. O'Dwyer and colleagues (2004, 2005) used multi-level modeling statistical analysis and found similar teacher factors that were related to the success of technology initiatives: teacher skill, comfort level, and perceived importance of technology.

Teachers' technology skills in using software and computers were positively related to the extent that they used computers professionally and the extent to which they had their students use computers for production of products and analyzing information (Becker, Ravitz, & Wong, 1999). In fact, the teachers' use of multi-media production software was positively related to the variety of ways that students used computers (Becker, 2001). Thus, in order to have the most impact on student achievement by technology, not only must teachers have skills in using technology for productivity and integrating technology into the curriculum, but they must also have expertise in using instructional strategies, classroom management, and classroom curriculum design. Equally important for effective integration of technology, teachers must believe that technology is an important element in the instructional design, and they must desire to integrate it into their daily lessons.

Professional development. Professional development can have a positive impact on the teacher level factors that impact student achievement: instructional strategies, classroom management, curriculum design, integration of technology, and technology skills. Due to the rapid advances in technology, professional development for technology integration needs to be ongoing for both new and experienced teachers. However, novice and experienced teachers may have different needs for professional development regarding technology integration. Although newly graduated teachers may be proficient technology users, they may not be skilled in the classroom management necessary for effective delivery of technology integrated lessons for students in the classroom environment. In addition, many new teachers have not experienced effective modeling of technology integration in their teacher preparation (Benner, Shapley, Heikes, & Pieper, 2002). Many experienced teachers have had no formal training in technology integration. For experienced teachers, technology skills may be either self-taught or acquired through staff development programs. Indeed, 93% of teachers reported that they learned about using technology independently (Smerdon, Cronen, Lanahan, Anderson, Iannotti, & Angeles, 2000).

Teachers progress through several stages of instructional and technological evolution as they become expert integrators of technology (Apple Computer, Inc., 1995; Coughlin & Lemke, 1999; Dwyer et al., 1990). During the initial level of technology integration, as they learn technology production skills, teachers become aware of the possibilities of technology for improved achievement. Given that many teachers do not feel confident in integrating technology into their daily instructional routines, impacting teachers' perceptions about the usefulness and desirability of integrating technology as well as their comfort level in using technology is vital during this stage (Donnelly, Dove, & Tiffany-Morales, 2002).

Smerdon and colleagues (2000) reported that only one third of teachers in their nationally representative study felt well-prepared to use technology for instruction. Two years later, researchers in another nationally representative study found that 84% of teachers felt that they had the technical skills necessary to be at least somewhat prepared to use computers and the Internet for instruction, and nearly 92% of teachers had taught some activities that used technology (Adelman, Donnelly, Dove, Tiffany-Morales, Wayne, & Zucker, 2002). The professional development needs of these teachers had progressed from becoming aware of the potential of technology to the next stage of integration, how to integrate technology into the curriculum.

However in 2000, only 67% of the teachers reported that they had opportunities for follow-up activities or advanced training (Smerdon et al., 2000). In 2002, 88% of teachers expressed a medium or high level of need for professional development about the integration of technology into the curriculum, and 89% wanted to see demonstrations of these types of classroom activities (Adelman et al., 2002). Indeed, O'Dwyer and colleagues (2004, 2005) found that having a variety of professional development opportunities about technology, especially when focused on the integration of technology, was significantly and positively related to having students use technology during class time.

Teachers who participate in more professional development activities for longer periods of time are more likely to use technology in their instruction (Adelman et al., 2002; Smerdon et al., 2000). Adelman et al. found that formal professional development that included more key features had greater impact for increasing the extent to which teachers instruct with technology. The top ranked key features of formal training for teachers included teaching at the appropriate skill-level of the teacher, opportunities for meaningful engagement with colleagues and materials, and input from teachers in the district in the preparation and delivery of multiple sessions that occur over substantial time. Professional development that increased teachers' instructional use of technology focused on integrating technology into instruction that was directly related to the content areas taught. The key feature identified that was lacking in formal training was follow-up planning time to implement new practices.

Although professional development increased teachers' use of technology, teachers also reported significant barriers to integrating technology activities into instruction for students. The greatest barriers were lack of release time to learn how to use technology (82%), not having enough computers in their classrooms (78%), and not having enough instructional time available to incorporate technology activities (80%) (Smerdon et al., 2000). Adelman et al. (2002) confirmed similar barriers of lack of time for practicing technology skills, developing lessons, and scheduling student activities, as well as availability of too few computers.

Access to computers. Having access to enough resources is also important for the successful integration of technology. In a national study conducted in 1999, researchers found that approximately half of the teachers with Internet access used computers for classroom instruction (Smerdon et al., 2000). O'Dwyer et al. (2004, 2005) found that the availability of technology was significantly positively related to teachers' professional use of technology and their students' use of technology during class time. Teachers reported that having too few computers was a barrier to integrating technology (Adelman et al., 2002). The availability of computers has increased over time. Adelman et al. (2002) reported that 47% of teachers had between 2 to 5 computers within their classroom. On the national level, the student/instructional computer ratio had decreased from 12:1 in 1999 to 4:1 in 2003 (Parsad & Jones, 2005). By 2006, there were 3.5 students per computer nationally and 3.8 students per computer in Florida (Technology Counts, 2006).

Location is an important factor that impacts the frequency that teachers use computers with their students for instruction. For example, Becker (2001) reported that secondary teachers who had access to 5 to 8 computers within their classroom reported that students frequently used computers during class twice as often as teachers who used computer labs. In 1998, 62% of secondary teachers with one computer per four students in their classroom used computers frequently with their students for instruction, while only 18% of teachers who used computer labs frequently used computers with their students (Becker et al., 1999).

Mann et al. (1999) reported that teachers, who had computers in their classrooms rather than in computer labs, spent more time using computers for reading, math, and writing instruction. Indeed, the students who had access to the computers in their classroom had greater achievement gains than students who had access to the computers in labs. Similar results were found in 2001, 77% of teachers with one computer per four students in their classroom used computers frequently for instruction, while only 21% of teachers with no computers in their classroom had their students frequently use computers for instruction (Adelman et al., 2002). Moreover, recent studies about the impact of one-to-one access to laptop computers by teachers and students have reported significant increases in how often teachers use computers with their students (Bebell, 2005; Lowther et al., 2003; Shapley, Sheehan, Sturges, Caranias-Walker, Huntsberger, & Maloney, 2006; Silvernail & Lane, 2004).

Access to software. Teachers can use software for various educational purposes in their instructional activities. To get the greatest return, technology must be a necessary component of the lesson (Donnelly et al., 2002). In 1999, the software most often used by secondary students was word processing; in contrast, elementary students most often used drill and practice software. Nevertheless, word processing software was used by over 50% of students in grades 4 – 12 (Becker et al., 1999). Smerdon et al. (2000) reported that within classrooms, students used computers for tool-based instruction with spreadsheets and word processors (61%), solving problems and analyzing data (50%), creating multimedia projects (45%); researching on the Internet (51%), practicing drills (50%), and demonstrations/ simulations (39%). A similar ranking of instructional activities was found by Adelman et al. in 2001: writing with word processors (77%), researching on the Internet (70%), learning computer skills (70%), as a reward or for free time (62%), and practicing drills (60%).

Technical and technology integration support. Once teachers have access to the computers needed for instruction, they must be able to count on having the support necessary to utilize them with students during the lesson. Breakdowns can occur when the hardware and network do not function or when the teacher is not proficient with the instructional methods for integrating the software into the lesson. Thus, teachers require two types of support in order to utilize technology for instruction: technical support and instructional technology support.

Staff development is often entwined with support, as the technology specialist in the school often performs both roles (Donnelly et al., 2002). Ronnkvist, Dexter, and Anderson (2000) found from their 1998 nationally representative survey that 87% of schools had someone who served as a technology coordinator, but only 19% performed this function full-time in the school. Almost half of these schools had technology coordinators who were also classroom teachers. By 2001, 38% of schools had a paid full-time technology coordinator (Adelman et al., 2002). Although the increase in full-time technology coordinators is important, the support that they supply to individual teachers is small. On average, full-time coordinators spent 22.8 minutes per teacher each week maintaining the functioning of hardware and software and 22.1 minutes per teacher each week supporting staff development, while on average part-time coordinators spent 8.4 minutes per teacher each week maintaining the infrastructure and 10.8 minutes per teacher each week supporting staff development. Of note, 41% of teachers believed that both instructional and technical support were available only to them sometimes (Adelman et al., 2002).

By 2001, 97% of teachers reported having technical support, while 83% reported they had support for integrating technology into their instruction (Adelman et al., 2002). However, only 73% of the teachers reported that their technical needs were supported fairly to extremely well, and 50% had their support needs for integration of technology met fairly to extremely well. Dexter, Anderson, & Ronnkvist (2002) further analyzed their results by including indicators for the quality of their technology support. Access to resources and professional development that focused on the integration of technology had the greatest impact on teachers' perceptions of the quality of their support. The frequency that teachers used technology with their students was positively impacted by the teachers' perceptions about the availability and quality of the support.

Student-Level Factors

Demographic and personal characteristics of students that impact the outcomes of the individual student are student level factors. Examples of student level factors that have been found to impact individual achievement are gender, ethnicity, socio-economic status, disability, and English as a second language. In addition, students' abilities, attitudes, motivation, and home environment have been found to impact achievement (Marzano, 2004).

These individual variables can also be aggregated to the next level. For example, several students' misbehavior can impact the class learning environment and thus impact class level achievement. The number of special education, limited English proficient students, or gifted students can make increased demands on the teacher's time. These students may need special supports and accommodations to be successful. When the proportion of students needing accommodations is high, the design of the curriculum and depth of coverage may change. Fewer opportunities to engage deeply with the curriculum may impact the overall achievement level of a class.

Socio-economic status. Aggregated student level factors can have even broader impact on both predictors and outcomes. Research studies have found that the proportion of students who are economically disadvantaged can impact school level variables. Adelman et al. (2002) found that students in low socio-economic schools have less access to the most modern computers and Internet in school and decreased access to computers at home. Conversely, as a result of federal funding programs, Anderson and Becker (2001) found little difference in the initial infrastructure of computer hardware and software between schools with high and low proportions of students eligible for Title 1 funding. Similar findings were found by Benner et al. (2002) in a large scale study about technology integration in Texas schools. Schools that served the most economically disadvantaged students and had the greatest Technology Literacy Challenge Funding had the greatest number of classroom Internet connections. Indeed, over the past five years, Texas schools with the greatest number of students at poverty level made the greatest gains in technology resources. Wenglinsky (1998, 2005) also found that the gap between high and low economic students for access and use of technology for math instruction had been eliminated by the time of his study that used secondary data collected by National Assessment of Educational Progress (NAEP) in mathematics in 1996.

However, when recent expenditures are examined, differences arise. At the school level, the socio-economic status of a school, as determined by the community in which the school is located, impacts the amount that the school spends on technology, especially for hardware and support (Anderson & Becker, 2001). Schools in economically disadvantaged areas spend less than half the amount that high income area schools spend on additional hardware and on-going support. Teachers in high income schools had more resources available to them and were more likely to attend professional development sessions on technology (Ronnkvist et al., 2000), while teachers in low economic schools had the least access to technology support and training (Benner et al., 2002; Wenglinsky, 1998, 2005). As a result, teachers may have different training needs based on the economic status of their schools. Teachers in low socio-economic schools needed more training in basic technology skills, while teachers in high socio-economic schools needed training about the integration of technology (Benner et al., 2002). In addition, Anderson and Becker (2001) found that the school's degree of investment in hardware, software, and technology supports were positively related to the frequency that teachers assigned students to computer work. Consequently, students in low socio-economic schools had fewer technology skills when compared with those in high socio-economic schools (Adelman et al., 2002).

On the other hand, low socio-economic status does not always negatively impact a school. Adelman et al. (2002) found that teachers in high-poverty schools that participated in the Technology

Literacy Challenge Fund program were significantly more likely to receive incentives for participating in professional development. These grants encouraged 30% of the technology funds to be allocated to professional development. Additionally, level of poverty was not a statistically significant predictor of the impact of school reform programs (Borman et al. 2003). Schools with the greatest levels of poverty were just as likely to have positive results from their school reforms as all other schools. Moreover, Benner et al. (2002) found that students in economically disadvantaged schools participated in more technology activities than higher socio-economic schools.

However, Becker (2001) found that the educational experiences of students in low economic schools were different from those in high economic schools. Using logistic regression, Becker found an interaction between ability, school level, and school socio-economic status. He concluded that economically disadvantaged students used computers more often for learning basic skills. Adelman and colleagues (2002) confirmed this conclusion in their integrated studies of educational technology. They found two significant differences in high frequency computer use between high-poverty and low-poverty schools. Students in low-poverty schools more often used computers for drills (42% vs. 25%) and for free-time (42% vs. 26%). Wenglinsky (1998) found that poor eighth grade students were less likely to use computers for simulations or applications than non-poor students (22% vs. 33%) and were more likely to use computers for the lower-order thinking skills involved in drill and practice (34%). He found that this trend had not changed in 2000 (Wenglinsky, 2005).

There are many factors that facilitate the integration of technology at both the macro and micro levels. Factors at the macro or district and school levels include communication, leadership and vision, and school level differences. Factors at the classroom level include the teacher, professional development, access to computers and software, and support for technology integration. At the micro-level or the student level, student demographics and personal characteristics, especially socio-economic status impacts the integration of technology into the daily instructional routine.

Research Evidence for the Relationship of Technology and Student Outcomes

Student Achievement Outcomes

How technology is used has had an impact on studies measuring its effectiveness. Interestingly, even when researchers looked at how technology was utilized by the same programs, they did not always draw the same conclusions. Borman et al. (2003) recommended the Co-NECT program, which includes technology integration in its model, as having the greatest need for additional research because of its potential. This is the same program that Oppenheimer (2003) observed when he visited a high school in Massachusetts and concluded that the technology used by the students distracted them from deeper understanding of subject matter, so that they performed at a similar level as middle school students. Conversely, when Wenglinsky (2005) visited the same school, he found that the quality of the students' work was similar to that of advanced placement students and that the students demonstrated sophisticated problem solving skills. Berends et al. (2001) reported that six out of 18 schools that implemented the Co-NECT program had gains in reading test scores and ten out of 17 schools had gains in math test scores, when compared with the average of the other schools in the district. In addition, the standardized tests that were used to measure achievement did not assess the deeper level of knowledge and skills that students had gained from using the technology (Russell & Higgins, 2003; Wenglinsky, 2005). These various interpretations about the same program provide some insight into the disparity of the results that have been reported on the effectiveness of technology on student achievement.

Moreover, even though individual researchers have used the same data and drawn the same overall conclusions, they have disagreed on methods, variables, and specific outcomes. For example, both Wenglinsky (2004, 2006) and Lubienski (2006) agreed that student achievement is impacted by the socio-economic status of the student and school in their studies that were conducted using secondary data from NAEP in 2000 to examine the differences in mathematics achievement by ethnicity. However, they disagreed on the methods for conducting the multi-level analysis. Specifically, they differed on the level of alpha needed to control for Type I errors, how many individual variables to include, whether to use individual variables or composite variables in the multi-level models, as well as the appropriate level of the model for inclusion of these variables. As a result, Wenglinsky (2004, 2006) and Lubienski (2006) came to different conclusions about the relationships of various teaching methods with achievement of black, Hispanic, and white students. Ultimately, they both concluded that experimental research is needed to confirm the best teaching practices to use with minority students.

Meta-analysis. The many problems that exist with experimental research on the impact of technology on student achievement are illustrated by the descriptions of the methods used in meta-analysis research. Meta-analysis is a research method that combines the results of many experimental research studies conducted over time to determine the relative impact of various factors that are associated with student outcomes.

Borman et al. (2003) used a total of 232 studies that met specific exclusion criteria in their meta-analysis on the relationship of comprehensive school reform and student achievement. However, when the requirements for inclusion were more restrictive and the studies were filtered so that they used a control group, the number of studies decreased to 145. When the criteria also required that the study was conducted by an independent evaluator and used a control group, the number of studies used in the analyses decreased to 109. The researchers reported that many studies did not even meet the standards for initial eligibility because they did not include information needed for computing effect size, and many did not report the sample size used. The researchers lost 53% of the initial studies that they found when more stringent quality criteria were required for the analysis.

Borman et al. (2003) used the initial inclusion criteria to restrict the studies selected to whole school-wide reform programs conducted by entities outside the school with at least 10 different evaluation studies. This resulted in 33 models identified. Additional inclusion criteria restricted the studies to those with reports on outcome measures of student achievement necessary for computation of effect sizes; experimental, quasi-experimental, or pre- post- study design; and students who were in regular education in the U.S. and were not duplicated in other studies. Reports from 232 studies, obtained from ERIC and PsychLit databases, Google searches, and requests to the developers were used in their analyses. The overall effect size of the 232 studies and 1111 independent observations had a mean effect size of 0.15 ($Z = 33.26$, $p < .01$); however, when the requirements for inclusion specified that the study was conducted by an independent evaluator and used a control group, the number of studies used in the analyses decreased to 109 and the number of independent observations decreased to 461 with a mean effect size of 0.09 ($Z = 10.59$, $p < .01$) a difference in effect size of 0.06 standard deviations. Results from 1,017 independent samples indicated a mean effect size of 0.13 ($Z = 10.81$, $p < .001$) for reading achievement from comprehensive school reform, while the mean effect size of math achievement from 679 independent samples for comprehensive school reform was 0.15 ($Z = 9.86$, $p < .001$). However, school reform was the focus of these meta-analyses, and technology was only one of the components of some of the school reforms.

Meta-analysis has been used to look specifically at the effect of instructional technology on student outcomes. Waxman, Lin, and Michko (2003) conducted a meta-analysis on the effectiveness of teaching and learning with technology on student outcomes. Out of an initial 200 articles, only 42 were included in the analyses, a loss of 79% of the research studies. They used ERIC databases, Google and Metacrawler search engines, and reference lists of articles in specific educational journals to find articles published between 1997 and 2003. Inclusion criteria included: experimental, quasi-experimental, or pre- and post-test design that was published in refereed journals; focus on K-12 classrooms that meet over 50% of the time face-to-face; and studies wherein the control group did not have access to computers and the statistics necessary to calculate effect sizes for all groups were reported. When there was more than one comparison in a study, each was weighted in inverse proportion to the total number of comparisons in the study. Studies with multiple outcomes were included when statistics were available to calculate effect sizes yielding a total of 282 effect sizes. Analysis of the twenty-nine articles that reported student cognitive outcomes had a mean study-weighted effect size of .448 ($p<.001$) with 95% confidence intervals that did not include zero (Waxman et al., 2003). However, Waxman et al. did not disaggregate the effect size of the student cognitive outcomes by subject area.

Several meta-analysis studies have been conducted to measure the effectiveness of various technology indicators and instructional methods for supporting student achievement in different content areas. For example, Kulik (2003), as part of his literature review on the effects of using instructional technology in elementary and secondary schools, specifically analyzed 61 studies conducted after 1990. However, he did not report how many studies were reviewed that did not meet inclusion criteria. For this study, he searched ERIC, Dissertation Abstracts, and NSF databases for experimental and quasi-experimental studies in the following categories: integrated learning systems (ILS), reading management systems, writing programs for reading, word processing and Internet resources, microcomputer-based laboratories and science tutoring and simulation. Specifically, he looked for Level II interventions that had a common theoretical basis but may have had different implementations and Level III innovations that were clearly defined with specific materials, implementation procedures, and professional development. The experimental and quasi-experimental studies had to have controlled comparisons of outcome measures that could be used to measure effect sizes. However, Kulik used the median effect size of the group of studies to measure the overall effect of the technology intervention. He did not calculate a mean weighted effect size nor did he examine specific aspects of the intervention by performing regression analysis on the study technology variables and outcomes. Instead Kulik (2003) used a narrative approach to describe the characteristics of the intervention in each study.

Kulik (2003) found a median effect size of 0.28 for the impact of integrated learning systems (ILS) on composites of scores from students' reading and mathematics achievement. However, Kulik (2003) found that the median effect sizes of seven studies that investigated the impact of ILS for only mathematics instruction on student mathematics achievement was 0.38. The effect sizes for ILS for only mathematics instruction ranged from 0.14 for grade six to 1.05 for grade eight with an overall median effect size of 0.40. Time for implementation of these programs ranged from several months to five school years.

Penuel and other researchers at SRI (2002) conducted an evaluation synthesis to examine the impact of technology used to promote connections between home and school and improve student outcomes. They used a systematic search of the Internet, research organizations, journals and educational databases for abstracts of articles from 1995 to 2001 about experimental, quasi experimental, or pre- post-design studies that measured student learning or engagement, parent involvement, or outcomes of parent-school communications. They specifically searched for combinations of keywords: home, parent, family, school, technology, computer, laptop, and voicemail. Although they had millions of hits, examined 98 abstracts, and reviewed 28 research articles, in total they calculated 103 effect sizes for all sub analyses that were reported in 19 articles. Thus, out of the initial 28 research articles reviewed, only 19 met the methodological criteria to be included in the analyses, a loss of 32%. Only two studies used experimental designs.

Several issues may influence the interpretation of the results reported by Penuel and colleagues (2002). The first is that two of the studies used in the calculation of effect sizes were embedded in school-wide reform initiatives. The positive results from these programs reported for technology innovations cannot be separated from the total effect of all the components of the school-wide reform. The second issue is that several of the studies included multiple levels for more than one school year, so the results from these same students may be included in more than one level of the results. The third issue is that several studies were sponsored and funded by the vendor and some studies did not reveal their funding. Nevertheless, similar to Kulik (2003), Penuel et al. (2002) found positive relationships between technology and mathematics achievement in their meta-analysis, although their effect sizes were not as large. The weighted effects of different technology treatments (laptop, home desktop, and discrete software) on mathematics achievement ranged from -0.01 to +0.94, with weighted mean effect size of 0.18. Although a total of nineteen effect sizes were calculated, two of the programs with three of the highest effect sizes were embedded in school reform programs (Penuel et al., 2002). These results suggest that the specific instructional methods used with the technology have a great impact on the effectiveness of the treatments.

Indeed, Kulik (2003) also investigated the effect size of ILS on mathematics achievement in nine studies when the implementation included reading instruction as well. Most studies used elementary age populations, and implementation time was longer than the studies with just mathematics, from six months to three years. The effect sizes for mathematics ranged in these studies from 0.04 to 0.58, with median effect of 0.17.The range of effect size for reading was from 0.00 to 0.44, with an overall mean effect for reading of 0.06. Interestingly in Kulik’s (2003) meta-analysis, schools that had the three highest effect sizes for mathematics had the three lowest effect sizes for reading. Likewise, the two schools with the highest effect sizes in reading, had effect sizes within the three lowest in mathematics. These results may indicate that an ILS has the greatest positive impact on student achievement when it is used for only one subject area at a time, as demonstrated by the difference in mean effect sizes for mathematics, 0.40 when ILS is used exclusively for mathematics vs. 0.17 when ILS is used for instruction in both mathematics and reading. There may be a threshold for the minimum amount of focused time that students need to interact with ILS to achieve results as well as maximum amount of time that students are able to attend to instruction in this format.

Additional, meta-analyses have been conducted to specifically find the effects of instructional technology on reading achievement. For example, Pearson, Ferdig, Blomeyer, Jr., and Moran (2005) conducted a meta-analysis to find the effects of digital literacy tools on reading performance of middle-school students in strategy use, metacognition, reading motivation, reading engagement, and reading comprehension. They used the following inclusion criteria for selection of research studies: reports had to be published between 1988 and 2005 and peer-reviewed; experimental, quasi-experimental, or pre- post-test design; sample included grades 6, 7 and 8 or aggregated results that also included either grades 5 or 9; reading skills including comprehension, metacognition, strategy use and/or motivation as the outcome; technology as the independent or moderating variable; and statistics reported that are necessary for calculating effect size. Using search engines, journal databases, international journals, and websites of professional organizations, 204 articles were located. Ultimately, 20 articles that met the inclusion criteria were selected for analysis, a loss of 90% of the studies reviewed. The researchers used a random effects model. The effects for each study were weighted and aggregated to find an overall effect for the study, and then these 89 effects were weighted to determine an overall effect of all studies. Pearson et al. (2005) used two of the same studies in their analyses as Waxman et al. (2003).

Reading comprehension was the only criterion outcome that Pearson et al. (2005) could analyze, and had a weighted mean effect size of 0.49 (z=4.36, p<.0005). The researchers also looked at contextual variables to determine differences in effect sizes. As expected, they found that special populations such as at risk readers and students with learning disabilities had smaller effect sizes than the general education population (d=0.32 vs. 0.52, Q=4.42, p<.05).

Penuel et al. (2002) reported weighted effects of different technology treatments (laptop, home desktop, and discrete software) on reading achievement that ranged from 0.07 to 1.26 with weighted mean effect size of 0.10. However, two of these programs were also embedded in a school reform initiative, so the positive results can not be attributed to the technology but to the total effect of the school reform program. In addition, some studies occurred over time for multiple grades, so some students are included in the analysis more than once.

Kulik (2003) conducted a meta-analysis of 13 studies to find the effect of the Writing to Read program on reading achievement in kindergarten, first grade, and elementary grades. Effect sizes were greatest for the youngest students, kindergarten (0.63 and 1.06 with median effect of 0.84), first grade (-0.18 to 0.78 with median effect of 0.40), and elementary (-0.01 to 0.70 with median effect of 0.25). Effect sizes for three controlled studies of Accelerated Reader, a reading management program, conducted by independent evaluators ranged from -0.02 to 1.12 with median effect of 0.43 (Kulik, 2003). Reading effect sizes for ILS studies ranged from 0.00 to 0.44 (Kulik, 2003).

Results from the meta-analysis reported in three separate studies by Pearson et al. (2005), Penuel et al. (2003) and Kulick (2003) indicate that instructional technology can have a positive effect on reading achievement. Mean effect size for these studies ranged from 0.10 to 0.49. Of interest, there were no overlaps in studies used by these researchers. Further research is needed to find the specific technology integrations that produce consistent positive improvements in reading achievement. In addition, it is important to disaggregate this information by student demographics to determine the interventions that are most likely to improve reading achievement for each group.

Goldberg et al. (2003) conducted a meta-analysis on the effects of computers on student writing. They identified 99 articles through searches of ERIC, Educational Abstracts, PsychLit, and Dissertation Abstracts databases; websites of government and professional organizations; Google search engine; e-journals; and contacting researchers in the field. Inclusion criteria included studies conducted between 1992 and 2002; longitudinal studies of the impact of word-processing over time or comparison of paper and pencil writing with using a computer for writing; sample of K – 12 grades; and outcome measures that include quality, quantity, or revisions of student writing that are not focused on spell checkers, grammar checkers or test administration. Twenty-six studies met the inclusion criterion and provided the statistics necessary to calculate effect sizes, a loss of 74% of the reports reviewed. Pre-post test designs were analyzed using only post-test, and weighted effect sizes were used to determine the overall effect size for each of the three outcomes. Additional tests of homogeneity and publication bias were conducted. Regression analyses were conducted with moderator variables.

Goldberg et al. (2003) used fourteen studies to calculate the mean weighted effect size for quantity of writing (d=0.50). Goldberg et al. also found a mean weighted effect size of 0.40 higher for the quality of writing for students who wrote with a computer when compared to the quality of writing of students who wrote with pencil and paper. Through regression analysis on moderating aspects that impact using computers for writing, the researchers found that students in middle school made greater gains in quantity and quality of writing than those in high school and elementary school.

Confirming results were found by Kulik (2003) by his meta-analysis on the effects of technology innovations on writing achievement. He found that the effects of using word processing ranged from -0.42 to 0.54 with median effect size of 0.30. Penuel (2002) also found similar results. Five programs that used technology to improve writing had a weighted mean effect of 0.34. Weighted effects for each program ranged from -0.09 to 0.40. Nineteen effect sizes were calculated; however, the two highest effect sizes were from schools involved in school-wide reform. In addition, the assessment of writing was problematic since the studies measured writing skills with different methods. In fact, none of the studies used students' writing samples obtained from their class work (Penuel, 2002).

These three meta-analyses (Goldberg et al., 2003; Kulik, 2003; Penuel, 2002) demonstrate the powerful impact that using a computer for word processing can have on students writing achievement. Mean effect sizes for these meta-analyses ranged from 0.30 to 0.50. Only one study was used in both the meta-analyses of Kulik and Goldberg. Follow-up research is needed to investigate the best instructional methods for integrating word processing into the curriculum and daily activities of students that produce the greatest improvement in students' writing achievement.

Important information about the quality of the experimental research conducted to investigate the impact of technology on student achievement can be gleaned from the descriptions of the methods used in meta-analysis research. All meta-analytic researchers included in the limitations of their studies the quantity of reports that lack the technical information that was needed to calculate effect sizes so they could not be included in their analyses (Borman et al., 2003; Goldberg et al., 2003; Kulik, 2003; Pearson et al., 2005; Penuel et al., 2002; Waxman et al., 2003). In addition, Borman (2003) found that having a study conducted by the developer increased the effect size by 0.16 standard deviations over evaluations conducted by third parties. Penuel et al. (2002) expressed concerns that more than half of their research reports were sponsored by vendors, which might indicate a conflict of interest, while other reports did not even designate the source of their funding. As a result, Waxman et al. (2003) only included articles in refereed journals. Nevertheless, Waxman et al. also complained about the quality of many of the technology reports included in these journals. Even peer reviewed journals that publish educational research have not maintained the quality of reported research by requiring authors to report all information needed to replicate the study and all statistical information necessary for calculating effect sizes. Indeed, between 32% and 90% of the reports reviewed by the meta-analyses researchers in this literature review were not analyzed because they did not meet the minimum quality requirements necessary to be used in their meta-analysis. There is great need for quality experimental and quasi experimental research with control groups to be conducted to determine the best practices for integrating technology that will positively impact student achievement. In addition, the reports about this research should comply with the quality standards for reporting results that can be used by independent researchers in further studies and educators for making informed decisions for technology integration planning and program implementation.

Table 2.

Meta-analysis Research Studies about the Integration of Technology and Student Achievement

Citation	Purpose	Time Period	Studies	Effect Size
Borman, G. D., Hewes, G. M., Overman, L. V., & Brown, S. (2003). Comprehensive school reform and achievement: A meta-analysis. *Review of Educational Research, 73*(2), 125-230.	relationship of comprehensive school reform and student achievement; reading achievement and CSR; math achievement and CSR		232 studies and 1111 independent observations	overall mean effect size of comprehensive school reform (CSR) and achievement 0.15 ($Z = 33.26$, $p < 01$); CSR and reading achievement 0.13 ($Z = 10.81$, $p < .001$); CSR and math achievement 0.15 ($Z = 9.86$, $p < .001$)
Waxman, H. C., Lin, M. & Michko, G. (2003). *A meta-analysis of the effectiveness of teaching and learning with technology on student outcomes.* Naperville, IL: Learning Point Associates. Retrieved February 17, 2008, from http://www.ncrel.org/tech/effects2/	teaching and learning with technology on student outcomes	1997 and 2003	42 studies	cognitive outcomes mean study-weighted effect size of .448 ($p<.001$) with 95% confidence intervals that did not include zero
Kulik, J. (2003). *Effects of using instructional technology in elementary and secondary schools: What controlled evaluation studies say*. Arlington, VA: SRI International. Retrieved February 17,2008, from http://www.sri.eu/policy/csted/reports/sandt/it/Kulik_ITinK-12_Main_Report.pdf			61 studies conducted after 1990	ILS effect size 0.28; mathematics overall mean effect of 0.17; reading overall mean effect size 0.06; word processing median effect size of 0.30.

Citation	Purpose	Time Period	Studies	Effect Size
Penuel, W. R., Kim, D. Y., Michalchik, V., Lewis. S., Means, B., Murphy, R., Korbak. C., & Whaley, A., (2002). *Using technology to enhance connections between home and school: A research synthesis.* Arlington, VA: SRI International. Retrieved February 17, 2008, from http://ctl.sri.com/publications/displayPublication.jsp?ID=83			19 articles and 103 effect sizes	Mathematics achievement effect size weighted mean effect size of 0.18; writing weighted mean effect of 0.34.
Pearson, P. D., Ferdig, R. E., Blomeyer, Jr., R. L., & Moran, J. (2005). *The effects of technology on reading performance in the middle-school grades: A meta-analysis with recommendations for policy.* Naperville, IL: Learning Point Associates. Retrieved February 17, 2008, from http://www.ncrel.org/tech/reading/index.html			20 articles	Reading comprehension weighted mean effect size of 0.49 (z=4.36, p<.0005)
Goldberg, A., Russell, M., & Cook, A. (2003). The effect of computers on student writing: A meta-analysis of studies from 1992 to 2002. *Journal of Technology, Learning, and Assessment, 2*(1). Retrieved February 17, 2008, from http://escholarship.bc.edu/jtla/vol2/1/			13 studies	Writing mean effect size 0.40

Research synthesis. Not all research supports the effectiveness of using technology to deliver instruction. For example, Lockee et al. (2004) reported in their research synthesis on programmed instruction, which is the foundation for computer-assisted, computer-based tutorials, and web-based tutorials, that almost all research conducted was of poor quality so that the results could not be generalized beyond that particular study. As suggested by the findings from the meta-analyses of research, the results of poor quality research cannot be used to support the effectiveness of using technology.

Even when researchers tried to control the confounding variables in order to isolate the impact of using technology to deliver instruction, mixed results were reported. Hill and colleagues (2004) reported in their research synthesis on using the Internet to deliver instruction that results yielded both positive and negative impacts on learning. Kmitta & Davis (2004) reported that most research studies have found a low to moderate positive effect for computers on student achievement, although with a great deal of variance.

Mixed findings also have been reported when specific aspects of the instruction have been examined. Although the organization of the instructional material is often thought to impact learning, Shapiro and Niederhauser (2004) reported from their literature review that some research studies have demonstrated that system structure for the delivery of content has positively impacted learning, while other research studies found none or even negative effects. They explain that these conflicting results are due to the interaction between the structure and the attributes of the learners, such as the prior knowledge, goals, and metacognitive skills of the learner. Consequently, the ability to adapt instruction for individual learning differences would make the use of technology to deliver instruction very appealing. However, Park and Lee (2004) reported that "no convincing evidence was found to suggest that such individual differences were useful for differentiating alternative treatments" (p. 659).

Another important variable that influences learning of content and that technology shows promise for manipulating, is the feedback provided to the learner. Nevertheless, Mory (2004) reported that only half of the research studies found any effect from task-specific feedback and even less from information-based feedback. In addition, another area of disagreement was the optimal timing of feedback that maximizes learning, whether to use immediate or delayed feedback. Mory (2004) interpreted that the differences in findings among the studies were due to the various ways that researchers defined the treatments used in the studies.

Computer-mediated communication (CMC) has been used to create learning environments that students interact through the computer interface with objects, simulated personalities, and/or other real participants (Romiszowski & Mason, 2004). There are many forms of CMC that either occur at the same time or synchronously (e.g., written chat, audio conferencing, and multi-user object-oriented environments) or delayed time or asynchronously (e.g., discussion boards, e-mail, and listserv). Luppicini (2007) defines CMC used for educational purposes as "the process by which people create, exchange, and perceive information using networked telecommunications systems that facilitate encoding, transmitting, and decoding messages" (p. 143). At the most basic level, threaded discussions have been used to support learning through asynchronous written discourse (Romiszowski & Mason, 2004). Within discussion forums, students write about issues and respond to their classmates over a course of time. However, Romiszowski and Mason (2004) reported that scant research has been conducted and results have been inconclusive from research that compares different instructional methods that would support the increased effectiveness of discussion forums on student achievement. Luppicini (2007) stated that mixed findings were a result of different tasks with different objectives and differences in participants.

Mircroworlds and virtual realities are at the highest level of CMC, as they use technology to support synchronous, immersive interactivity. Simulations are a form of these virtual realities that has been used educationally both to deliver content and as a tool to support learning. Gredler (2004) makes a qualitative distinction between simulations that are “open-ended evolving situations with many interacting variables… [through which learners] experience the effects of their decisions” (p. 571) and models where students solve “a well-defined problem” (p. 572) to learn and understand specific relationships among variables. Rieber (2004) explains this distinction as the difference between using technology as an object to think with in order to solve problems versus learning information from a model that was designed by someone else.

Using computer simulations to learn basic content has not always been successful. For example, students using simulations were no more successful than students in control classes. When students were not taught prerequisite knowledge before engaging in discovery learning simulations, they learned inaccurate information (Gredler, 2004). In this case, using discovery learning to infer the underlying scientific relationships of the model placed too high a cognitive load on students to be successful (Gredler, 2004; Rieber, 2004). Students needed additional supports during the simulation activity. However, even when technology was used to deliver the scaffolds or prompts to support activities, discussions, and self-monitoring processes, results indicated that students’ learning did not improve unless the program provided instruction that matched what the student needed (Dennen, 2004). In addition, Dennen explained that not only must students know how to use the supports provided for higher-order problem-solving, but they also must have the prerequisite knowledge to know when to request the supports.

Although using computers to support higher-order problem-solving in an open-ended complex and ill-defined case study or real-world virtual reality offers promise, little research has been conducted to evaluate the educational benefits (Gredler, 2004; McLellan, 2004; Rieber, 2004). Virtual realities used for educational applications have been implemented mainly for professional (medical) and military training

(McLellan, 2004). Much of the current research has been developmental or design research, which focused on the iterative refinement of the product, often without a theoretical framework (Rieber, 2004).

Kim and Reeves (2007) proposed that using the computer as a tool should be examined using the theoretical framework of expertise and distributed cognition. They explained that the use of cognitive tools requires extended time for students to develop the expertise needed to be able to use the tool as an extension for enhanced intellectual activity and distributed production. Initially, when a new cognitive tool is introduced during a problem-solving activity, it produces additional cognitive load while the student becomes familiar with the interface and learns how to use the tool for learning. The process of learning to use cognitive tools is iterative, as the learner develops expertise in both subject matter and using the tool. The relationship between the learner and the tool is dynamic and complex; they cannot be separated, and thus, learning must be assessed while the student uses the tool (Kim & Reeves, 2007).

Large-scale longitudinal research. Several research studies have investigated the effects of large scale technology initiatives over time. One of the first large-scale state-wide educational reform initiatives based on the use of technology was implemented by West Virginia (Mann et al., 1999). The Basic Skills/ Computer Education program (BS/CE) was first implemented in all kindergarten classes in 1990-91 school year, and then over the next eight years, with each successive year, it was implemented in the next higher grade level. Each school was provided with a networked file server and enough computers and printers to equip each class in the targeted grade level with three or four computers and a printer as well as the decision on how and where to implement the program, either in each classroom or in computer labs. Counties could select integrated learning systems from two providers, either Jostens Learning or IBM that matched their pedagogical practices. Thus, all schools in a grade level were given the same software for basic reading, writing, and mathematics skills development, and all teachers participated in thorough professional development prior to implementation and on-going support during initial implementation.

To investigate the effects of this program, Mann et al. (1999) examined the longitudinal gains in achievement of fifth graders in 1996-97. The study used mixed methods that included survey data from students and teachers, interviews with teachers and principals, observations, and document analysis, and gain scale scores from Stanford-9 reading, language arts, and mathematics achievement tests. The sample included a stratified sample of 18 schools based on achievement, intensity of program implementation, geography, vendors, and SES. The sample included 950 fifth grade students who began their participation in the program in kindergarten in 1989-90 and all 290 third through fifth grade teachers in the 18 schools. Researchers surveyed all students and teachers in the sample and interviewed all principals and fifth grade teachers as well as selected teachers in lower grades. Addition data were collected from documents related to technology planning and implementation at the district, school, and classroom level, as well as state records.

There were three components in the regression model for the BS/CE program used for determining the impact of technology on student achievement gains: hardware and software access and use; student and teacher attitudes; and teacher training and involvement. Results of the regression model accounted for 11% of the variance in the achievement gains of the students. Moreover, the researchers found that the children without home computers made the greatest gains in total basic skills, total language, language expression, total reading, reading comprehension, and vocabulary. In addition, the placement of the computers in the classroom was important, as teachers who had computers in their classroom reported higher skill levels for planning, managing, and delivering instruction as well as using computers more often for instruction in reading, math, writing. Thus, the students in classrooms with computers made the greatest gains in achievement. The variable that had the most impact on student achievement gains was time, that is, both the frequency that students participated in the BS/CE program during each year and their accumulated experience in the program over all of the years of the study. However, the researchers point out that all student achievement gains cannot be attributed to the BS/CE program alone because West Virginia was involved in other reforms during the same period of time (e.g., building renovations, significant increases in teacher salaries, instituting a statewide curriculum framework, state-wide standards testing, and accreditation visits) that also impacted student achievement.

Wenglinsky (1998, 2005) investigated the relationships between technology used with instructional methods and math, science, and reading achievement. In 1996, 6,000 fourth grade students and 7,000 eighth grade students and in 2000 (Wenglinsky, 1998, 2005), 13,000 fourth grade students and 15,000 eighth grade students took mathematics assessments, and 13,000 fourth grade and 15,000 eighth students took science assessments in 1996 and 2000 (Wenglinsky, 2005). Although Wenglinsky does not report the number of eighth grade students who took the NAEP reading assessment in 1998, *The NAEP*

1998 Reading Report Card for the Nation and the State reports that 22,000 eighth grade students took the reading test. However, the NAEP data are cross-sectional and different cohorts of students are tested each year, so the student data collected by NAEP can not be used for repeated measures longitudinal analysis. Wenglinsky used t-tests with two groups at a time with Bonferonni adjustments for multiple comparisons to statistically test for differences among different groups of students. He used structural equation modeling with multiple indicators to find models that best explained the relationships among student variables, teacher variables, technology indicators, and student achievement in mathematics, science, and reading. Due to the administration method of the NAEP that uses different booklets of tests with students rather than the complete test, total scores were imputed and design effects were used for the analysis.

Wenglinsky (1998, 2005) found positive relationships between technology used with specific instructional methods that focused on higher order thinking skills and achievement in both mathematics and science for both fourth and eighth grades when examining secondary data from the NAEP in 1996 and 2000. Interesting, when all uses were included, increased computer use at school had a negative relationship with mathematics and science achievement at both grade levels. Professional development for computers was related to higher achievement in eighth grade for math, science, and reading. Using computers to revise drafts was significantly related to reading achievement. Learning games were associated with higher achievement at the fourth grade level in both mathematics and science. Noteworthy, the variable that had the greatest relationship with mathematics, science, and reading achievement at all grade levels was socio-economic status.

In a more recent mixed method study of one school district, Lowther et al. (2003) investigated the impact of using laptops in the classroom on teaching strategies and student achievement. They selected one treatment class and two control classes in the same school at the same grade level in four middle schools and one elementary school resulting in 21 classrooms (12 laptop and 9 control classes) in grades 5, 6, and 7. Control classes had access to 5-6 desktop computers within the classroom. Previous writing and science achievement scores for some of the laptop and control students were compared before the treatment. Results indicated significant writing advantage of the control group and a significant science advantage of the laptop group. Researchers collected data through classroom observations, district writing assessment, problem solving task rubric, student surveys, student focus groups, teacher interviews, and district parent interview. School observations were conducted using the School Observation Measure (SOM) and the Survey of Computer Use (SCU). Observers were trained to use these instruments, and the inter-rater reliability for the five category response rubric SOM was 67% for identical responses and 95% for responses within one category difference, and the inter-rater reliability for identical responses to the five category rubric was 86%. Randomly selected writing samples of 59 control and 59 laptop students in sixth and seventh grades were assessed by trained reviewers with the district four point rubric on four dimensions. Fifty-two laptop students and 59 control students were randomly selected to complete a specially designed problem solving task. Trained reviewers used a rubric with seven components to blindly assess the student responses for 3 levels of performance. Inter-rater correlations ranged from 0.73 to 0.79. Parallel forms of on-line student surveys were administered to 257 laptop students and 134 control students. Reliabilities of the scores of Likert-style items were .795 and .854 for the laptop group and .735 and .806 for the control group. Seventy-one randomly selected students participated in six focus groups, and six teachers were randomly selected from teachers in the control and laptop groups at each grade level to participate in interviews.

Lowther et al. used analysis of variance (ANOVA), multivariate (MANOVA), t tests for independent samples, and chi square tests of independence statistical tests on quantitative data collected. Effect sizes were computed using Cohen's d with pooled standard deviations. The researchers reported that laptop computers positively impacted students' writing and problem solving skills when compared to students without access to laptops. Results of MANOVA analysis on overall writing indicated that both sixth and seventh grade laptop students performed better than the control students. Effect sizes for the four dimensions ranged from 0.53 to 1.47. Results of MANOVA analysis on problem solving achievement indicated that sixth and seventh grade laptop students performed better than the control students. Positive effect sizes for the five of the seven dimensions ranged from 0.38 to 0.76.

Multi-level model research. Several recent studies used multi-level modeling techniques for analysis. Russell, O'Dwyer, Bebell, and Tucker-Seeley (2004) examined the relationship between students' mathematics test scores and computer use at home and school. For this study, the researchers obtained a stratified sample of fourth grade teachers who were high, medium, and low users of technology from an original sample that included 200 schools in 22 school districts in Massachusetts between spring 2001 and spring 2003. Teachers were recruited to participate in this study. The results from an additional district were incorporated with this sample resulting in 1,213 students and 55 teachers from 25 elementary schools in 9 school districts. After excluding special student populations, students with disabilities and English Language Learners, the sample included 986 students. When compared with the averages for all students in the state, the students in the researcher's sample had a higher ratio of students to computers, had a lower proportion of economically disadvantaged students, and had higher average academic performance scores.

Students and teachers completed surveys about their technology use in Spring 2003, and achievement data from the Massachusetts Comprehensive Assessment System (MCAS) fourth grade mathematics scores and subscale scores from 2002-03 were obtained from the districts. Reliability of the total mathematics score was .86 and the subscale scores ranged from .32 to .71. Reliabilities of composite scores made to measure student technology variables ranged from .54 to .74, and reliabilities of the composite scores used to measure teacher use of technology ranged from .45 to .89. Scores were standardized for the analysis (Russell et al., 2004).

The multi-level models with student level and teacher level factors for the total mathematics score accounted for 16% of the total variance explained. Significant student-level factors in the full model included the student's grade 3 reading score and the number of computers at home, and significant teacher-level factors included the teacher mean 3rd grade student reading score and a negative relationship with teacher directs students to create products using technology. However, Russell and colleagues report that the impact of the measure, the teacher directs students to create products using technology, became insignificant when the more parsimonious model was analyzed using only the significant factors. Thus, results from this study seem to indicate little relationship between technology use and student achievement in mathematics.

O'Dwyer et al. (2005) examined the relationship between home and school computer use and students' English/ Language Arts test scores. O'Dwyer and colleagues (2005) used the same sample as Russell et al. (2004) with the same technology indicators from student and teacher surveys. The fourth grade MACS English/ Language Arts total score and sub domain scores for reading, literature, and writing were used as outcome variables in the analysis.

The full model with all student-level and teacher-level factors explained 23% of the variance of the total scores on the fourth grade MACS English/ Language Arts test. Significant student-level factors that were negatively related to total score were how often students use a computer in school to create presentations and recreational home use of the computer. Significant positive student-level factors related to English/ Language Arts Achievement included the frequency that students use a computer in school to edit papers, how many books the student owns at home, how many computers at home, and the student's 3rd grade reading score. The only significant teacher-level factor related to achievement was the teacher mean student 3rd grade reading score. When the more parsimonious model with only significant factors was analyzed, all factors remained significant and accounted for 24% of the total variance explained.

The researchers followed up with analyzing the writing scores in the sub domain of the MACS English/ Language Arts test. The full model with all student-level and teacher-level factors explained 12% of the variance. Significant student-level factors and teacher-level factors were the same as the total MACS English/ Language Arts test, except that recreation home use was no longer significant. Follow-up analysis for the Reading and Literature sub domain scores explained 25% of the total variance. Significant student-level factors and teacher-level factors were the same as the total MACS English/ Language Arts test, except that how often students use a computer in school to create presentations was not significant. The consistent positive relationship between technology and student English/ Language Arts achievement found by O'Dwyer et al. (2005) was with using a computer at school to edit papers. The negative relationships between student-level technology factors, recreational home use and using computers at school to create presentations, and student English/ Language Arts achievement were not significant for all three outcome measures.

Shapley et al. (2006) evaluated the first year of the Texas Technology Immersion Pilot, which was conducted in 22 middle schools with high proportions of economically disadvantaged students. Requirements of the program were both students and teachers had laptops with productivity tools, wireless access to on-line curriculum resources, and ongoing technical support. Data were collected for this evaluation study through site visits, observations, pre- and post campus technology survey by technology coordinators, pre- and post teacher surveys, and pre- and post student surveys in fall 2004 and spring 2005. The initial cohort used in this study included 5,564 sixth grade students and 1,304 teachers in both immersed and control schools. Additional demographic data were collected through the Texas Public Information Management System and the Academic Excellence Indicator System. Student level discipline data were collected from 2605 middle schools in spring 2005.

Multi-level models were analyzed to determine the relationships between predictor technology immersion indicators obtained from students and teachers responses on the surveys with achievement outcomes measured by the Texas Assessment of Knowledge and Skills (TAKS). Internal reliability measures of the TAKS were reported to be between high .80's and low .90's. Results found from the initial analysis during this first year indicate there was no significant relationship between technology immersion and reading or mathematics achievement for sixth graders. Shapley et al. (2006) explain that the lack of significant results for student achievement outcomes was because most schools had only partial immersion and teachers reported that most students only participated in technology activities once or twice a month. In addition, the researchers expected that analyses of longitudinal data collected from future data were needed to reveal the impacts of immersion on student achievement.

Dynarski and colleagues (2007) used 3-level multi-level modelling to determine the effectiveness of reading and mathematics software products for increasing student achievement. This study included a total of 33 districts, 132 schools, and 439 teachers. Software products were grouped together for first grade reading, fourth grade reading, sixth grade math, and Algebra. Districts and teachers were recruited because they did not already use the technology. An experimental design was used; teachers were randomly assigned to treatment or control groups. Teachers in control groups were able to use technology products that they had available to them. Teachers in experimental groups were also free to discontinue using the products or use the products in ways that were not intended. Students' achievement was measured by the researchers in the fall and again in the spring. Achievement data also were collected from the districts and schools when available. In addition, the researchers observed each classroom three times during the school year to assess product implementation. Teachers were interviewed about implementation issues, and background information was collected with a teacher survey. All teachers were trained to use the products. Additional variables included in the model were student age, gender, pre-test scores, teacher gender, teacher experience, masters degree, school race and ethnicity, percent of students in special education, percent of students eligible for free lunch, time using treatment product, time using other products, adequate preparation time, students having problems accessing products, computer specialist on staff, and student, classroom, and school random effects (Dynarski et al., 2007).

Results from the first year of the two year study indicated that the differences in test scores between the control and treatment groups for first grade reading were not significantly different. All products used for the first grade treatment had a tutorial-practice-assessment modular structure. The only moderating effect that was statistically significant was the teacher-student ratio. Three of four products used for fourth grade reading were tutorials with practice and assessments for specific reading skills. The fourth product provided access for teachers to digital resources that they could choose to use to supplement the reading curriculum. The differences in test scores between the control groups and treatment groups were not statistically significant; however, there was a moderating effect for the duration that the product was used. The three 6th grade math products were tutorials with practice and assessments. Results indicated no statistical difference between the test scores of the treatment and control groups, and there were no moderating effects from student, classroom, or school variables. The Algebra products covered the conventional curriculum. One product was a full curriculum with most activities carried out during class periods "off-line". The other two products were supplements to the regular curriculum. Results again indicated that there was no statistical difference between the test scores of control and treatment groups, and there were no statistically significant moderating effects from student, classroom, or school variables (Dynarski et al., 2007).

Researchers at SRI International (2007) conducted an experimental study using 2-level multi-level modelling statistical analysis to determine if the integrated curriculum "SimCalc Mathworlds" could enhance the understanding of seventh grade students about rate and proportionality. Participants were selected from volunteers who attended a summer workshop and had complete data. For a two to three-week period the treatment group (48 teachers) used the SimCalc unit, while the control group (47 teachers) used the existing textbook. All teachers received three days of training. The researchers developed a student assessment using psychometrically recommended procedures to measure student learning (Roschelle, Tatar, Shechtman, Hegedus, Hopkins, Knudsen, & Stroter, 2007).

Results indicated a significant overall treatment effect (0.84, $t(93)=9.1$, $p<0.0001$). Most of the difference between groups occurred on the complex skills assessment portion (effect = 1.22, $t(93)=10.0$,

$p<0.0001$. The researchers attribute the significant differences to the increased focus of the instruction that students received in the treatment group on cognitive complexity. The cognitive complexity of teaching was measured by the daily report of teachers using a 4-point Likert scale to designate the degree of lower-order and higher-order goals (Roschelle et al., 2007).

These positive results need to be contrasted with the insignificant results reported by Dynarski et al. (2007). The duration of the study conducted by Roschelle et al. was three weeks, while the duration of the study conducted by Dynarski et al. was an academic year. It is possible that the newness of the treatment impacted students' motivation to learn during the one instructional unit. However, another difference may have been the essential integration of the technology into the highly interactive curriculum to stimulate cognitive complexity. The instructional implementation of the math products evaluated by Dynarski et al. may not have been delivered with as high a focus on cognitive complexity.

Summary of research on student achievement. Research synthesis literature reviews yielded inconclusive results about the impact of technology integration on student achievement (e.g., Gredler, 2004; Hill et al., 2004; Lockee et al., 2004; Luppicini, 2007; McLellan, 2004; Metri Group, 2006; Mory, 2004; Park & Lee, 2004; Rieber, 2004; Romiszowski & Mason, 2004; Shapiro & Niederhauser, 2004). Results from meta-analysis suggest that computer use has positive effects on student reading (Kulik, 2003; Pearson et al., 2005; Penuel et al., 2002), writing (Goldberg et al., 2003; Kulik, 2003; Penuel et al., 2002), and mathematics achievement (Kulik, 2003; Penuel et al., 2002). These effects may be enhanced when they are embedded in school-wide reform programs (Borman et al., 2003; Kulik, 2003; Penuel et al., 2002). Indeed, Mann et al. (1999) found positive impacts of technology when embedded in a long-term state-wide reform initiative. Structural Equation Modelling with large scale NAEP assessments found that technology use was positively related to student science, math, and reading achievement when used to enhance higher order thinking skills (Wenglinsky, 2005). Mixed method research also found positive impacts from using computers on writing and problem solving achievement (Lowther et al., 2003). However, research using multi-level modelling statistical techniques with large scale data found no significant relationships between computer use and student achievement in math (Dynarski et al., 2007; Russell et al., 2004) and reading (Dynarski et al., 2007). One study found a positive relationship between using a computer to edit papers with reading and writing achievement (O'Dwyer et al., 2005), and another for using integrated technology for a mathematics unit (Roschelle et al., 2007). However, the time span for all of these multi-level modelling research studies was only two years or less.

Time may be the critical component. Results from the comprehensive school reform and student achievement meta-analysis found that the years of implementation had a large impact (Borman, 2003). Indeed, schools that had implemented their comprehensive school reform model for five years had almost twice the effect size as all schools in general, and after seven years of implementation, schools had effect sizes of 0.50. Given that multi-level models have found significant positive relationships between having access to computers and the frequency with which students and teachers use them (O'Dwyer et al., 2004, 2005; Shapley, 2006), there may be mediating variables that must be impacted first before student achievement is effected.

Table 3.

Large Scale Research Studies about the Relationship of Technology Integration with Student Achievement

Citation	Purpose	Time Period	Studies	Effect Size
Mann, D., Shakeshaft, C., Becker, J., & Kottkamp, R. (1999). *West Virginia story: Achievement gains from a statewide comprehensive instructional technology program*. Retrieved February 17, 2008, from http://www.mff.org/publications/publications.taf?page=155	stratified sample 18 schools; 950 students	8 years	mixed methods	positive impact on reading, writing, and math basic skills
Wenglinsky, H. (2005). *Using technology wisely: The keys to success in schools*. New York: Teachers College Press.	Math, reading and science - 13,000 students in 1996 and 28,000 in 2000	1996 and 2000; one year	Structural Equation Modeling	positive relationship of technology used with higher order thinking skills and problem solving with achievement in math and science
Lowther, D. L., Ross, S. M., & Morrison, G. M. (2003). When each one has one: The influences on teaching strategies and student achievement of using laptops in the classroom. *Educational Technology Research and Development 51*(3) 23-44.	5 schools and 12 classes	2001-02	mixed methods	positive relationship with overall writing

Citation	Purpose	Time Period	Studies	Effect Size
Russell, M., O'Dwyer, L., Bebell, D., & Tucker-Seeley, K. (2004). *Examining the relationship between students' mathematics test scores and computer use at home and at school*. Boston, MA: Technology and Assessment Study Collaborative, Boston College. Retrieved February, 17, 2008, from http://escholarship.bc.edu/intasc/28/	9 school districts, 25 schools, 55 teachers, and 986 students	2001-2003	multi-level models	little relationship between technology use and student achievement in mathematics
O'Dwyer, L. M., Russell, M. Bebell, D. J., & Tucker-Seeley, K. L. (2005). Examining the relationship between home and school computer use and students' English/ language arts test scores. *The Journal of Technology, Learning, and Assessment, 3*(3) Retrieved February 17, 2008, from http://escholarship.bc.edu/jtla/	9 school districts, 25 schools, 55 teachers, and 986 students	2001-2003	multi-level models	consistent positive relationships between students using a computer at school to edit papers and writing achievement
Shapley, K., Sheehan, D., Caranikas-Walker, F., Huntsberger, B., & Maloney, C. (2006). *Evaluation of the Texas technology immersion pilot: First-year results.* Austin, TX: Texas Center for Educational Research. Retrieved February 17, 2008, from http://www.tcer.org/research/etxtip/index.aspx	22 middle schools, 5,564 sixth grade students, and 1,304 teachers	2004-2005 one school year	multi-level modeling	no significant relationship between technology immersion and reading or mathematics achievement

Student Behavioral Outcomes

The lack of significant results found by current research for the relationships of technology integration with student achievement may be a result of mediating variables such as students' motivation to learn, their conduct, and their attendance. If technology integration positively impacts these factors, it may result in a positive impact on student achievement. Ringstaff & Kelley (2002) reported that technology has had a positive impact on student self-confidence, responsibility, and attitudes toward learning. These impacts also lead to improved student attendance rates and decreased dropout rates (Ringstaff & Kelley, 2002). Kmitta and Davis (2004) reported that research studies have demonstrated that computers supported students improved motivation to learn and their behaviour at school. Barron et al. (1999) investigated the relationships between student conduct and the number of computers per student in Florida schools. Barron et al. collected school level data for the number of computers available from the State of Florida Computer

Use Surveys for 1993-94 (N = 2250), 1994-95 (N = 2200), and 1995-96 (N = 2350) school years. Schools were divided into two groups by the direction in the trend of students using computers at school. Thus, schools with decreasing trends of students using technology included 74 elementary schools (5%), 27 middle schools (6%), and 17 high schools (5%) with increasing trends of students using technology included 786 elementary schools (56%), 231 middle schools (52%), and 148 high schools (47%). Schools that were stable or had inconsistent trends were purposively excluded from the analyses. In addition, schools that were not elementary, middle or high schools were purposively removed from the sample. School demographic information and discipline and attendance information were obtained for the 1995-96 school year from the State of Florida Department of Education Annual School Reports. Differences between schools in the proportions of students on Free or Reduced Lunch status and proportions of minority students were controlled for by the statistical analysis.

Effect sizes were used to compare the two groups. Findings indicated that schools with increasing trends for students using computers had better student conduct measured by mean differences in total conduct violations and better attendance rates measured by mean differences in rates of attendance (elementary schools - total conduct violations d=-0.14 and attendance rate d=0.25; middle schools - total conduct violations d=-0.35; and high schools - total conduct violations d=-0.23 and attendance rate d=0.09). However, middle schools did not experience increases in attendance rates; indeed, the trend was decreased rates (d=-.09). The researchers pointed out that this inconsistent result may have been because there were a large number of factors that can impact student outcomes such as student socio-economic status that were not controlled in the study. Moreover, they also pointed out that the unit of analysis in this study was the school, not the individual student. Barron et al. suggested that future studies look at how computers are used not just the ratio of computers to students.

Although Waxman et al. (2003) found no significant effect between technology and students' behavioral outcomes using meta-analysis, in 2006, Barron et al.'s results were supported by a new study that included student level data. Shapley et al. (2006) reported a positive relationship between technology immersion and decreased number of students referrals (d=0.16) and suspensions (d=0.06) during the initial year of a large scale middle school laptop immersion initiative. Although they found a significant difference between treatment and control groups for improved school attendance rate (d=-0.08), the researchers explained that this significant difference was the same before treatment as well and concluded that there were no apparent gains in student attendance from the treatment. Moreover, Muir-Herzig (2004) examined the relationship between at-risk student attendance and teacher use of technology, student use of technology, and overall use of technology. Results indicated no significant relationships between any of the technology uses and attendance. Muir-Herzig explained that the overall use of technology by all teachers and students in the study was very low, and that without appropriate use by students, their attendance was not impacted. All studies call for further investigation with longitudinal data.

Summary of research on student behavioral outcomes. Ringstaff and Kelley (2002) and Kmitta and Davis (2004) reported that research has demonstrated positive relationships between technology integration and positive student behaviours. In addition, positive relationships were found between technology integration and improved student conduct (Barron et al., 1999; Shapley, 2006). However, Waxman et al. (2003) reported no significant effect between technology and students' behavioral outcomes using meta-analysis. Furthermore, other studies reported no significant differences in the relationship of technology integration with student attendance (Barron et al., 1999; Muir-Herzig, 2004). These mixed results may be due to the duration of the studies and the measurement of the variables. It is important to examine the relationship between technology integration and student behavioral outcomes over extended period of time.

Table 4.

Research Studies about the Relationship between Technology Integration and Student Behavioral Outcomes

Citation	Purpose	Time Period	Studies	Effect Size
Barron, A.E., Hogarty, K.Y., Kromrey, J.D., & Lenkway, P. (1999). An examination of the relationships between student conduct and the number of computers per student in Florida schools. *Journal of Research on Computing in Education, 32*(1), 98-107.	top 5% increasing trends for technology and bottom 5% decreasing trends for technology resulting in 850 elementary schools, 258 middle schools, and 165 high schools	1993-94 to 1995-96	comparison of effect size	schools with increasing trends for students using computers had better student conduct and attendance rates

Citation	Purpose	Time Period	Studies	Effect Size
Waxman, H. C., Lin, M. & Michko, G. (2003). *A meta-analysis of the effectiveness of teaching and learning with technology on student outcomes.* Naperville, IL: Learning Point Associates. Retrieved February 17, 2008, from http://www.ncrel.org/tech/effects2/	3 studies	1997 and 2003	meta-analysis	mean study-weighted effect size for behavioral outcomes was slightly negative -.091, ($p > .05$)
Shapley, K., Sheehan, D., Caranikas-Walker, F., Huntsberger, B., & Maloney, C. (2006). *Evaluation of the Texas technology immersion pilot: First-year results*. Austin, TX: Texas Center for Educational Research. Retrieved February 17, 2008, from http://www.tcer.org/research/etxtip/index.aspx	22 middle schools, 5,564 sixth grade students, and 1,304 teachers; discipline records from 2605 middle schools	2004-2005 one school year	multi-level modeling	positive relationship between technology immersion and decreased number of students referrals

Summary

Complexity theory provides the framework that explains how schools as institutions respond to school reform efforts and academic standards for increasing student achievement by adapting instructional methods. Technology facilitates this change process. Both the teaching and learning process and the interactions of students evolve as teachers integrate technology into the curriculum. Some research has revealed positive relationships between technology use and student achievement, while others have reported no significant relationships. However, there are many factors that influence student achievement that need to be controlled or included in research investigations. Moreover, few large scale, longitudinal studies have investigated the relationship between technology integration and student achievement using multi-level modelling that takes into account the nested nature of educational data and moderating factors. This research study built on previous studies by using multi-level modeling with state-wide, school-level data about their technology integration and their average school achievement scores collected over three years.

Chapter 3: Methods

While traditional statistical techniques cannot handle violations of the basic assumption of independence, multi-level modeling is a flexible approach that allows the analysis of data that have a nested structure. This is especially important with educational data analyses, since the variables that compose the educational environment and instructional dynamics are nested by nature. Multi-level modeling also allows for analyses to be conducted on longitudinal data when there are missing observation points, without losing participants or information. Therefore, when examining changes, this technique is preferable to repeated measures Multivariate Analysis of Variance (MANOVA), because MANOVA cannot handle longitudinal data that is "messy" or unbalanced with uneven time points and missing data (Luke, 2004). Also, in this study, multi-level modeling allows the variance to be decomposed into between school and within school components (Luke, 2004; Raudenbush & Bryk, 2002). This study used multi-level modeling analyses with longitudinal data over a four year period.

Data sources

The Division of Accountability, Research, and Measurement of the Florida Department of Education provides educational data in order to promote longitudinal research that will improve the outcomes of students in Florida schools Division of Accountability, Research and Measurement, Florida Department of Education, 2007a). Many aggregated variables at the school level are available in a variety of publicly available on-line databases. For this study data school-level data were downloaded from four of these on-line databases. Downloaded data for schools from the different datasets were connected using the school identification number.

Master School Identification (MSID) files

The identification number and school level designation were obtained from the *Master School Identification (MSID)* files in Florida. The file for the current year (2006-07) was available to the public at the FLDOE website (Division of Accountability, Research and Measurement, Florida Department of Education, 2007a). Files for the other years included in the study (2003-04 to 2005-06) were obtained by email request to the person designated on the FLDOE website. The categorical designation as magnet school or magnet program with technology specialty was obtained from the MSID file for 2005-06 (Bureau of Education Information and Accountability Services, Florida Department of Education, 2007).

Instrument: Florida Comprehensive Assessment Test

The FCAT Reading, Math, and Writing were chosen to measure achievement because they are required to be administered to all students enrolled in public schools as part of the state of Florida student assessment and school accountability program developed by the Department of Education. The FCAT in Reading and Mathematics has been administered every year to all students in public schools in grades 3 through 10 since 1998. These assessments were developed using psychometric procedures to assure their validity and reliability. The scores of the 2003 FCAT for grade levels 3 to 10 were reported to have internal consistency reliability measured with Cronbach's alpha and KR-20 for Math between .87 and .93 and for Reading between .88 and .91(Human Resources Research Organization & Harcourt Educational Measurement, 2003). The reading and mathematics assessments include multiple choice, short response, and extended response items. The mathematics FCAT also includes guided-response items. In 2005, the test was changed from the version that was based on the Stanford Achievement Test Series, Ninth Edition (SAT9) to the version based on the Stanford Achievement Test Series, Tenth Edition (SAT10) (Florida Department of Education, 2005b). The Total Reading was normed in the spring of 2002 with a stratified national sample by geographic area, socio-economic status, urbanicity, and ethnicity (Harcourt Assessment, Inc., 2002, 2004). Scaled scores have approximately equal units on a continuous scale and allow scores within a domain to be compared across levels (Harcourt Assessment, Inc., 2002, 2004). Norm referenced scaled scores for Total Reading and Total Mathematics ranged from 400 to 800 (Harcourt Assessment, Inc., 2002, 2004). The mean scaled scores for the spring norms of Total Reading for grades 3 to 10 ranged between 621 and 702, with standard deviations between 36.7 and 39.2 (Harcourt Assessment, Inc., 2002, 2004). The mean scaled scores for the spring norms of Total Mathematics for grades 3 to 10 ranged between 606 and 700, with standard deviations between 35.9 and 40.8 (Harcourt Assessment, Inc., 2002, 2004). The writing FCAT is a 45-minute essay that is scored based on focus, organization, support, and conventions (Florida Department of Education, 2005a). In 2006, multiple-choice items were added to the FCAT Writing Test and the score was changed to a scale score that range from 100 – 500; however the rubric-based sub-score was also reported (Florida Department of Education, 2006). These rubric scores range from unscorable to 6.

Each school's mean FCAT NRT score in Reading and Mathematics, for grades 3 to 10 and mean rubric-based score in Writing for grades 5, 8, and 10 for 2004, 2005, 2006, and 2007 were obtained from the Florida Comprehensive Assessment Test, Assessment, and School Performance System (Division of Accountability, Research and Measurement, Florida Department of Education, 2007b. Obtaining these datasets involved downloading separate MS Excel files for each FCAT given for each grade (3rd - 10th) for each school year (2003, 2004, 2005, and 2006) from the Florida Department of Education Assessment and School Performance website.

Instrument: Florida School Indicators Report (FSIR)

Other school factors for the school years between 2003-04 and 2005-06 were obtained from the interactive on-line Florida School Indicators Report (Division of Accountability, Research and Measurement, Florida Department of Education, 2007c). Indicators for the outcome variables of attendance and student conduct for the school years between 2003-04 and 2005-06 were downloaded for each school in the state. In addition, other indicators used as predictor variables for learning environment variables that included both student variables and teacher professional variables were downloaded for all the schools for the school years between 2003-04 and 2005-06. Data for the school year 2006-07 was unavailable. These data files were all downloaded as comma delimited data files.

Instrument: Average Yearly Progress Reports

Demographic variables were obtained from the Average Yearly Progress Reports for school years 2003-04, 2004-05, 2005-06, and 2006-07 on the Florida School Grades website (Division of Accountability, Research and Measurement, Florida Department of Education, 2007d). These indicators provided demographic information about the school proportions of low socio-economic status, minority, and Limited English Proficiency students, as well as proportion of students with disabilities (Florida Department of Education, 2007b). These files were downloaded in comma delimited format.

Instrument: System for Technology Accountability and Rigor (STAR) Surveys

Each year, the Florida Department of Education surveys every school in Florida about how technology is used by teachers and students within their schools (Bureau of Instruction and Innovation, Florida Department of Education, 2007a). The instrument that has been used since 2002 was called the System for Technology Accountability and Rigor (STAR) Survey. In the 2006-07 school year, the survey name was changed to Florida Innovates Survey (STAR), and was administered in spring 2007. This survey contains 78 items and was organized into five sections: digital learning environment, instructional leadership, Florida digital educators, access to technology, and infrastructure and support. The response rate on the survey has been very high – 97% in 2003-04 (N = 2514); 96% in 2004-05 (N = 2553); 97% in 2005-06 (N = 2658); and 97% in 2006-07 (N = 2700). Survey items included radio buttons with 2 to 5 options; check boxes that allowed the selection of all that applied; and open-ended responses that usually involved reporting a numeric quantity.

Predictor Variables

Predictor variables were organized by category and by how they were added to the multi-level model. The first category was school level. Then demographics and learning environment variables were added to the model. Finally, technology integration predictor variables were added to the model.

School Level Predictors at the School Level

All classifications of schools were obtained from the Master School Identification (MSID) files (Division of Accountability, Research and Measurement, Florida Department of Education, 2007a). The definitions of these variables were obtained from the *Technical assistance paper: Master School Identification File – 2006-07* (Bureau of Education Information and Accountability Services, Florida Department of Education, 2007).

Elementary school level was a categorical predictor that was designated in the MSID file.

Middle school level was a categorical predictor that was designated in the MSID file.

High school level was a categorical predictor that was designated in the MSID file.

Technology Magnet was a categorical predictor that was designated in the MSID file. These schools could also be an elementary, middle, or high school.

Demographic Predictors at the School Level

Two factors were determined through exploratory factor analysis of the demographic variables. The first factor loaded free or reduced lunch status students, minority students, and limited English proficiency/ESOL students on one factor. The second factor included special populations of students: gifted and students with disabilities. It was decided to add each of these variables separately in the multi-level model, because it was expected that gifted and students with disabilities would have opposite relationships with student achievement. Combining these groups for the analysis would negate any relationship with student achievement that existed. In addition, limited English proficiency students had been expected to group with students with disabilities as a factor for special populations of students that needed specialized and individualized support in order to make adequate gains in achievement. Rather than an academic grouping, the factor that limited English proficiency students loaded appeared to represent students with limited resources and social power. The focus of this study was academics; therefore, the relationships of the demographic variables with student outcomes were examined separately.

Free or reduced lunch status students was measured by the indicator Economically Disadvantaged Students in the Measuring Adequate Yearly Progress Files (Division of Accountability, Research and Measurement, Florida Department of Education, 2007d). This indicator measured the percentage of students who were eligible for free or reduced-price lunch and students enrolled in a USDA-approved Provision 2 school (Florida Department of Education, 2007d).

Minority was measured by the indicators available in the Measuring Adequate Yearly Progress Files – Number of Students - White, Black, Hispanic, Asian/Pacific Islander, and American Indian/Alaskan. The classification Multiracial was not included in the count (Florida Department of Education, 2007d). The proportion of minority students was calculated by adding the numbers of students classified as Hispanic, Asian/Pacific Islander, and American Indian/Alaskan or by subtracting the number of White students from the total number of students, and then dividing by this total minority of students by the total number of students.

Limited English Proficiency (LEP) was measured by the number of students in the school who were currently being served in an English for Speakers of Other Languages (ESOL) program, as well as students who had attained English proficiency for up to two years after exiting the ESOL program (Florida Department of Education, 2007b).

Student with disabilities was a measure that included the total number of Primary and Other Exceptionality fields with disabilities, other than gifted students (Florida Department of Education, 2007b).

Gifted is only reported for elementary and middle school; therefore, this variable was included in a separate analysis for these levels (Florida Department of Education, 2007b). Another analysis was conducted with all school levels including high school level without the gifted variable. Because the data were not available for gifted students in 2006-07, the data from 2005-06 were used to impute values.

Learning Environment Predictors at the School Level

Predictor variables used to measure the learning environment were obtained from the on-line Florida Indicators Report (Division of Accountability, Research and Measurement, Florida Department of Education, 2007c). The data for only three years (2003-04, 2004-05, and 2005-06) were available. The values from 2005-06 were used to impute values for 2006-07. Exploratory factor analysis was conducted with all of the variables used to measure the positive student learning environment and all of the variables used to measure teacher qualifications. Initially, School Staff and Student Membership were going to be used to create a variable to measure the ratio of students per instructional staff and included in the composite variable used to measure positive student learning environment. However, the low factor loadings (less than .3) obtained through exploratory factor analysis revealed that this was not a good measure to use for the learning environment. All other variables were used to create the composite score used to measure positive learning environment and teacher qualifications. Cronbach's alpha used to measure internal consistency reliability of the scores for these composite variables are depicted in Table 5.

Positive student learning environment was measured by six variables (Absent 21+ Days (Students); Stability Rate; Suspensions both in-house and out-of-school; and Incidents of Crime and Violence, Offenses, Student Membership) obtained from the on-line Florida Indicators Report (Division of Accountability, Research and Measurement, Florida Department of Education, 2007c). This variable served as a proxy for positive impacts to the school learning environment.

Absence was measured by the indicator Students Absent 21+ Days. This was obtained from the percentage of students from the year's total enrollment who were absent 21 or more days during the 180-day school year (Florida Department of Education, 2007c). This variable was subtracted from 100% to produce a rate of absence for students who were absent less than 21 days.

Stability rate was measured by the percentage of students in the October membership count who were still present in the February membership (Florida Department of Education, 2007c).

Student conduct was measured by the indicators Suspensions and Incidents of Crime and Violence, Offenses (Florida Department of Education, 2007c). Suspensions were measured by the mean of the percentage of students who served in-school suspensions and the percentage of students who served out-of-school suspensions. To change this to a positive rate for the percentage of students who were not suspended the percentages of suspensions were subtracted from 100. Incidents of Crime and Violence, Offenses was obtained from the total number of reported incidents occurring on school grounds, on school transportation, or at school-sponsored events. Categories of offenses included in this report were: violent acts against persons; alcohol, tobacco, or other drugs; property offenses; fighting and harassment; weapons possession; other nonviolent incidents and disorderly conduct. The total number of incidents was divided by the Student Membership to get a ratio of the number of incidents per student and then multiplied by 100. The result was then multiplied by negative one to make the score be a penalty for positive learning environment.

The sum of each of these scores was used for the composite variable that measured positive school learning environment. That is absence (percentage of students not absent over 21 days), stability, suspensions (the percentage of students who were not suspended in house and the percentage of students who were not suspended out-of-school) were added together. Then the score for Crime and Violence, Offenses per student multiplied by 100 was subtracted from the total.

Teacher qualifications were measured by three variables (Average Years of Experience, advanced degree attainment, and teaching in certified field) obtained from the On-line Florida Indicators Report (Division of Accountability, Research, and Measurement, Florida Department of Education, 2007c). Average Years of Experience was measured by the indicator Teachers: Average Years of Experience (Florida Department of Education, 2007c). It consists of the average number of years of in-state and out-of-state teaching experience for teachers in the school. To change this to a positive measure for Teacher Experience the mean Average Years of Experience for the school was divided by the Average Years of Experience for all of Florida’s schools. Advanced Degree was measured by the indicator Teachers: Master’s Degree or Higher (Division of Accountability, Research and Measurement, Florida Department of Education, 2007c). This indicator was the percentage of instructional staff in the school with an advanced degree (master’s degree, a doctorate, or a specialist’s degree). Teaching in certificate field was measured by the indicator Classes Taught by Teachers Teaching out of Field (Division of Accountability, Research and Measurement, Florida Department of Education, 2007c). This indicator was a measure of the percentage of classes being taught by classroom teachers teaching out-of-field for core academic courses (English, reading, language arts, mathematics, science, foreign languages, civics, government, economics, arts, history, and geography). It was subtracted from 100% to yield the positive variable Teaching In-field. Teacher skill was measured by summing three variables, that is, the value of (Average Years of Experience + Advanced Degree + Teaching In-field).

Technology Integration Measures

The response data from the STAR surveys were downloaded from the Florida Innovates website as spreadsheets in either text format or comma delimited format. The survey responses for each year were in multiple files. Only responses to survey items that were included on the survey for all four years were used in this data analysis. A side-by-side table comparing the exact survey items from each year is included in the Appendix B. Factor analysis was conducted to validate the grouping of the items used in the analysis. Internal Consistency Reliability of the scores for each of the groups of variables from survey items used in this study is reported in Table 5.

Student access to software. To determine the school level variables for access to software for student use in the school, the item "What percentage of student computers at your school have the following software types available on them?" was used. Factor analysis was used to separate the types of software into three categories: content software, office/ production software, and advanced production software. Then an overall level of availability was computed by calculating the mean degree of availability of all of the programs in each of these categories. When no response option was designated for a particular software program, it was assumed that the software was not available and zero was used in calculating the mean. The Cronbach's alpha for the scores for student access to software is depicted in Table 5.

Percent of teachers who regularly use computer technology. The responses to the item "Approximately what percentage of your teachers regularly uses technology in the following ways?" were used to measure the degree of teacher computer technology use at the school level. Factor analysis was used to separate the types of software into two categories: delivery of instruction and administrative purposes. The composite score for each of these factors was computed by calculating the mean percentage of teachers who regularly used each of the software programs in the factor that were common in the items across all four years. When no response option was designated for a particular software program, it was assumed that the software was not used and zero was used in calculating the mean. The internal consistency of the responses is depicted in Table 5.

Frequency that students use software. The item "How often do students at your school use the following types of software?" was used to measure the frequency of student technology usage. This item was worded slightly differently in the 2003 survey and had to be reverse coded in order to compare the results (see Appendix B). Factor analysis was used to separate the types of software into two categories: content delivery software and tool-based software. The internal consistency reliability of these responses is depicted Table 5).

Support for technology. A composite variable was created by summing the scores of the following items: "Our school-based technical support is provided by:"; "Our school-based instructional technology specialist is:"; "How dependable is the Internet connection at your school?"; "How often do you experience delays when using the Internet at your school?"; and "What is the average length of time at your school for a technical issue to be resolved?" (See Appendix B). Factor analysis was used to separate the types of support into two categories: human/ time and hardware/ Internet. Response options to the first two items included level of support from *none* to *full-time*. Items that have no responses were recoded as no support. Variables were recoded so that higher scores designated more support. Responses to "How dependable is the Internet connection at your school?" were recoded so that the option *very dependable* had the highest value. The item "How often do you experience delays when using the Internet at your school?" was reworded and ordered in 2005-06. The responses to items for 2003-04 and 2004-05 were recoded so that *no delay has* the highest score. The responses to the item "What is the average length of time at your school for a technical issue to be resolved?" were recoded so that the shortest length of time had the highest value. One other item was considered for inclusion for this category, "What percentage of the money spent on technology for your school is devoted to professional development in technology-related training?" Low factor loadings (less than .3) during the factor analysis demonstrated that this item was not contributing to the measurement of support. It was not used for creating the composite variable. The internal consistency reliability measures of these responses for support for technology are depicted Table 5.

Table 5.

Internal Consistency Reliability for Predictors by Year Measured with Cronbach's Alpha

	Cronbach Coefficient Alpha			
Variables	2003	2004	2005	2006
Learning environment predictors				
Positive learning environment	.68	.66	.65	
Teacher Qualifications	.30	.37	.33	
Student access to all software	.79	.79	.77	.75
Student access to content software	.80	.81	.69	.67
Student access to office/ production software	.73	.70	.73	.66
Student access to advanced production software	.60	.60	.66	.68
Teachers regularly use software	.78	.77	.78	.75
Teachers regularly use for delivery of instruction	.70	.68	.72	.69
Teachers regularly use for administrative purposes	.67	.64	.64	.56
Frequency students use all software	.37	.57	.76	.78
Frequency Students Use Content Delivery Software	.27	.50	.52	.55
Frequency Students Use Production Tool Software	.54	.63	.82	.83
Tech Support	.54	.56	.54	.51
Tech Support - Human/ Time	.63	.68	.62	.62
Tech Support - Internet/ Hardware	.62	.57	.54	.53

Outcome Measures

There were two categories of outcomes examined: student achievement and student behavioral outcomes that were mediating outcomes.

Student Achievement

Reading achievement. School level reading achievement was measured by the mean FCAT Reading norm referenced scores for each school for each year (Division of Accountability, Research and Measurement, Florida Department of Education, 2007b). The mean scores from all grade levels in the school were averaged to obtain a school mean score for each year.

Mathematics achievement. School level mathematics achievement was measured by the mean FCAT Mathematics norm referenced scores for each school for each year (Division of Accountability, Research and Measurement, Florida Department of Education, 2007b). The mean scores from all grade levels in the school were averaged to obtain a school mean score for each year.

Writing achievement. School level writing achievement was measured by the mean FCAT Writing rubric scores for each school (Division of Accountability, Research and Measurement, Florida Department of Education, 2007b). The mean scores from all grade levels in the school was averaged to obtain a school mean score for each year. The mean rubric-based score reported for 2006 was used to match the data from the preceding years.

Mediating Behavioral Outcomes

Absence was measured by the indicator Absent 21+ Days (Students). This was obtained from the percentage of students from the year's total enrollment who were absent 21 or more days during the 180-day school year (Division of Accountability, Research and Measurement, Florida Department of Education, 2007c). Data were not available for the 2006-07 school year.

Student misconduct was measured by the indicators Suspensions and Incidents of Crime and Violence, Offenses (Florida Department of Education, 2007c). Suspensions were measured by the percentage of students who served in-school suspensions and the percentage of students who served out-of-school suspensions. Incidents of Crime and Violence Offenses were obtained from the total number of reported incidents occurring on school grounds, on school transportation, or at school-sponsored events. Categories of offenses included in this report were: violent acts against persons; alcohol, tobacco, or other drugs; property offenses; fighting and harassment; weapons possession; other nonviolent incidents and disorderly conduct. The total number of incidents was divided by the Student Membership to get a ratio of the number of incidents per student. The composite measure for school level of student misconduct was obtained from the sum of the percentage of students serving in-school suspensions, the percentage of students serving out-of-school suspensions, and the number of crime incidents per student for the school. Data were not available for the school year 2006-07.

Data Preparation Procedures

Merging Data Files

First, the Master School Identification Files (MSID) for each academic year were entered into the dataset. They were downloaded from the FLDOE website in MS Excel format or text format. Magnet school information was added to this file. Then for each year, the additional files were brought into the dataset. The next set of files brought into the dataset were the school level mean FCAT NRT scores for reading, mathematics, and writing. These scores were used to measure the outcome variables in the study. The files were obtained for each of the four school years from the FLDOE at the Assessment and School Performance: Florida Comprehensive Assessment Test website and then merged with the MSID files to determine the number of schools at each school level with FCAT scores. Next, the Florida School Indicators Reports (FSIR) files for each school for each year that were obtained on-line from the FLDOE were merged. The FSIR did not include any information about minority status or information at the high school level about the proportion of students on Free or Reduced Price Lunch Programs. Therefore, data also were obtained from the AYP Reports on the FLDOE Evaluation and Reporting website for each school for each year. These files were merged so that missing demographic information in the FSIR was filled in with data from the AYP. Last, the technology indicator variables from the responses to the STAR surveys were brought into the data set. As the files for each year were merged, missing data were analyzed. Complete procedures are delineated in Appendix C. These cleaned files were saved in comma delimited text format so they could be imported into SAS 9.1.

Exploratory Factor Analysis

Exploratory factor analysis was conducted with the data that was going to be grouped to make composite variables. Because the variables in each category were expected to be correlated, the prior communality was inspected to determine if the items were correlated. Because there was a high degree of correlation among the items, exploratory factor analysis was conducted using Principal Axis Factoring and oblique - Promax rotation with listwise deletion of missing data. The number of factors was determined through inspection of the scree plot, proportion of the variance accounted for by each factor, parallel analysis, and consistency of interpretability over the four years. Because the data were not normally distributed, exploratory factor analysis was conducted with the original data and with the natural log transformation of these data. Results from both of these analyses grouped the items in the same factors, so the original data were used for all the rest of the analyses. The results from the exploratory factor analysis for each year for each composite variable are delineated in Appendix C.

Sample

This study spans the four school years from 2003-04 to 2006-07. The sample was filtered to include only public elementary, middle, and high schools in Florida that participated in the System for

Technology Accountability and Rigor (STAR) survey for all four years so that the relationships between technology indicators and school level achievement could be compared across school levels (see Table 6).

Table 6.

Number of Schools Used in the Analysis by Outcome

	School Level			All School Levels
	Elementary	Middle	High	
Reading FCAT	1496	444	346	2286
Math FCAT	1511	444	346	2301
Writing FCAT	1480	437	347	2264
Student Conduct	1517	446	349	2312
Attendance	1517	446	349	2312

Descriptive Statistics for Outcome Variables

Table 7 lists the descriptive statistics for each of the outcome variables by school level for each year, including range, mean, standard deviation, skew, and kurtosis. To prevent collinearity new composite variables were created for positive learning environment to be used in the analysis for student conduct and attendance. The student misconduct composite was left out of the composite variable measuring positive learning environment for the student conduct outcome, and the percent of students with more than 21 days absent was left out of the composite variable measuring positive learning environment for the student attendance outcome.

Table 7.

Descriptive statistics for outcome variables by school level and school year

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
FCAT Reading									
	All Schools	2286	2003-04	664.65	21.71	613.0	754.0	0.27	-0.51
			2004-05	657.95	25.14	606.5	768.0	0.71	-0.06
			2005-06	668.85	21.88	622.0	767.0	0.58	0.01
			2006-07	667.69	22.35	618.5	762.5	0.62	-0.03
	Elementary	1496	2003-04	653.00	14.62	613.0	700.7	0.04	-0.46
			2004-05	643.61	13.27	606.5	693.3	0.18	-0.25
			2005-06	657.37	13.75	622.0	704.3	0.17	-0.36
			2006-07	655.58	13.30	618.5	704.7	0.19	-0.27
	High	346	2003-04	693.18	13.09	649.5	754.0	0.25	1.58
			2004-05	699.84	14.67	658.0	768.0	0.42	1.60
			2005-06	703.92	13.84	667.5	767.0	0.48	1.56
			2006-07	703.48	14.12	669.0	762.5	0.42	1.04

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
	Middle	444	2003-04	681.66	13.83	643.0	716.0	-0.04	-0.16
			2004-05	673.62	13.72	640.3	710.7	0.10	-0.11
			2005-06	680.22	12.11	650.0	712.3	0.05	-0.22
			2006-07	680.60	12.70	649.7	715.7	0.12	-0.34
FCAT Math									
	All Schools	2301	2003-04	658.47	30.33	595.0	791.5	0.75	-0.23
			2004-05	655.59	32.47	592.0	784.5	0.56	-0.62
			2005-06	664.07	32.42	594.0	793.5	0.60	-0.47
			2006-07	667.42	29.96	604.0	780.5	0.50	-0.48
	Elementary	1511	2003-04	640.22	13.94	595.0	689.0	0.10	-0.28
			2004-05	635.87	16.40	592.0	696.5	0.22	-0.17
			2005-06	644.78	16.71	594.0	704.5	0.21	-0.27
			2006-07	650.14	17.06	604.0	712.0	0.16	-0.22
	High	346	2003-04	710.58	15.05	672.4	791.5	0.61	2.37
			2004-05	708.86	13.27	675.5	784.5	0.82	3.23
			2005-06	717.56	14.81	675.0	793.5	0.71	2.27
			2006-07	716.15	13.81	677.0	780.5	0.64	1.64
	Middle	444	2003-04	679.96	14.82	641.0	719.0	0.11	-0.21
			2004-05	681.22	14.85	647.3	723.3	0.30	-0.18
			2005-06	688.01	16.02	651.7	735.7	0.30	-0.24
			2006-07	688.28	14.55	657.0	731.0	0.33	-0.36
FCAT Writing									
	All Schools	2264	2003-04	3.70	0.31	2.7	5.3	0.20	0.53
		2264	2004-05	3.75	0.30	2.8	5.4	0.27	0.57
		2264	2005-06	3.88	0.31	2.9	5.4	0.22	0.43
		2264	2006-07	3.91	0.32	2.9	5.3	0.29	0.62
	Elementary	1480	2003-04	3.64	0.30	2.7	4.6	0.09	0.20
		1480	2004-05	3.70	0.29	2.8	4.7	0.13	0.14
		1480	2005-06	3.84	0.31	2.9	4.9	0.12	-0.07
		1480	2006-07	3.84	0.29	2.9	5.0	0.01	0.20
	High	347	2003-04	3.83	0.26	3.1	5.3	0.74	3.22
		347	2004-05	3.86	0.28	3.0	5.4	0.57	2.47
		347	2005-06	3.91	0.30	3.2	5.4	0.80	2.25
		347	2006-07	3.96	0.29	3.4	5.3	0.76	1.71
	Middle	437	2003-04	3.79	0.33	2.9	4.8	0.35	-0.02
		437	2004-05	3.82	0.30	3.2	4.9	0.55	0.18
		437	2005-06	3.98	0.27	3.3	4.8	0.59	0.43
		437	2006-07	4.13	0.31	3.5	5.0	0.55	-0.12
Percent of Students with Over 21 Days Absences									
	All Schools	2312	2003-04	8.32	5.51	0.0	38.9	1.57	3.43
		2312	2004-05	9.30	6.41	0.0	47.5	1.53	3.32
		2312	2005-06	9.37	6.57	0.0	57.6	1.58	3.75
	Elementary	1517	2003-04	6.29	3.14	0.0	24.5	0.82	1.32
		1517	2004-05	7.59	4.76	0.2	47.5	1.92	6.78
		1517	2005-06	7.52	5.11	0.1	57.6	2.36	10.27
	High	349	2003-04	13.89	7.68	0.0	35.6	0.46	-0.19
		349	2004-05	14.11	8.41	0.0	38.4	0.52	-0.14
		349	2005-06	15.22	8.48	0.0	48.7	0.59	0.69

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
	Middle	446	2003-04	10.86	5.74	0.0	38.9	0.92	2.09
		446	2004-05	11.34	6.96	0.0	44.4	1.11	2.81
		446	2005-06	11.12	6.13	0.0	35.7	0.67	0.60
Student Misconduct									
	All Schools	2312	2003-04	21.51	23.56	0.0	216.8	1.68	3.97
		2312	2004-05	19.64	21.56	0.0	150.0	1.53	2.35
		2312	2005-06	18.84	20.79	0.0	131.3	1.58	2.59
	Elementary	1517	2003-04	10.17	14.09	0.0	132.2	3.88	21.40
		1517	2004-05	8.94	11.55	0.0	104.2	3.37	16.58
		1517	2005-06	9.16	12.07	0.0	121.2	3.40	16.52
	High	349	2003-04	42.59	21.49	0.4	122.0	0.66	0.58
		349	2004-05	39.25	20.76	1.2	108.6	0.70	0.38
		349	2005-06	36.25	18.70	0.0	93.9	0.37	-0.09
	Middle	446	2003-04	43.56	23.91	0.8	216.8	1.55	6.48
		446	2004-05	40.67	22.08	0.3	150.0	0.95	1.66
		446	2005-06	38.12	23.33	0.6	131.3	0.94	1.21

Descriptive Statistics for Predictor Variables

The descriptive statistics for the predictor variables for each of the outcomes by school level and school year are listed in Appendix C.

Correlations of Technology Indicators with Predictor Variables

Because technology is used within the classroom, the variables used to measure the learning environment and the technology indicators were expected to be correlated. The correlations of composite variables used to measure the learning environment and composite technology indicators were analyzed for each outcome. The absolute value of correlations for predictor variables ranged between 0.01 and 0.56 for all outcomes. The correlations are delineated in Appendix C.

Data Analysis Plan

Multi-level Models

Multi-level models were used to estimate the relationships of the predictors at each level with each outcome variable and to find the best model fit for the data using maximum likelihood estimation. In order to make meaningful comparisons, all predictors were standardized. Because the educational data for this study were nested at levels of time and school, two-level models were progressively developed to describe the relationship between technology integration and school achievement. Due to the fact that technology is used within the classroom, the variables used to measure the learning environment and the technology indicators were expected to be correlated. Therefore, because the focus of this study was on finding significant relationships between technology indicators and the outcome measures, variables were sequentially added to the model only to control their effect. SAS (version 9.13) statistical package (SAS Institute, Inc.) was used to analyze the data. The following steps were taken to analyze the data and to test the following hypotheses for the research questions.

Research Question 1

> What is the relationship between indicators of technology integration and changes in mean student achievement when controlling for school level, school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality?
>
> Hypothesis 1
>
> After controlling for school level (elementary, middle, and high), school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality, mean school achievement (FCAT NRT scaled scores for reading and mathematics and FCAT rubric scores for writing) will have a positive relationship with indicators of technology integration.

In order to answer the first research question and test the first hypothesis a series of models were built using FCAT reading as the first outcome, and then the same steps were followed to examine FCAT math, and FCAT writing. The steps were as follows: (1) The Unconditional Model with no predictors of FCAT reading achievement in the equation. (2) The Unconditional Growth Model with time added to the equation. (3) Since the trajectory may not have been linear, $time^2$ and $time^3$ were progressively added to form the polynomial equation. (4) School level was added to the equation of the Unconditional Growth Model with time, $time^2$, and $time^3$. (5) Demographic variables were added to the model separately in two steps, because students are not designated as gifted at the high school level in Florida. As a result, first the model was run using all three school levels, but without gifted in the equation. Then the model was estimated using only elementary and middle school levels with gifted as variable. Next the (6) Learning Environment variables were added to the equation: teacher qualification and student learning environment composite variables. (7) The Technology Indicators as composite variables were added to the equation. Last, (8) Technology Magnet School was added to the equation to determine if schools that had a high degree of technology infrastructure and professional development would have a positive relationship with achievement. At each step significant predictors were retained. Alpha was set to .05 to designate significant parameters. The significance of the parameter estimates, the deviance statistic for the model fit, and the amount of variance explained by the model determined the most parsimonious and thus best model fit. The level 1 and level 2 residuals were examined for independence and normal distribution in the final model.

Research Question 2

> What is the relationship between indicators of technology integration and changes in mediating outcomes of attendance rate and student conduct, when controlling for school level, school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality?
>
> Hypothesis 2:
>
> After controlling for school level (elementary, middle, and high), school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality, percent of students absent more than 21 days will have a negative relationship with indicators of technology integration and mean school level of student misconduct will have a negative relationship with indicators of technology integration.

To answer the second research question and test the second hypothesis a series of models were built using percent of students absent more than 21 days as the first outcome, and then the steps were repeated using student misconduct as the second outcome. Because the Florida Indicators Report for 2006-07 had not been released, these outcome variables were only available for three years, and the models examined only 2003-04, 2004-05, and 2005-06. The steps were as follows: (1) The Unconditional Model added Attendance Rate to the equation. (2) The Unconditional Growth Model added time to the equation. (3) Since the trajectory may not have been linear, $time^2$ was added to form the quadratic equation. Because there were only three years of outcome variables to analyze for the trends $time^3$ was not needed. (4) School level was added to the equation of the Unconditional Growth Model with time and $time^2$. (5) Demographic variables were added to the model separately in two steps, because students are not designated as gifted at the high school level in Florida. As a result, first the model was run using all three school levels, but without gifted in the equation. Then the model was estimated using only elementary and middle school levels with gifted as variable. Next the (6) Learning Environment variables were added to the equation: teacher qualification and student learning environment composite variables. (7) The Technology Indicators as composite variables were added to the equation. Last, (8) Technology Magnet School was added to the equation to determine if schools that had a high degree of technology infrastructure and professional development had a positive relationship with achievement. At each step significant predictors were retained. Alpha was set to .05 to designate significant parameters. The significance of the parameter estimates, the deviance statistic for the model fit, and the amount of variance explained by the model determined the most parsimonious and thus best model fit. The level-1 and level-2 residuals were examined for independence and normal distribution in the final model.

Chapter 4: Results

This chapter reviews the results that were obtained for the two main research questions separately. The steps that were used to analyze the data are delineated. The results are reported for each hypothesis for each research question.

Research Question 1

> What is the relationship between indicators of technology integration and changes in mean student achievement when controlling for school level, school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality?

The first research question was answered by conducting multi-level models with the FCAT achievement data for reading, mathematics, and writing.

Hypothesis 1

The first analysis conducted to answer the first research question used the FCAT Reading outcome data to test the following hypothesis:

> H_1: After controlling for school level (elementary, middle, and high), school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality, mean school reading achievement (FCAT NRT scaled scores for reading) will have a positive relationship with indicators of technology integration.

The first step was to build the unconditional model. The unconditional model predicted the schools' FCAT reading from the average of FCAT reading for all schools. There were no other predictors. The average FCAT for all schools was 664.79 points ($t\ (2285) = 1411.95$, $p <.0001$).

Model 1: Unconditional Model
Level 1: FCAT Reading = $\beta_0 + r$
Level 2: $\beta_0 = \gamma_{00} + u_0$
Mixed-Effects Model: FCAT Reading = $\gamma_{00} + u_0 + r$

The intraclass correlation coefficient (ICC) was computed to determine the proportion of variance in the FCAT Reading variable that is accounted for by the schools. The ICC was .92, which is high and supports using multi-level modeling for the analysis. The model fit statistics from this model were used as the baseline for model comparisons.

The next step added time to the predictor equation (see Model 2a). The variance components from this analysis showed how much of the variance in the model was accounted for by time. There was almost no variance in the slopes between schools. Therefore, time was set as a fixed effect, and the model with time as a fixed effect was estimated.

Model 2a: Unconditional Growth Model
Level 1: FCAT Reading = $\beta_0 + \beta_1$*Time + r
Level 2: $\beta_0 = \gamma_{00} + u_0$
$\beta_1 = \gamma_{10} + u_1$

Mixed-Effects Model: FCAT Reading = $\gamma_{00} + \gamma_{10}$*Time + $u_0 + u_1$*Time + r

Both the intercept (t (2285) = 1384.17, p <.0001) and time (t (6857) = 36.13, p <.0001) were significant parameters. Although there was no additional explained variance between schools, time accounted for 16% of the variance within schools (see Model 2b).

Model 2b: Unconditional Growth Model with Time Fixed
Level 1: FCAT Reading = $\beta_0 + \beta_1$*Time + r
Level 2: $\beta_0 = \gamma_{00}$
$\beta_1 = \gamma_{10}$

Mixed-Effects Model: FCAT Reading = $\gamma_{00} + \gamma_{10}$*Time + u_0 + r

To determine if the equation was not linear but curvilinear, time^2 was added to the equation so the variance could be compared. Results indicated that time^2 was significant (t (6856) = 23.22, p <.0001) and increased the variance explained by an additional 6% (see Model 2c). When time^3 was added to the equation with time^2, time^3 also was significant (t (4570) = -80.28, p <.0001), and all model fit indices improved. Although adding time^3 increased the amount of variance between schools, it increased the variance explained by an additional 41%. Consequently, both time^2 and time^3 were retained in the polynomial growth model equation (see Model 2d).

Model 2c: Quadratic Growth Model
Level 1: FCAT Reading = $\beta_0 + \beta_1$*Time + β_2* Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + u_0$
$\beta_1 = \gamma_{10}$
$\beta_2 = \gamma_{20}$

Mixed-Effects Model: FCAT Reading = $\gamma_{00} + \gamma_{10}$*Time + γ_{20}* Time^2 + u_0 + r

Model 2d: Polynomial Growth Model

Level 1: FCAT Reading $= \beta_0 + \beta_1$*Time $+ \beta_2$* Time$^2 + \beta_3$* Time^3 + r

Level 2: $\beta_0 = \gamma_{00} + u_0$

$\beta_1 = \gamma_{10}$

$\beta_2 = \gamma_{20}$

$\beta_2 = \gamma_{30}$

Mixed-Effects Model: FCAT Reading $= \gamma_{00} + \gamma_{10}$*Time $+ \gamma_{20}$* Time$^2 + \gamma_{30}$* Time$^3 + u_0 +$ r

Next, school level was added to the Polynomial Growth Model to predict reading (See Model 3). The significance of the parameter estimates determined if school level was significantly related to the FCAT Reading and if there was an interaction with time. This model adjusted the mean school FCAT Reading and the slope of FCAT Reading growth for school level. The parameter estimates of school level, time, time^2, and time^3 were all significant. The interactions between time and both the school levels, time^2 and both the school levels, and time^3 and both the school levels relative to middle school were also significant. All model fit indices indicated improved fit with this model (Table 8). This model accounted for 65% of the between school variance and an additional 11% of the within school variance from the Polynomial Growth Model.

Model 3: school level as Predictor

Level 1: FCAT Reading $= \beta_0 + \beta_1$*Time $+ \beta_2$*Time$^2 + \beta_3$* Time^3 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level $+ u_0$

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level

Mixed-Effects Model: FCAT Reading $= \gamma_{00} + \gamma_{01}$*School Level $+ \gamma_{10}$*Time $+ \gamma_{11}$*School Level*Time $+ \gamma_{20}$*Time$^2 + \gamma_{21}$*School Level*Time$^2 + \gamma_{30}$*Time$^3 + \gamma_{31}$*School Level*Time$^3 + u_0 +$ r

Table 8.

Model 3: Time, Time^2, Time^3, and School Level as Predictors of Reading

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		681.66	0.6476	2283	1052.6	<.0001	**
Time		-22.3275	0.6021	6849	-37.08	<.0001	**
Time^2		17.7633	0.5322	6849	33.38	<.0001	**
Time^3		-3.4795	0.117	6849	-29.75	<.0001	**
School Level	Elementary	-28.6569	0.7375	6849	-38.86	<.0001	**
School Level	High	11.5234	0.9786	6849	11.78	<.0001	**
School Level	Middle	0	.	.	.	.	
Time*School Level	Elementary	-11.5396	0.6857	6849	-16.83	<.0001	**
Time*School Level	High	29.6256	0.9098	6849	32.56	<.0001	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time*School Level	Middle	0	.	.	.	.	
$Time^2$*School Level	Elementary	13.1594	0.606	6849	21.72	<.0001	**
$Time^2$*School Level	High	-18.08	0.8041	6849	-22.48	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	
$Time^3$*School Level	Elementary	-2.9695	0.1332	6849	-22.29	<.0001	**
$Time^3$*School Level	High	3.1555	0.1767	6849	17.85	<.0001	**
$Time^3$*School Level	Middle	0	.	.	.	.	
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		175.28	5.2657		33.29	<.0001	**
Residual		10.9335	0.1867		58.56	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added student demographic variables to the School Level Model. This model was estimated twice. The first time, the model was run with high school as a school level and all of the demographic variables except gifted, because gifted is not a designation at the high school level (see Model 4a). The second time, the data were filtered to exclude high school as a school level and kept the gifted variable with middle and elementary schools (see Model 4b). The model fit statistics of the demographic model with all three school levels was compared with the School Level as Predictor Model to determine if there was a better fit (see Table 17). The significance of the parameter estimates determined which of the demographic variables remained in the predictor equation (see Table 9). The variance estimates showed the amount of the total variance that was accounted for by each model. When all of the demographics variables except gifted were added to the model (see Model 4a), the intercept was significant and the average middle school started with FCAT reading score of 679.36 (t (2234) = 1945.24, p <.0001). The parameter estimates for school level, time, $time^2$, $time^3$, free or reduced lunch status, minority, limited English proficiency (LEP), and students with disabilities were significant. Interactions with time were all significant except for those with minority. Interactions with $time^2$ were all significant except for minority. Interactions with $time^3$ were all significant except for minority and students with disabilities. All model fit indices indicated better fit with the addition of these demographics variables. Adding the demographics variables with school level explained 92% of the between school variance and 76% of the within school variance for a total of 91% of all variance explained.

Model 4a: Demographics by School Level (including High School and no Gifted)
Level 1: FCAT Reading = $\beta_0 + \beta_1$*Time + β_2*$Time^2$ + β_3*$Time^3$ + r

$$\text{Level 2: } \beta_0 = \gamma_{00} + \gamma_{01}\text{*School Level} + \gamma_{02}\text{*SES} + \gamma_{03}\text{*Minority} + \gamma_{04}\text{* LEP} + \gamma_{05}\text{* SWD} + u_0$$
$$\beta_1 = \gamma_{10} + \gamma_{11}\text{*School Level} + \gamma_{12}\text{*SES} + \gamma_{13}\text{*Minority} + \gamma_{14}\text{* LEP} + \gamma_{15}\text{* SWD}$$
$$\beta_2 = \gamma_{20} + \gamma_{21}\text{*School Level} + \gamma_{22}\text{*SES} + \gamma_{23}\text{*Minority} + \gamma_{24}\text{* LEP} + \gamma_{25}\text{* SWD}$$
$$\beta_3 = \gamma_{30} + \gamma_{31}\text{*School Level} + \gamma_{32}\text{*SES} + \gamma_{33}\text{*Minority} + \gamma_{34}\text{* LEP} + \gamma_{35}\text{* SWD}$$

Mixed-Effects Model: $\text{FCAT Reading} = \gamma_{00} + \gamma_{01}\text{*School Level} + \gamma_{02}\text{*SES} + \gamma_{03}\text{*Minority} + \gamma_{04}\text{*SWD} + \gamma_{05}\text{*LEP} + \gamma_{10}\text{*Time} + \gamma_{11}\text{*School Level*Time} + \gamma_{12}\text{*SES*Time} + \gamma_{13}\text{*Minority*Time} + \gamma_{14}\text{*SWD*Time} + \gamma_{15}\text{*LEP*Time} + \gamma_{20}\text{*Time}^2 + \gamma_{21}\text{*School Level*Time}^2 + \gamma_{22}\text{*SES*Time}^2 + \gamma_{23}\text{*Minority*Time}^2 + \gamma_{24}\text{*SWD*Time}^2 + \gamma_{25}\text{*LEP*Time}^2 + \gamma_{30}\text{*Time}^3 + \gamma_{31}\text{*School Level*Time}^3 + \gamma_{32}\text{*SES*Time}^3 + \gamma_{33}\text{*Minority*Time}^3 + \gamma_{34}\text{*SWD*Time}^3 + \gamma_{35}\text{*LEP*Time}^3 + u_0 + r$

Table 9.

Model 4a: Reading predicted by Time, School Level, and Demographics Variables No Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		679.36	0.3492	2234	1945.2	<.0001	**
Time		-20.953	0.6035	6443	-34.72	<.0001	**
Time^2		17.2553	0.5312	6443	32.48	<.0001	**
Time^3		-3.4122	0.1166	6443	-29.27	<.0001	**
School Level	Elementary	-25.5824	0.4006	6443	-63.85	<.0001	**
School Level	High	6.7244	0.5268	6443	12.76	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-5.6423	0.1728	6443	-32.65	<.0001	**
Minority		-6.3466	0.2066	6443	-30.71	<.0001	**
LEP		-0.5969	0.1789	6443	-3.34	0.0009	**
Students with Disabilities		-1.9872	0.1271	6443	-15.63	<.0001	**
Time*School Level	Elementary	-13.6237	0.6986	6443	-19.5	<.0001	**
Time*School Level	High	30.3797	0.9153	6443	33.19	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.9142	0.4112	6443	2.22	0.0262	*
Time*Minority		0.7421	0.4227	6443	1.76	0.0792	
Time*LEP		1.1256	0.3518	6443	3.2	0.0014	**
Time*Students with Disabilities		-0.7753	0.2973	6443	-2.61	0.0091	**
Time^2*School Level	Elementary	14.8613	0.6157	6443	24.14	<.0001	**
Time^2*School Level	High	-18.5166	0.806	6443	-22.97	<.0001	**
Time^2*School Level	Middle	0	.	.	.	.	
Time^2*Free Reduced Lunch		-1.0632	0.3622	6443	-2.94	0.0033	**
Time^2*Minority		0.446	0.3713	6443	1.2	0.2298	
Time^2*LEP		-0.9216	0.3068	6443	-3	0.0027	**
Time^2*Students with Disabilities		0.5495	0.2604	6443	2.11	0.0349	*
Time^3*School Level	Elementary	-3.315	0.1352	6443	-24.52	<.0001	**
Time^3*School Level	High	3.2411	0.1769	6443	18.33	<.0001	**
Time^3*School Level	Middle	0	.	.	.	.	
Time^3*Free Reduced Lunch		0.2308	0.07944	6443	2.91	0.0037	**
Time^3*Minority		-0.1406	0.08144	6443	-1.73	0.0844	
Time^3*LEP		0.1905	0.06699	6443	2.84	0.0045	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
$Time^3$*Students with Disabilities		-0.09712	0.057	6443	-1.7	0.0885	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	40.5487	1.4746	27.5	<.0001	**
Residual	10.1746	0.1876	54.24	<.0001	**

Note: * $p < .05$; ** $p < .01$

The results from the analysis in Model 4b indicated that the intercept, school level, time, time^2, time^3, free or reduced lunch status, minority, LEP, students with disabilities, and gifted were all significant (see Table 10). Interactions between time and elementary school level, free or reduced lunch status, LEP, and gifted were significant. Interactions between time^2 and free or reduced lunch status, LEP, and gifted were significant. Interactions between time^3 and free or reduced lunch status, LEP, and gifted were significant. Because the parameter for gifted was significant in this model, an unconditional model using the same population with high schools filtered out, predicting FCAT reading with average FCAT reading was estimated in order to compare the fit of this model. All of the model fit statistics indicated better model fit. When examining the variance of FCAT reading in elementary and middle schools, adding demographics variables to the equation explained 91% of the between school variance and 78% more of the within school variance. Two sets of analyses were conducted on the rest of the models in order to examine the relationship of gifted with technology integration as one of the predictors of school achievement.

Model 4b: Demographics by School Level (Elementary and Middle School only)

Level 1: $\text{FCAT Reading} = \beta_0 + \beta_1\text{*Time} + \beta_2\text{*Time}^2 + \beta_3\text{*Time}^3 + r$

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}\text{*School Level} + \gamma_{02}\text{*SES} + \gamma_{03}\text{*Minority} + \gamma_{04}\text{* LEP} + \gamma_{05}\text{* SWD} + \gamma_{06}\text{*Gifted} + u_0$

$\beta_1 = \gamma_{10} + \gamma_{11}\text{*School Level} + \gamma_{12}\text{*SES} + \gamma_{13}\text{*Minority} + \gamma_{14}\text{* LEP} + \gamma_{15}\text{* SWD} + \gamma_{16}\text{*Gifted}$

$\beta_2 = \gamma_{20} + \gamma_{21}\text{*School Level} + \gamma_{22}\text{*SES} + \gamma_{23}\text{*Minority} + \gamma_{24}\text{* LEP} + \gamma_{25}\text{* SWD} + \gamma_{26}\text{*Gifted}$

$\beta_3 = \gamma_{30} + \gamma_{31}\text{*School Level} + \gamma_{32}\text{*SES} + \gamma_{33}\text{*Minority} + \gamma_{34}\text{* LEP} + \gamma_{35}\text{* SWD} + \gamma_{36}\text{*Gifted}$

Mixed-Effects Model: $\text{FCAT Reading} = \gamma_{00} + \gamma_{01}\text{*School Level} + \gamma_{02}\text{*SES} + \gamma_{03}\text{*Minority} + \gamma_{04}\text{*SWD} + \gamma_{05}\text{*LEP} + \gamma_{06}\text{*Gifted} + \gamma_{10}\text{*Time} + \gamma_{11}\text{*School Level*Time} + \gamma_{12}\text{*SES*Time} + \gamma_{13}\text{*Minority*Time} + \gamma_{14}\text{* LEP*Time} + \gamma_{15}\text{* SWD*Time} + \gamma_{16}\text{*Gifted*Time} + \gamma_{20}\text{*Time}^2 + \gamma_{21}\text{*School Level*Time}^2 + \gamma_{22}\text{*SES*Time}^2 + \gamma_{23}\text{*Minority*Time}^2 + \gamma_{24}\text{* LEP*Time}^2 + \gamma_{25}\text{* SWD*Time}^2 + \gamma_{26}\text{*Gifted*Time}^2 + \gamma_{30}\text{*Time}^3 + \gamma_{31}\text{*School Level*Time}^3 + \gamma_{32}\text{*SES*Time}^3 + \gamma_{33}\text{*Minority*Time}^3 + \gamma_{34}\text{* LEP*Time}^3 + \gamma_{35}\text{* SWD*Time}^3 + \gamma_{36}\text{*Gifted*Time}^3 + u_0 + r$

Table 10.

Model 4b: Reading predicted by Time, School Level, and Demographics Variables for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		678.32	0.3003	1805	2258.5	<.0001	**
Time		-20.5295	0.6066	4908	-33.84	<.0001	**
$Time^2$		16.8488	0.535	4908	31.49	<.0001	**
$Time^3$		-3.324	0.1175	4908	-28.29	<.0001	**
School Level	Elementary	-23.972	0.3481	4908	-68.87	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-5.6423	0.1845	4908	-30.59	<.0001	**
Minority		-5.9592	0.211	4908	-28.24	<.0001	**
LEP		-0.3349	0.1693	4908	-1.98	0.048	*
Students with Disabilities		-1.159	0.1291	4908	-8.98	<.0001	**
Gifted		3.6388	0.1468	4908	24.79	<.0001	**
Time*School Level	Elementary	-13.7743	0.7103	4908	-19.39	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		1.2973	0.4815	4908	2.69	0.0071	**
Time*Minority		0.5315	0.4908	4908	1.08	0.2789	
Time*LEP		1.6122	0.3801	4908	4.24	<.0001	**
Time*Students with Disabilities		-0.1868	0.3268	4908	-0.57	0.5676	
Time*Gifted		0.9406	0.3407	4908	2.76	0.0058	**
$Time^2$*School Level	Elementary	15.0662	0.6269	4908	24.03	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	
$Time^2$*Free Reduced Lunch		-1.1625	0.4241	4908	-2.74	0.0061	**
$Time^2$*Minority		0.4354	0.4304	4908	1.01	0.3118	
$Time^2$*LEP		-1.3998	0.331	4908	-4.23	<.0001	**
$Time^2$*Students with Disabilities		0.006271	0.2855	4908	0.02	0.9825	
$Time^2$*Gifted		-0.9038	0.2977	4908	-3.04	0.0024	**
$Time^3$*School Level	Elementary	-3.3724	0.1377	4908	-24.49	<.0001	**
$Time^3$*School Level	Middle	0	.	.	.	.	
$Time^3$*Free Reduced Lunch		0.2331	0.09296	4908	2.51	0.0122	*
$Time^3$*Minority		-0.1281	0.09424	4908	-1.36	0.1741	
$Time^3$*LEP		0.2944	0.07208	4908	4.08	<.0001	**
$Time^3$*Students with Disabilities		0.01513	0.06229	4908	0.24	0.808	
$Time^3$*Gifted		0.1827	0.065	4908	2.81	0.005	**

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	26.3269	1.0559	24.93	<.0001	**
Residual	9.5552	0.1984	48.15	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added the variable that measures the School Learning Environment factors to the Demographics Model by School Level Model. These included teacher qualifications and positive learning environment. This model was estimated twice, first without gifted population but all school levels (see model 5a) and then with elementary and middle school levels and gifted population (see model 5b). When school learning environment factors were added with the demographic and school level variables for all school levels, the parameter estimates for the intercept, time, time^2, time^3, elementary and high school relative to middle school, free or reduced lunch status, minority, LEP, students with disabilities, teacher qualifications, and positive learning environment were significant (see Table 11). Significant interactions with time, time^2, and time^3 included elementary and high school relative to middle school, free or reduced lunch status, LEP, teacher qualifications, and positive learning environment. Significant interactions with time^2 were elementary and high school, free or reduced lunch status, and positive learning environment. Adding the student learning environment variables explained an additional 2% of the between school variance and explained 1% less of the within school variance for a total of 92% of all of the variance explained. All of the model fit indices indicated that this model fit of the data better (see Table 17).

Model 5a: School Learning Environment with Demographics by School Level (all school levels without gifted and LEP)
Level 1: FCAT Reading = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}*SWD + γ_{05}* Teacher Qualifications + γ_{06}*Positive Learning Environment + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}*SWD + γ_{15}* Teacher Qualifications + γ_{16}*Positive Learning Environment
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* SWD + γ_{25}* Teacher Qualifications + γ_{26}*Positive Learning Environment
$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}*SWD + γ_{35}* Teacher Qualifications + γ_{36}*Positive Learning Environment

Mixed-Effects Model: FCAT Reading = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* SWD + γ_{05}*Teacher Qualifications + γ_{06}* Positive Learning Environment + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}*SWD *Time + γ_{15}* Teacher Qualifications*Time + γ_{16}* Positive Learning Environment*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* SWD*Time^2 + γ_{25}* Teacher Qualifications*Time^2 + γ_{26}* Positive Learning Environment*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}*SWD*Time^3 + γ_{35}* Teacher Qualifications*Time^3 + γ_{36}* Positive Learning Environment*Time^3 + u_0 + r

Table 11.

Model 5a: Reading Predicted by Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		680.14	0.4403	2298	1544.6	<.0001	**
Time		-5.504	0.8634	6867	-6.37	<.0001	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
$Time^2$		9.2097	0.7489	6867	12.3	<.0001	**
$Time^3$		-2.1354	0.1624	6867	-13.15	<.0001	**
School Level	Elementary	-39.8795	0.5171	6867	-77.12	<.0001	**
School Level	High	26.3373	0.6155	6867	42.79	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-4.1447	0.1922	6867	-21.56	<.0001	**
Minority		-6.1259	0.2129	6867	-28.77	<.0001	**
Students with Disabilities		-2.1066	0.1437	6867	-14.66	<.0001	**
Positive Learning Environment		1.6474	0.1513	6867	10.89	<.0001	**
Positive Teacher Qualifications		1.003	0.1138	6867	8.81	<.0001	**
Time*School Level	Elementary	-11.0835	1.064	6867	-10.42	<.0001	**
Time*School Level	High	-9.3217	1.0637	6867	-8.76	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-1.411	0.489	6867	-2.89	0.0039	**
Time*Minority		-0.4513	0.442	6867	-1.02	0.3074	
Time*Students with Disabilities		-0.4879	0.3396	6867	-1.44	0.1509	
Time*Positive Learning Environment		-0.7349	0.4571	6867	-1.61	0.1079	
Time*Positive Teacher Qualifications		0.8114	0.3249	6867	2.5	0.0125	*
$Time^2$*School Level	Elementary	6.3613	0.9335	6867	6.81	<.0001	**
$Time^2$*School Level	High	7.3264	0.9384	6867	7.81	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	
$Time^2$*Free Reduced Lunch		-0.2134	0.4348	6867	-0.49	0.6236	
$Time^2$*Minority		1.0957	0.3913	6867	2.8	0.0051	**
$Time^2$*Students with Disabilities		0.4279	0.2986	6867	1.43	0.1518	
$Time^2$*Positive Learning Environment		0.9942	0.409	6867	2.43	0.0151	*
$Time^2$*Positive Teacher Qualifications		-0.49	0.2848	6867	-1.72	0.0854	
$Time^3$*School Level	Elementary	-0.8004	0.204	6867	-3.92	<.0001	**
$Time^3$*School Level	High	-1.5226	0.206	6867	-7.39	<.0001	**
$Time^3$*School Level	Middle	0	.	.	.	.	
$Time^3$*Free Reduced Lunch		0.13	0.09581	6867	1.36	0.1749	
$Time^3$*Minority		-0.2709	0.08609	6867	-3.15	0.0017	**
$Time^3$*Students with Disabilities		-0.07848	0.06536	6867	-1.2	0.2299	
$Time^3$*Positive Learning Environment		-0.242	0.09033	6867	-2.68	0.0074	**
$Time^3$*Positive Teacher Qualifications		0.07683	0.06214	6867	1.24	0.2163	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	57.0301	2.1007	27.15	<.0001	**
Residual	13.8759	0.2505	55.39	<.0001	**

Note: * $p < .05$; ** $p < .01$

When the data were filtered to include only elementary and middle schools and gifted was also added to the equation, all intercept parameter estimates were significant (i.e., elementary school, time, time^2, time^3, free or reduced lunch status, minority, students with disabilities, teacher qualifications, and positive learning environment except for LEP). Significant interactions with time included elementary, free or reduced lunch status, minority, LEP, gifted, and teacher qualifications. Significant interactions with time^2 included elementary, minority, LEP, gifted, and positive learning environment. Significant interactions with time^3 included elementary, minority, LEP, gifted, and positive learning environment (see Table 12). This model demonstrated better fit than the previous model by all model fit indices (see Table 18). It explained 1% more of the between school variance and the same amount of the within school variance as the previous model and explained 91% of all the variance.

Model 5b: School Learning Environment with Demographics by School Level (Elementary and Middle Schools with Gifted)

Level 1: FCAT Reading = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}*Gifted + γ_{37}* Teacher Qualifications + γ_{38}* Positive Learning Environment

Mixed-Effects Model: FCAT Reading = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}* LEP*Time^3 + γ_{35}* SWD*Time^3 + γ_{36}*Gifted*Time^3 + γ_{37}* Teacher Qualifications*Time^3 + γ_{38}* Positive Learning Environment*Time^3 + u_0 + r

Table 12.

Model 5b: Reading Predicted by Demographics and Student Learning Environment by School Level for Elementary and Middle School with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		680.36	0.3405	1805	1998.4	<.0001	**
Time		-20.7804	0.8278	4900	-25.1	<.0001	**
$Time^2$		16.61	0.7109	4900	23.37	<.0001	**
$Time^3$		-3.2426	0.1532	4900	-21.16	<.0001	**
School Level	Elementary	-26.7137	0.4149	4900	-64.38	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-5.5867	0.183	4900	-30.53	<.0001	**
Minority		-5.368	0.2094	4900	-25.63	<.0001	**
LEP		-0.5767	0.1649	4900	-3.5	0.0005	**
Students with Disabilities		-0.999	0.1273	4900	-7.85	<.0001	**
Gifted		3.2493	0.144	4900	22.56	<.0001	**
Positive Learning Environment		1.6988	0.162	4900	10.48	<.0001	**
Positive Teacher Qualifications		0.6293	0.1072	4900	5.87	<.0001	**
Time*School Level		-13.1048	1.0511	4900	-12.47	<.0001	**
Time*School Level		0	.	.	.	.	
Time*Free Reduced Lunch		1.5475	0.518	4900	2.99	0.0028	**
Time*Minority		0.2554	0.5008	4900	0.51	0.61	
Time*LEP		1.5728	0.3925	4900	4.01	<.0001	**
Time*Students with Disabilities		-0.1581	0.3326	4900	-0.48	0.6345	
Time*Gifted		0.8477	0.3482	4900	2.43	0.015	*
Time*Positive Learning Environment		-0.5364	0.5209	4900	-1.03	0.3031	
Time*Positive Teacher Qualifications		0.8785	0.3134	4900	2.8	0.0051	**
$Time^2$*School Level	Elementary	14.9872	0.9131	4900	16.41	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	
$Time^2$*Free Reduced Lunch		-1.3266	0.4599	4900	-2.88	0.0039	**
$Time^2$*Minority		0.5603	0.4378	4900	1.28	0.2008	
$Time^2$*LEP		-1.3883	0.3428	4900	-4.05	<.0001	**
$Time^2$*Students with Disabilities		-0.04735	0.2904	4900	-0.16	0.8705	
$Time^2$*Gifted		-0.8037	0.304	4900	-2.64	0.0082	**
$Time^2$*Positive Learning Environment		0.2667	0.4604	4900	0.58	0.5624	
$Time^2$*Positive Teacher Qualifications		-0.7095	0.2752	4900	-2.58	0.01	*
$Time^3$*School Level	Elementary	-3.3955	0.1983	4900	-17.12	<.0001	**
$Time^3$*School Level	Middle	0	.	.	.	.	
$Time^3$*Free Reduced Lunch		0.2666	0.1011	4900	2.64	0.0084	**
$Time^3$*Minority		-0.1465	0.09575	4900	-1.53	0.126	
$Time^3$*LEP		0.292	0.07472	4900	3.91	<.0001	**
$Time^3$*Students with		0.02797	0.06332	4900	0.44	0.6586	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Disabilities							
$Time^3$*Gifted		0.1601	0.06636	4900	2.41	0.0159	*
$Time^3$*Positive Learning Environment		-0.03561	0.1008	4900	-0.35	0.7239	
$Time^3$*Positive Teacher Qualifications		0.1438	0.0602	4900	2.39	0.0169	*
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		22.7383	0.9189		24.74	<.0001	**
Residual		9.5272	0.1973		48.3	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added technology integration variables with the demographics, learning environment, and school level variables. These included student access to various types of software, teachers regularly using various types of software, frequency that students use various types of software, and technology support. This model was estimated twice, first without gifted population but all school levels (see model 6a) and then with elementary and middle school levels and gifted population (see model 6b). When the model was estimated with all school levels without gifted, the only significant technology parameter estimates were frequency that students use tool-based software and the interaction of time, $time^2$, and $time^3$ with teacher's use of technology for administrative purposes and frequency that students use content software (see Table 13). Other significant parameter estimates included the intercept, time, $time^2$, $time^3$, high school and elementary school relative to middle school, free or reduced lunch status, minority, LEP, students with disabilities, positive learning environment, and positive teacher qualifications. Significant interactions with time, $time^2$, and $time^3$ included elementary and high school relative to middle school, free or reduced lunch status, LEP, positive learning environment, and positive teacher qualifications. Only one model fit index indicated that this model had better fit (see Table 17). No additional variance was explained with this model. Three technology integration indicators were retained in the final model for all school levels without gifted, frequency that students use tool-based software, frequency that students use content software, and percent of teachers who use technology for administrative purposes.

Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Level 1: FCAT Reading = $\beta_0 + \beta_1$*Time + β_2*$Time^2$ + β_3*$Time^3$ + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Access Content SW + γ_{09}*Access Office SW + γ_{010}*Access Ad Prod SW + γ_{011}*Teachers Use Deliver Instruction + γ_{012}*Teachers use Admin + γ_{013}*Frequency Students Use Content + γ_{014}*Frequency Students Use Tool + γ_{015}*Technical Support Human + γ_{016}*Technical Support Hardware + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}* Teacher Qualifications + γ_{17}* Positive Learning Environment + γ_{18}*Access Content SW + γ_{19}*Access Office SW + γ_{110}*Access Ad Prod SW + γ_{111}*Teachers Use Deliver Instruction + γ_{112}*Teachers use Admin + γ_{113}*Frequency Students Use Content + γ_{114}*Frequency Students Use Tool + γ_{115}*Technical Support Human + γ_{116}*Technical Support Hardware

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}* Teacher Qualifications + γ_{27}* Positive Learning Environment + γ_{28}*Access Content SW + γ_{29}*Access Office SW + γ_{210}*Access Ad Prod SW + γ_{211}*Teachers Use Deliver Instruction + γ_{212}*Teachers use Admin + γ_{213}*Frequency Students Use Content + γ_{214}*Frequency Students Use Tool + γ_{215}*Technical Support Human + γ_{216}*Technical Support Hardware

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}* Teacher Qualifications + γ_{37}* Positive Learning Environment + γ_{38}*Access Content SW + γ_{39}*Access Office SW + γ_{310}*Access Ad Prod SW + γ_{311}*Teachers Use Deliver Instruction + γ_{312}*Teachers use Admin + γ_{313}*Frequency Students Use Content + γ_{314}*Frequency Students Use Tool + γ_{315}*Technical Support Human + γ_{316}*Technical Support Hardware

Mixed-Effects Model: FCAT Reading = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Access Content SW + γ_{09}*Access Office SW + γ_{010}*Access Ad Prod SW + γ_{011}*Teachers Use Deliver Instruction + γ_{012}*Teachers use Admin + γ_{013}*Frequency Students Use Content + γ_{014}*Frequency Students Use Tool + γ_{015}*Technical Support Human + γ_{016}*Technical Support Hardware + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Teacher Qualifications*Time + γ_{17}* Positive Learning Environment*Time + γ_{18}*Access Content SW*Time + γ_{19}*Access Office SW*Time + γ_{110}*Access Ad Prod SW*Time + γ_{111}*Teachers Use Deliver Instruction*Time + γ_{112}*Teachers use Admin*Time + γ_{113}*Frequency Students Use Content*Time + γ_{114}*Frequency Students Use Tool*Time + γ_{115}*Technical Support Human*Time + γ_{116}*Technical Support Hardware*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Teacher Qualifications*Time^2 + γ_{27}* Positive Learning Environment*Time^2 + γ_{28}*Access Content SW*Time^2 + γ_{29}*Access Office SW*Time^2 + γ_{210}*Access Ad Prod SW*Time^2 + γ_{211}*Teachers Use Deliver Instruction*Time^2 + γ_{212}*Teachers use Admin*Time^2 + γ_{213}*Frequency Students Use Content*Time^2 + γ_{214}*Frequency Students Use Tool*Time^2 + γ_{215}*Technical Support Human*Time^2 + γ_{216}*Technical Support Hardware*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}* LEP*Time^3 + γ_{35}* SWD*Time^3 + γ_{36}*Teacher Qualifications*Time^3 + γ_{37}* Positive Learning Environment*Time^3 + γ_{38}*Access Content SW*Time^3 + γ_{39}*Access Office SW*Time^3 + γ_{310}*Access Ad Prod SW*Time^3 + γ_{311}*Teachers Use Deliver Instruction*Time^3 + γ_{312}*Teachers use Admin*Time^3 + γ_{313}*Frequency Students Use Content*Time^3 + γ_{314}*Frequency Students Use Tool*Time^3 + γ_{315}*Technical Support Human*Time^3 + γ_{316}*Technical Support Hardware*Time^3 + $u_0 + r$

Table 13.

Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		681.26	0.3596	2234	1894.5	<.0001	**
Time		-20.2469	0.8024	6399	-25.23	<.0001	**
$Time^2$		16.2751	0.6942	6399	23.44	<.0001	**
$Time^3$		-3.1892	0.1502	6399	-21.23	<.0001	**
School Level	Elementary	-28.0814	0.4283	6399	-65.56	<.0001	**
School Level	High	6.6111	0.4874	6399	13.57	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-5.8016	0.174	6399	-33.35	<.0001	**
Minority		-5.5842	0.1997	6399	-27.96	<.0001	**
LEP		-0.7877	0.1703	6399	-4.63	<.0001	**
Students with Disabilities		-1.7237	0.1251	6399	-13.78	<.0001	**
Positive Learning Environment		1.6229	0.1352	6399	12	<.0001	**
Positive Teacher Qualifications		0.8536	0.1002	6399	8.52	<.0001	**
Access Content Software		0.1047	0.09503	6399	1.1	0.2708	
Access Office Software		-0.1464	0.09431	6399	-1.55	0.1205	
Access Advanced Production Software		-0.08175	0.09657	6399	-0.85	0.3973	
Teachers Use To Deliver Instruction		-0.02342	0.1054	6399	-0.22	0.8242	
Teachers Use For Administrative Purposes		-0.02003	0.1089	6399	-0.18	0.8541	
Frequency that Students Use Content Software		0.02092	0.08741	6399	0.24	0.8108	
Frequency Students Use Tool-Based Software		0.2425	0.0939	6399	2.58	0.0098	**
Technical Support Human		-0.02141	0.08646	6399	-0.25	0.8044	
Technical Support Hardware		-0.148	0.08354	6399	-1.77	0.0766	
Time*School Level	Elementary	-14.2787	1.0076	6399	-14.17	<.0001	**
Time*School Level	High	30.3597	0.9526	6399	31.87	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		1.9416	0.4586	6399	4.23	<.0001	**
Time*Minority		0.8543	0.4402	6399	1.94	0.0523	
Time*LEP		0.8362	0.3626	6399	2.31	0.0211	*
Time*Students with Disabilities		-0.4985	0.3066	6399	-1.63	0.104	
Time*Positive Learning Environment		0.8869	0.4224	6399	2.1	0.0358	*
Time*Positive Teacher Qualifications		1.0263	0.2912	6399	3.52	0.0004	**
Time*Access Content Software		-0.4158	0.3339	6399	-1.25	0.213	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time*Access Office Software		0.1448	0.3312	6399	0.44	0.6621	
Time*Access Advanced Production Software		0.0794	0.3323	6399	0.24	0.8112	
Time*Teachers Use To Deliver Instruction		-0.1032	0.3698	6399	-0.28	0.7802	
Time*Teachers Use For Administrative Purposes		0.7513	0.3767	6399	1.99	0.0461	*
Time*Frequency that Students Use Content Software		-0.6827	0.3238	6399	-2.11	0.035	*
Time*Frequency Students Use Tool-Based Software		0.2084	0.34	6399	0.61	0.5398	
Time*Technical Support Human		0.2347	0.2913	6399	0.81	0.4204	
Time*Technical Support Hardware		0.4103	0.2943	6399	1.39	0.1633	
$Time^2$*School Level	Elementary	15.8282	0.8842	6399	17.9	<.0001	**
$Time^2$*School Level	High	-18.4859	0.8389	6399	-22.04	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	
$Time^2$*Free Reduced Lunch		-1.8766	0.4082	6399	-4.6	<.0001	**
$Time^2$*Minority		0.2788	0.3856	6399	0.72	0.4696	
$Time^2$*LEP		-0.728	0.3172	6399	-2.3	0.0217	*
$Time^2$*Students with Disabilities		0.2934	0.2681	6399	1.09	0.274	
$Time^2$*Positive Learning Environment		-0.806	0.377	6399	-2.14	0.0326	*
$Time^2$*Positive Teacher Qualifications		-0.7878	0.2558	6399	-3.08	0.0021	**
$Time^2$*Access Content Software		0.2281	0.2931	6399	0.78	0.4365	
$Time^2$*Access Office Software		-0.02218	0.2899	6399	-0.08	0.939	
$Time^2$*Access Advanced Production Software		-0.03315	0.2912	6399	-0.11	0.9094	
$Time^2$*Teach Use Deliver Instruction		0.1713	0.3258	6399	0.53	0.5992	
$Time^2$*Teach Use Administrative Purposes		-0.6823	0.3282	6399	-2.08	0.0377	*
$Time^2$*Frequency Student Use Content Software		0.6071	0.2854	6399	2.13	0.0334	*
$Time^2$*Frequency Students Use Tool-Based Software		-0.2636	0.304	6399	-0.87	0.3859	
$Time^2$*Technical Support Human		-0.1704	0.2565	6399	-0.66	0.5064	
$Time^2$*Technical Support Hardware		-0.2141	0.2579	6399	-0.83	0.4066	
$Time^3$*School Level	Elementary	-3.5408	0.193	6399	-18.34	<.0001	**
$Time^3$*School Level	High	3.2418	0.184	6399	17.62	<.0001	**
$Time^3$*School Level	Middle	0	.	.	.	.	
$Time^3$*Free Reduced Lunch		0.3964	0.08998	6399	4.41	<.0001	**
$Time^3$*Minority		-0.1027	0.08443	6399	-1.22	0.2237	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
$Time^3$*LEP		0.1538	0.06936	6399	2.22	0.0266	*
$Time^3$*Students with Disabilities		-0.04336	0.05861	6399	-0.74	0.4594	
$Time^3$*Positive Learning Environment		0.1667	0.08311	6399	2.01	0.0449	*
$Time^3$*Positive Teacher Qualifications		0.1556	0.05592	6399	2.78	0.0054	**
$Time^3$*Access Content Software		-0.03266	0.06428	6399	-0.51	0.6115	
$Time^3$*Access Office Software		-0.00119	0.06339	6399	-0.02	0.985	
$Time^3$*Access Advanced Production Software		0.005037	0.06368	6399	0.08	0.937	
$Time^3$*Teach Use Deliver Instruction		-0.0395	0.07155	6399	-0.55	0.5809	
$Time^3$*Teach Use Administrative Purposes		0.1543	0.07158	6399	2.16	0.0311	*
$Time^3$*Frequency Student Use Content Software		-0.1292	0.06252	6399	-2.07	0.0388	*
$Time^3$*Frequency Students Use Tool-Based Software		0.05051	0.06741	6399	0.75	0.4537	
$Time^3$*Technical Support Human		0.02933	0.05634	6399	0.52	0.6026	
$Time^3$*Technical Support Hardware		0.02591	0.05654	6399	0.46	0.6468	
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		32.0042	1.181		27.1	<.0001	**
Residual		10.1853	0.1875		54.31	<.0001	**

Note: * $p < .05$; ** $p < .01$

Similar results were found with the elementary and middle school data with gifted. The only significant technology parameter estimates were technical support for hardware and its interaction with time, $time^2$, and $time^3$, and the interaction of time, $time^2$, and $time^3$ with frequency that students use content software and teachers use technology for administrative purposes (see Table 14). Other significant parameter estimates included the intercept, time, $time^2$, $time^3$, elementary school, free or reduced lunch status, minority, LEP, students with disabilities, gifted, positive learning environment, and positive teacher qualifications. Significant interactions with time, $time^2$, and $time^3$ included free or reduced lunch status, LEP, gifted, and positive learning environment. Only the -2 Log Likelihood index indicated that this model had better fit (see Table 17). Moreover, adding the technology integration indicators to the model did not explain any additional variance. Technology support for hardware, frequency that students use content software, and teachers' use of technology for administrative purposes were the only technology integration indicators retained in the final model for the data with elementary and middle schools and gifted in order to determine if the model fit improved without the noise from the technology integration variables that were not significant.

Model 6b: Technology Integration with Demographics and Student Learning Environment by School Level (Elementary and Middle Schools with Gifted)
Level 1: FCAT Reading = β_0 + β_1*Time + β_2*Time^2 + β_3*Time^3 + r
Level 2: β_0 = γ_{00} + γ_{01}*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Access Content SW + γ_{010}*Access Office SW + γ_{011}*Access Ad Prod SW + γ_{012}*Teachers Use Deliver Instruction + γ_{013}*Teachers use Admin + γ_{014}*Frequency Students Use Content + γ_{015}*Frequency Students Use Tool + γ_{016}*Technical Support Human + γ_{017}*Technical Support Hardware + u_0
β_1 = γ_{10} + γ_{11}*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + γ_{19}*Access Content SW + γ_{110}*Access Office SW + γ_{111}*Access Ad Prod SW + γ_{112}*Teachers Use Deliver Instruction + γ_{113}*Teachers use Admin + γ_{114}*Frequency Students Use Content + γ_{115}*Frequency Students Use Tool + γ_{116}*Technical Support Human + γ_{117}*Technical Support Hardware
β_2 = γ_{20} + γ_{21}*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment + γ_{29}*Access Content SW + γ_{210}*Access Office SW + γ_{211}*Access Ad Prod SW + γ_{212}*Teachers Use Deliver Instruction + γ_{213}*Teachers use Admin + γ_{214}*Frequency Students Use Content + γ_{215}*Frequency Students Use Tool + γ_{216}*Technical Support Human + γ_{217}*Technical Support Hardware
β_3 = γ_{30} + γ_{31}*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}*Gifted + γ_{37}* Teacher Qualifications + γ_{38}* Positive Learning Environment + γ_{39}*Access Content SW + γ_{310}*Access Office SW + γ_{311}*Access Ad Prod SW + γ_{312}*Teachers Use Deliver Instruction + γ_{313}*Teachers use Admin + γ_{314}*Frequency Students Use Content + γ_{315}*Frequency Students Use Tool + γ_{316}*Technical Support Human + γ_{317}*Technical Support Hardware

Mixed-Effects Model: FCAT Reading = γ_{00} + γ_{01}*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Access Content SW + γ_{010}*Access Office SW + γ_{011}*Access Ad Prod SW + γ_{012}*Teachers Use Deliver Instruction + γ_{013}*Teachers use Admin + γ_{014}*Frequency Students Use Content + γ_{015}*Frequency Students Use Tool + γ_{016}*Technical Support Human + γ_{017}*Technical Support Hardware + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{19}*Access Content SW*Time + γ_{110}*Access Office SW*Time + γ_{111}*Access Ad Prod SW*Time + γ_{112}*Teachers Use Deliver Instruction*Time + γ_{113}*Teachers use Admin*Time + γ_{114}*Frequency Students Use Content*Time + γ_{115}*Frequency Students Use Tool*Time + γ_{116}*Technical Support Human*Time + γ_{117}*Technical Support Hardware*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + γ_{29}*Access Content SW*Time^2 + γ_{210}*Access Office SW*Time^2 + γ_{211}*Access Ad Prod SW*Time^2 + γ_{212}*Teachers Use Deliver Instruction*Time^2 + γ_{213}*Teachers use Admin*Time^2 + γ_{214}*Frequency Students Use Content*Time^2 + γ_{215}*Frequency Students Use Tool*Time^2 + γ_{216}*Technical Support Human*Time^2 + γ_{217}*Technical Support Hardware*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}* LEP*Time^3 + γ_{35}* SWD*Time^3 + γ_{36}*Gifted*Time^3 + γ_{37}* Teacher Qualifications*Time^3 + γ_{38}* Positive Learning Environment*Time^3 + γ_{39}*Access Content SW*Time^3 + γ_{310}*Access Office SW*Time^3 + γ_{311}*Access Ad Prod SW*Time^3 + γ_{312}*Teachers Use Deliver Instruction*Time^3 + γ_{313}*Teachers use Admin*Time^3 + γ_{314}*Frequency Students Use Content*Time^3 + γ_{315}*Frequency Students Use Tool*Time^3 + γ_{316}*Technical Support Human*Time^3 + γ_{317}*Technical Support Hardware*Time^3 + u_0 + r

Table 14.

Model 6b: Technology Integration with Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		680.41	0.3455	1805	1969.4	<.0001	**
Time		-21.5066	0.8706	4864	-24.7	<.0001	**
$Time^2$		17.1501	0.7484	4864	22.92	<.0001	**
$Time^3$		-3.3436	0.1612	4864	-20.74	<.0001	**
School Level	Elementary	-26.7788	0.4228	4864	-63.34	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-5.5813	0.1866	4864	-29.92	<.0001	**
Minority		-5.3867	0.2097	4864	-25.68	<.0001	**
LEP		-0.593	0.1651	4864	-3.59	0.0003	**
Students with Disabilities		-0.9745	0.1272	4864	-7.66	<.0001	**
Gifted		3.2711	0.1447	4864	22.61	<.0001	**
Positive Learning Environment		1.6996	0.1626	4864	10.46	<.0001	**
Positive Teacher Qualifications		0.6139	0.1071	4864	5.73	<.0001	**
Access Content Software		0.01653	0.1046	4864	0.16	0.8744	
Access Office Software		-0.07994	0.09993	4864	-0.8	0.4238	
Access Advanced Production Software		-0.1018	0.1046	4864	-0.97	0.3304	
Teachers Use To Deliver Instruction		-0.00444	0.1152	4864	-0.04	0.9693	
Teachers Use For Administrative Purposes		-0.09236	0.1209	4864	-0.76	0.4449	
Frequency that Students Use Content Software		0.1639	0.09642	4864	1.7	0.0892	
Frequency Students Use Tool-Based Software		0.1914	0.1011	4864	1.89	0.0583	
Technical Support Human		-0.04484	0.09504	4864	-0.47	0.6371	
Technical Support Hardware		-0.2621	0.0894	4864	-2.93	0.0034	**
Time*School Level	Elementary	-12.1692	1.1153	4864	-10.91	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		1.5767	0.5292	4864	2.98	0.0029	**
Time*Minority		0.4593	0.5057	4864	0.91	0.3638	
Time*LEP		1.5244	0.3937	4864	3.87	0.0001	**
Time*Students with Disabilities		-0.104	0.3333	4864	-0.31	0.7551	
Time*Gifted		0.8081	0.3522	4864	2.29	0.0218	*
Time*Positive Learning Environment		-0.6142	0.5243	4864	-1.17	0.2415	
Time*Positive Teacher Qualifications		0.8703	0.3173	4864	2.74	0.0061	**
Time*Access Content Software		-0.2275	0.3654	4864	-0.62	0.5335	
Time*Access Office Software		-0.1091	0.3536	4864	-0.31	0.7577	
Time*Access Advanced Production Software		0.2427	0.3576	4864	0.68	0.4974	
Time*Teachers Use To Deliver Instruction		-0.09376	0.4085	4864	-0.23	0.8185	
Time*Teachers Use For		0.9038	0.421	4864	2.15	0.0319	*

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Administrative Purposes							
Time*Frequency that Students Use Content Software		-0.7795	0.3647	4864	-2.14	0.0326	*
Time*Frequency Students Use Tool-Based Software		-0.08583	0.3719	4864	-0.23	0.8175	
Time*Technical Support Human		0.565	0.3237	4864	1.75	0.081	
Time*Technical Support Hardware		0.6596	0.3189	4864	2.07	0.0387	*
$Time^2$*School Level	Elementary	14.3156	0.9724	4864	14.72	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	
$Time^2$*Free Reduced Lunch		-1.3937	0.4705	4864	-2.96	0.0031	**
$Time^2$*Minority		0.4285	0.4423	4864	0.97	0.3327	
$Time^2$*LEP		-1.3274	0.3441	4864	-3.86	0.0001	**
$Time^2$*Students with Disabilities		-0.1044	0.291	4864	-0.36	0.7197	
$Time^2$*Gifted		-0.7675	0.3071	4864	-2.5	0.0125	*
$Time^2$*Positive Learning Environment		0.3074	0.4632	4864	0.66	0.507	
$Time^2$*Positive Teacher Qualifications		-0.6932	0.2802	4864	-2.47	0.0134	*
$Time^2$*Access Content Software		0.09879	0.321	4864	0.31	0.7583	
$Time^2$*Access Office Software		0.2076	0.3092	4864	0.67	0.5019	
$Time^2$*Access Advanced Production Software		-0.1561	0.314	4864	-0.5	0.619	
$Time^2$*Teach Use Deliver Instruction		0.1045	0.3596	4864	0.29	0.7713	
$Time^2$*Teach Use Administrative Purposes		-0.749	0.3647	4864	-2.05	0.0401	*
$Time^2$*Frequency Student Use Content Software		0.6575	0.3219	4864	2.04	0.0411	*
$Time^2$*Frequency Students Use Tool-Based Software		-0.00448	0.3324	4864	-0.01	0.9892	
$Time^2$*Technical Support Human		-0.4997	0.284	4864	-1.76	0.0786	
$Time^2$*Technical Support Hardware		-0.3582	0.279	4864	-1.28	0.1993	
$Time^3$*School Level	Elementary	-3.274	0.2114	4864	-15.49	<.0001	**
$Time^3$*School Level	Middle	0	.	.	.	.	
$Time^3$*Free Reduced Lunch		0.2851	0.1035	4864	2.75	0.0059	**
$Time^3$*Minority		-0.1216	0.09674	4864	-1.26	0.2089	
$Time^3$*LEP		0.2764	0.07505	4864	3.68	0.0002	**
$Time^3$*Students with Disabilities		0.04149	0.06343	4864	0.65	0.5131	
$Time^3$*Gifted		0.1508	0.06696	4864	2.25	0.0243	*
$Time^3$*Positive Learning Environment		-0.04003	0.1014	4864	-0.39	0.6929	
$Time^3$*Positive Teacher Qualifications		0.1411	0.06147	4864	2.29	0.0218	*
$Time^3$*Access Content Software		-0.00749	0.07047	4864	-0.11	0.9154	
$Time^3$*Access Office Software		-0.05101	0.0675	4864	-0.76	0.4499	
$Time^3$*Access Advanced Production Software		0.02369	0.06879	4864	0.34	0.7306	
$Time^3$*Teach Use Deliver Instruction		-0.02464	0.07886	4864	-0.31	0.7547	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time^3*Teach Use Administrative Purposes		0.1622	0.07922	4864	2.05	0.0407	*
Time^3*Frequency Student Use Content Software		-0.1381	0.07048	4864	-1.96	0.0502	
Time^3*Frequency Students Use Tool-Based Software		-0.00025	0.07361	4864	0	0.9973	
Time^3*Technical Support Human		0.1054	0.06221	4864	1.69	0.0902	
Time^3*Technical Support Hardware		0.05083	0.06104	4864	0.83	0.4051	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	22.5852	0.9142	24.7	<.0001	**
Residual	9.4602	0.196	48.26	<.0001	**

Note: * $p < .05$; ** $p < .01$

The last models that were estimated in order to answer the first hypothesis included all school levels, demographic, learning environment quality, and significant technology integration variables. These models were different because the model fit to the data for all schools levels without gifted included three technology integration variables - frequency that students use tool-based software, frequency that students use content software, and percent of teachers who regularly use technology for administrative purposes (see model 7a); while the model fitted to the data with elementary and middle school levels and gifted included three technology integration variables – frequency that students use content software, level of technical support – hardware, and percent of teachers who regularly use technology for administrative purposes (see model 7b). For the model with all schools levels and no gifted, the same parameter estimates and interactions identified in the previous models as significant were significant again (see Table 15). Although there was no difference in the percentage of variance explained in this model than was in the Demographic Model with Student Learning Environment by school level or the Technology Integration with Demographic and Student Learning Environment Model by school level, the AIC, AICC, and BIC indices all indicated better model fit (see Table 17). The level-1 residuals for the final model for predicting FCAT Reading using all school levels without gifted ranged between -15.18 and 17.40, with a standard deviation of 2.79. Although there were outliers, skewness was 0.10 and kurtosis was 1.86, which would indicate that the residuals were evenly distributed with most around the mean. Distribution of the empirical bayes intercepts ranged between -19.35 and 29.70 with standard deviation of 5.43. Skewness was 0.55, and kurtosis was 1.25, which indicated that the residuals at level-2 were within acceptable range.

Final Model 7a: Significant Technology Integration Indicators with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Level 1: FCAT Reading = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Frequency Students Use Tool + γ_{09}*Frequency Students Use Content + γ_{010}*Teachers use Admin + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}* Teacher Qualifications + γ_{17}* Positive Learning Environment + γ_{18}*Frequency Students Use Tool + γ_{19}*Frequency Students Use Content + γ_{110}*Teachers use Admin

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}* Teacher Qualifications + γ_{27}* Positive Learning Environment + γ_{28}*Frequency Students Use Tool + γ_{29}*Frequency Students Use Content + γ_{210}*Teachers use Admin

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}* Teacher Qualifications + γ_{37}* Positive Learning Environment + γ_{38}*Frequency Students Use Tool + γ_{39}*Frequency Students Use Content + γ_{310}*Teachers use Admin

Mixed-Effects Model: FCAT Reading = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Frequency Students Use Tool + γ_{09}*Frequency Students Use Content + γ_{010}*Teachers use Admin + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Teacher Qualifications*Time + γ_{17}* Positive Learning Environment*Time γ_{18}*Frequency Students Use Tool*Time + γ_{19}*Frequency Students Use Content*Time + γ_{110}*Teachers use Admin *Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Teacher Qualifications*Time^2 + γ_{27}* Positive Learning Environment*Time^2 + γ_{28}*Frequency Students Use Tool*Time^2 + γ_{29}*Frequency Students Use Content*Time^2 + γ_{210}*Teachers use Admin*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}* LEP*Time^3 + γ_{35}* SWD*Time^3 + γ_{36}*Teacher Qualifications*Time^3 + γ_{37}* Positive Learning Environment*Time^3 + γ_{38}*Frequency Students Use Tool*Time^3 + γ_{39}*Frequency Students Use Content*Time^3 + γ_{310}*Teachers use Admin*Time^3 + u_0 + r

Table 15.

Final Model 7a: Significant Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		681.21	0.3577	2234	1904.5	<.0001	**
Time		-20.094	0.7922	6423	-25.37	<.0001	**
Time^2		16.2106	0.6848	6423	23.67	<.0001	**
Time^3		-3.1829	0.1481	6423	-21.49	<.0001	**
School Level	Elementary	-28.0224	0.4253	6423	-65.89	<.0001	**
School Level	High	6.5409	0.4864	6423	13.45	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-5.8135	0.1729	6423	-33.63	<.0001	**
Minority		-5.563	0.1995	6423	-27.89	<.0001	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
LEP		-0.7833	0.1698	6423	-4.61	<.0001	**
Students with Disabilities		-1.7282	0.125	6423	-13.83	<.0001	**
Positive Learning Environment		1.6252	0.135	6423	12.04	<.0001	**
Positive Teacher Qualifications		0.865	0.1	6423	8.65	<.0001	**
Teachers Use For Administrative Purposes		-0.06951	0.09241	6423	-0.75	0.452	
Frequency that Students Use Content Software		0.04739	0.08422	6423	0.56	0.5737	
Frequency Students Use Tool-Based Software		0.219	0.09025	6423	2.43	0.0153	*
Time*School Level	Elementary	-14.4561	0.9915	6423	-14.58	<.0001	**
Time*School Level	High	30.6031	0.947	6423	32.32	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		2.0013	0.4562	6423	4.39	<.0001	**
Time*Minority		0.7906	0.4385	6423	1.8	0.0714	
Time*LEP		0.8464	0.361	6423	2.34	0.0191	*
Time*Students with Disabilities		-0.4998	0.3062	6423	-1.63	0.1027	
Time*Positive Learning Environment		0.8842	0.4209	6423	2.1	0.0357	*
Time*Positive Teacher Qualifications		1.0424	0.2879	6423	3.62	0.0003	**
Time*Teachers Use For Administrative Purposes		0.7114	0.3177	6423	2.24	0.0252	*
Time*Frequency that Students Use Content Software		-0.7688	0.3115	6423	-2.47	0.0136	*
Time*Frequency Students Use Tool-Based Software		0.1663	0.323	6423	0.51	0.6068	
Time^2*School Level	Elementary	15.8783	0.868	6423	18.29	<.0001	**
Time^2*School Level	High	-18.6382	0.834	6423	-22.35	<.0001	**
Time^2*School Level	Middle	0	.	.	.	.	
Time^2*Free Reduced Lunch		-1.912	0.4063	6423	-4.71	<.0001	**
Time^2*Minority		0.3215	0.3842	6423	0.84	0.4027	
Time^2*LEP		-0.74	0.3156	6423	-2.34	0.0191	*
Time^2*Students with Disabilities		0.2905	0.2678	6423	1.08	0.278	
Time^2*Positive Learning Environment		-0.7948	0.3757	6423	-2.12	0.0344	*
Time^2*Positive Teacher Qualifications		-0.8076	0.2518	6423	-3.21	0.0013	**
Time^2*Teachers Use For Administrative Purposes		-0.5955	0.2784	6423	-2.14	0.0325	*
Time^2*Frequency that Students Use Content Software		0.6547	0.2757	6423	2.37	0.0176	*
Time^2*Frequency Students Use Tool-Based Software		-0.201	0.2889	6423	-0.7	0.4866	
Time^3*School Level	Elementary	-3.5395	0.1892	6423	-18.7	<.0001	**
Time^3*School Level	High	3.2667	0.183	6423	17.85	<.0001	**
Time^3*School Level	Middle	0	.	.	.	.	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time^3*Free Reduced Lunch		0.4009	0.08959	6423	4.47	<.0001	**
Time^3*Minority		-0.1104	0.08411	6423	-1.31	0.1892	
Time^3*LEP		0.1565	0.06899	6423	2.27	0.0233	*
Time^3*Students with Disabilities		-0.04226	0.05853	6423	-0.72	0.4704	
Time^3*Positive Learning Environment		0.1635	0.08283	6423	1.97	0.0484	*
Time^3*Positive Teacher Qualifications		0.1596	0.05491	6423	2.91	0.0037	**
Time^3*Teachers Use For Administrative Purposes		0.1337	0.061	6423	2.19	0.0284	*
Time^3*Frequency that Students Use Content Software		-0.1364	0.06052	6423	-2.25	0.0242	*
Time^3*Frequency Students Use Tool-Based Software		0.03707	0.0641	6423	0.58	0.5631	
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		31.9887	1.1769		27.18	<.0001	**
Residual		10.2201	0.1879		54.38	<.0001	**

Note: * $p < .05$; ** $p < .01$

For the model with elementary and middle school levels and gifted, the same significant parameter estimates were identified as in the previous models; however, the significant parameters for technology indicators changed (see Table 16). Both frequency that students use content software and technical support for hardware were significant. Interactions between time and teachers' use of technology for administrative purposes, frequency that students use content software and technical support for hardware were significant. Interactions between time^2 and teachers' use of technology for administrative purposes and frequency that students use content software were significant. The interaction between time^3 and teachers use technology for administrative purposes was significant. Although there was no difference in the percentage of variance explained in this model than was in the Demographic Model with Student Learning Environment by school level or the Technology Integration with Demographic and Student Learning Environment Model by school level, the AIC, AICC, and BIC indices all indicated better model fit (see Table 18). The level-1 residuals for the final model for predicting FCAT Reading using elementary and middle schools with gifted ranged between -13.39 and 16.99 with a standard deviation of 2.69. Although there were outliers, skewness was 0.08 and kurtosis was 1.76, which would indicate that the residuals were evenly distributed with most around the mean. Distribution of the empirical bayes intercepts ranged between -13.91 and 20.73 with standard deviation of 4.50. Skewness was 0.32, and kurtosis was 0.31, which indicated that the residuals at level-2 were also normally distributed.

Final Model 7b: Technology Integration with Demographics and Student Learning Environment by School Level (Elementary and Middle Schools with Gifted)

Level 1: FCAT Reading = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Technical Support Hardware + γ_{010}*Frequency Students Use Content + γ_{011}*Teachers use Admin + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + γ_{19}*Technical Support Hardware + γ_{110}*Frequency Students Use Content + γ_{111}*Teachers use Admin

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment + γ_{29}*Technical Support Hardware + γ_{210}*Frequency Students Use Content + γ_{211}*Teachers use Admin

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}*Gifted + γ_{37}* Teacher Qualifications + γ_{38}* Positive Learning Environment + γ_{39}*Technical Support Hardware + γ_{310}*Frequency Students Use Content + γ_{311}*Teachers use Admin

Mixed-Effects Model: FCAT Reading = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Technical Support Hardware + γ_{010}*Frequency Students Use Content + γ_{011}*Teachers use Admin + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{19}*Technical Support Hardware*Time + γ_{110}*Frequency Students Use Content*Time + γ_{111}*Teachers use Admin*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + γ_{29}*Technical Support Hardware*Time^2 + γ_{210}*Frequency Students Use Content*Time^2 + γ_{211} Teachers use Admin*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}* LEP*Time^3 + γ_{35}* SWD*Time^3 + γ_{36}*Gifted*Time^3 + γ_{37}* Teacher Qualifications*Time^3 + γ_{38}* Positive Learning Environment*Time^3 + γ_{39}*Technical Support Hardware*Time^3 + γ_{310}*Frequency Students Use Content*Time^3 + γ_{311} Teachers use Admin*Time^3 + u_0 + r

Table 16.

Final Model 7b: Significant Technology Integration with Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		680.44	0.3429	1805	1984.5	<.0001	**
Time		-21.3167	0.8502	4888	-25.07	<.0001	**
Time^2		17.0195	0.7289	4888	23.35	<.0001	**
Time^3		-3.3238	0.1568	4888	-21.19	<.0001	**
School Level	Elementary	-26.8121	0.4187	4888	-64.04	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-5.5684	0.1861	4888	-29.92	<.0001	**
Minority		-5.399	0.2096	4888	-25.75	<.0001	**
LEP		-0.5986	0.1647	4888	-3.63	0.0003	**
Students with Disabilities		-0.9883	0.1271	4888	-7.78	<.0001	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Gifted		3.2803	0.1444	4888	22.71	<.0001	**
Positive Learning Environment		1.7124	0.1621	4888	10.56	<.0001	**
Positive Teacher Qualifications		0.6145	0.1071	4888	5.74	<.0001	**
Teachers Use For Administrative Purposes		-0.09228	0.09802	4888	-0.94	0.3465	
Frequency that students use content software		0.1809	0.09183	4888	1.97	0.0489	*
Technical Support Hardware		-0.2759	0.0889	4888	-3.1	0.0019	**
Time*School Level	Elementary	-12.3938	1.0834	4888	-11.44	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		1.6201	0.5246	4888	3.09	0.002	**
Time*Minority		0.4683	0.5034	4888	0.93	0.3522	
Time*LEP		1.568	0.3919	4888	4	<.0001	**
Time*Students with Disabilities		-0.1125	0.3323	4888	-0.34	0.735	
Time*Gifted		0.8005	0.3504	4888	2.28	0.0224	*
Time*Positive Learning Environment		-0.604	0.5226	4888	-1.16	0.2479	
Time*Positive Teacher Qualifications		0.916	0.314	4888	2.92	0.0035	**
Time*Teachers Use For Administrative Purposes		0.8386	0.3462	4888	2.42	0.0155	*
Time*Frequency that students use content software		-0.7416	0.3412	4888	-2.17	0.0298	*
Time*Technical Support Hardware		0.7107	0.3178	4888	2.24	0.0254	*
$Time^2$*School Level	Elementary	14.4502	0.9392	4888	15.39	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	
$Time^2$*Free Reduced Lunch		-1.4392	0.4659	4888	-3.09	0.002	**
$Time^2$*Minority		0.4136	0.4397	4888	0.94	0.3469	
$Time^2$*LEP		-1.3702	0.3424	4888	-4	<.0001	**
$Time^2$*Students with Disabilities		-0.09047	0.2901	4888	-0.31	0.7552	
$Time^2$*Gifted		-0.7713	0.3056	4888	-2.52	0.0116	*
$Time^2$*Positive Learning Environment		0.3029	0.4616	4888	0.66	0.5116	
$Time^2$*Positive Teacher Qualifications		-0.747	0.2762	4888	-2.7	0.0069	**
$Time^2$*Teachers Use For Administrative Purposes		-0.6818	0.3031	4888	-2.25	0.0245	*
$Time^2$*Frequency that students use content software		0.6093	0.3003	4888	2.03	0.0425	*
$Time^2$*Technical Support Hardware		-0.3993	0.2781	4888	-1.44	0.1511	
$Time^3$*School Level	Elementary	-3.2895	0.2036	4888	-16.16	<.0001	**
$Time^3$*School Level	Middle	0	.	.	.	.	
$Time^3$*Free Reduced Lunch		0.297	0.1025	4888	2.9	0.0038	**
$Time^3$*Minority		-0.1191	0.09609	4888	-1.24	0.2154	
$Time^3$*LEP		0.2867	0.07464	4888	3.84	0.0001	**
$Time^3$*Students with		0.03779	0.06325	4888	0.6	0.5503	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Disabilities							
Time^3*Gifted		0.153	0.06665	4888	2.3	0.0217	*
Time^3*Positive Learning Environment		-0.04094	0.101	4888	-0.41	0.6852	
Time^3*Positive Teacher Qualifications		0.1531	0.06046	4888	2.53	0.0114	*
Time^3*Teachers Use For Administrative Purposes		0.146	0.0662	4888	2.2	0.0275	*
Time^3*Frequency that students use content software		-0.1278	0.06566	4888	-1.95	0.0517	
Time^3*Technical Support Hardware		0.05961	0.06082	4888	0.98	0.327	
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		22.6794	0.9161		24.76	<.0001	**
Residual		9.4785	0.1962		48.3	<.0001	**

Note: * $p < .05$; ** $p < .01$

The last step was to add in USDOE funded Magnet Schools and USDOE Technology Magnet Schools as variables in the model. The USDOE funded Magnet schools were a collection of schools that were suggested to have high levels of technology infrastructure and high levels of staff development that included integrating technology into instruction. These schools were to be used as a proxy for schools that had the highest levels of technology integration over the longest period of time. Results of this model indicated that neither magnet school status nor technology magnet school status was a significant predictor of FCAT Reading.

Table 17.

Model Fit Indices for Models Predicting FCAT Reading Scores for All School Levels (without Gifted)

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 1: Reading Predicted by Average Reading of All Schools in Florida	68953.7	68959.7	68959.7	68976.9
Model 2a: Time as a Predictor of Reading	67756.5	67766.5	67766.5	67795.1
Model 2b: Time as a Predictor of Reading - Time Fixed	67758.7	67766.7	67766.7	67789.6
Quadratic Model 2c: Time^2 as a Predictor of Reading	67239.8	67249.8	67249.9	67278.5
Polynomial Model 2d: Time^3 as a Predictor of Reading	63024.7	63040.7	63040.7	63086.5
Model 3: Time, Time^2, Time^3, and School Level as Predictors of Reading	57367.6	57395.6	57395.6	57475.8

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 4a: Reading predicted by Time, School Level, and Demographics Variables	51149.2	51209.2	51209.4	51380.5
Model 5a: Demographics and Student Learning Environment by School Level	50716.9	50792.9	50793.2	51010
Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level	50663.7	50811.7	50812.9	51234.4
Final Model 7a: Significant Technology Integration with Demographics and Student Learning Environment by School Level	50685.3	50785.3	50785.9	51070.9

Table 18.

Model Fit Indices for Models Predicting FCAT Reading Scores for Elementary and Middle School Levels (with Gifted)

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 1: Reading Predicted by Average Reading of All Elementary and Middle Schools in Florida	57659.6	57665.6	57665.6	57682.3
Model 4b: Reading predicted by Time, School Level, and Demographics Variables No High School includes gifted	38677.4	38737.4	38737.7	38902.4
Model 5b: Demographics and Teacher Qualifications by School Level	38424.4	38500.4	38500.9	38709.4
Model 6b: Technology Integration with Demographics and Teacher Qualifications by School Level	38377.3	38525.3	38527	38932.3
Final Model 7b: Significant Technology Integration with Demographics and Student Learning Environment by School Level	38393.9	38493.9	38494.7	38768.9

The result of the analysis for all the models indicated that Hypothesis 1 was partially correct. When the sample included schools at all three school levels, there was a significant positive relationship between the frequency that students use tool-based software and school level FCAT reading achievement when all other school level, demographic, and school learning environment factors were controlled. Also, there were significant interactions between technology integration variables and time, $time^2$, and $time^3$ with FCAT reading achievement. There was a significant positive interaction between time and the percent of teachers who regularly use technology for administrative purposes with FCAT reading achievement, and a significant negative interaction between time and the frequency that students use content software with FCAT reading achievement. $Time^2$ and the frequency that students use content software had a significant positive interaction with FCAT reading achievement, and $time^2$ and the percent of teachers who regularly use technology for administrative purposes had a significant negative interaction with FCAT reading achievement. $Time^3$ and percent of teachers who regularly use technology for administrative purposes had a significant positive interaction with FCAT reading achievement, and $time^3$ and the frequency that students use content software had a significant negative interaction with FCAT reading achievement. These interactions resulted in a curvilinear trend.

After controlling so that all other variables were held at the mean, the trend for each school level could be examined separately, by comparing schools with different levels that students use tool-based software. Figure 5 illustrates the relationship between the average school frequency that students use tool-based software and average school FCAT Reading score for high schools. Frequencies that their students use tool-based software were compared at one and two standard deviations below the mean, the mean, and one and two standard deviations above the mean. This allowed the extreme cases of schools that had their students use tool-based software the most often, +2 standard deviations above the mean, and schools that had their students use tool-based software the least often, -2 standard deviations below the mean, to be compared. Schools that had students use software the most often started the study in 2003-04 with the highest FCAT Reading scores (688) and schools that had their students use the software the least often had started with the lowest FCAT Reading scores (687). This difference of one point was significant because there were so many schools in the sample; however, the practical importance was modest. The interaction between the frequency that students use tool-based software and time, $time^2$, and $time^3$ with FCAT Reading scores was not significant, so the slopes of the trends at each level of use were the same. By 2005-06, all high schools gained in their average FCAT reading scores, and all high schools had the same FCAT Reading scores, no matter how frequently their students used the software.

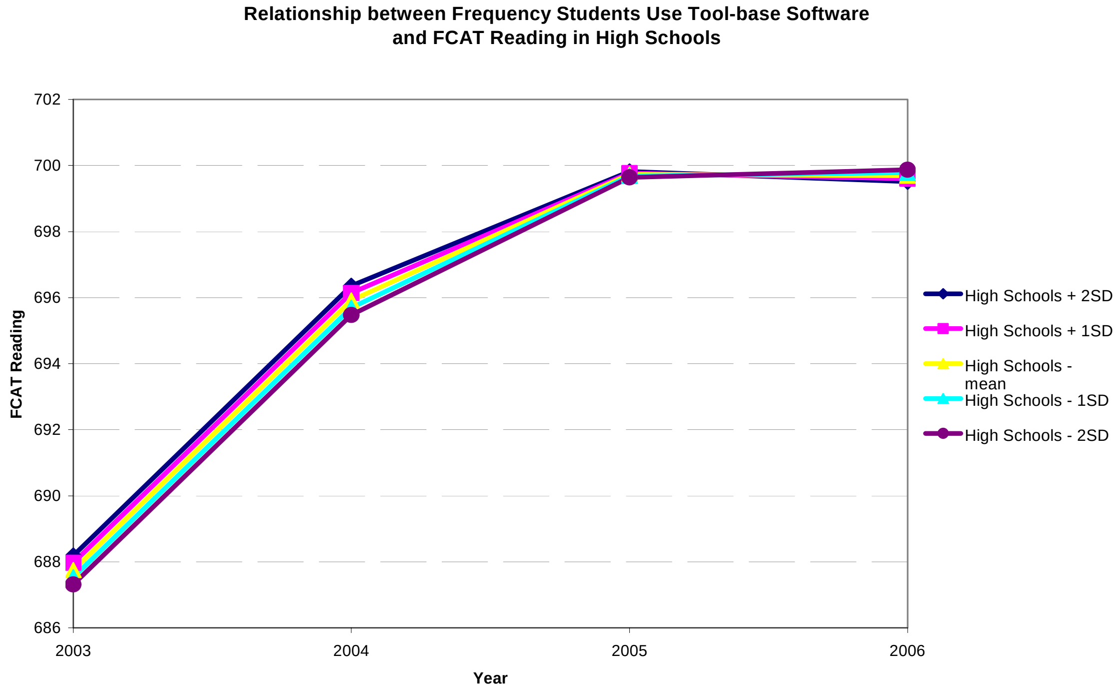

Figure 5. Relationship between Frequency Students Use Tool-base Software and FCAT Reading in High Schools.

Middle schools had a similar beginning pattern to high school; that is, after controlling for all other factors, schools that were two standard deviations above the mean in the frequency that their students used tool-based software had the highest FCAT Reading scores in 2003-04 (682), while those with two standard deviations below the mean had the lowest scores (681). Although this difference of one point was significant due to the large sample size, the practical importance is modest. Because there were no significant interactions between time, $time^2$, $time^3$ and the frequency that middle schools have their students use tool-based software with FCAT Reading scores, the trends were similar for all middle schools. Between 2003-04 and 2004-05 all middle schools had a decrease in their FCAT Reading scores (+2SD = 675 and +1SD, Mean, -1SD, and -2SD = 674). After this, all schools increased their FCAT Reading score each year to 680 in 2005-06 and 681 in 2006-07. Again, similar to high school, middle schools, at all five levels of frequency that students use tool-based software, ended with the same score.

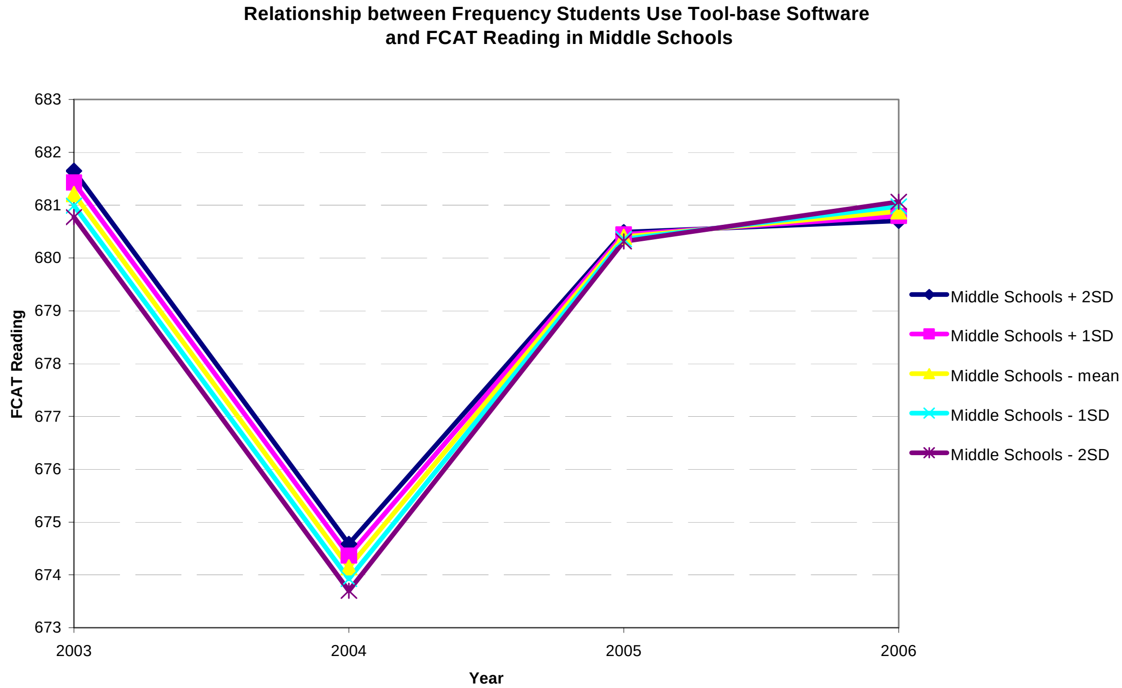

Figure 6. Relationship between Frequency Students Use Tool-base Software and FCAT Reading in Middle Schools.

Elementary schools experienced a similar pattern to middle schools. Schools with the highest frequency of students using tool-based software began the study with the highest FCAT Reading scores (654), while all other standard deviations or levels had the same score (653). Although this difference of one point was statistically significant, it has no practical importance. Between 2003-04 and 2004-05, all elementary schools experienced a decline in FCAT Reading scores (644), and then the trend reversed to 659 for all levels of frequency of use of tool-based software in 2005-06, followed by a slight decline (657) in 2006-07. In 2004-05, 2005-06, and 2006-07, all elementary schools at all levels of frequency that students use tool-based software had the same average FCAT Reading score.

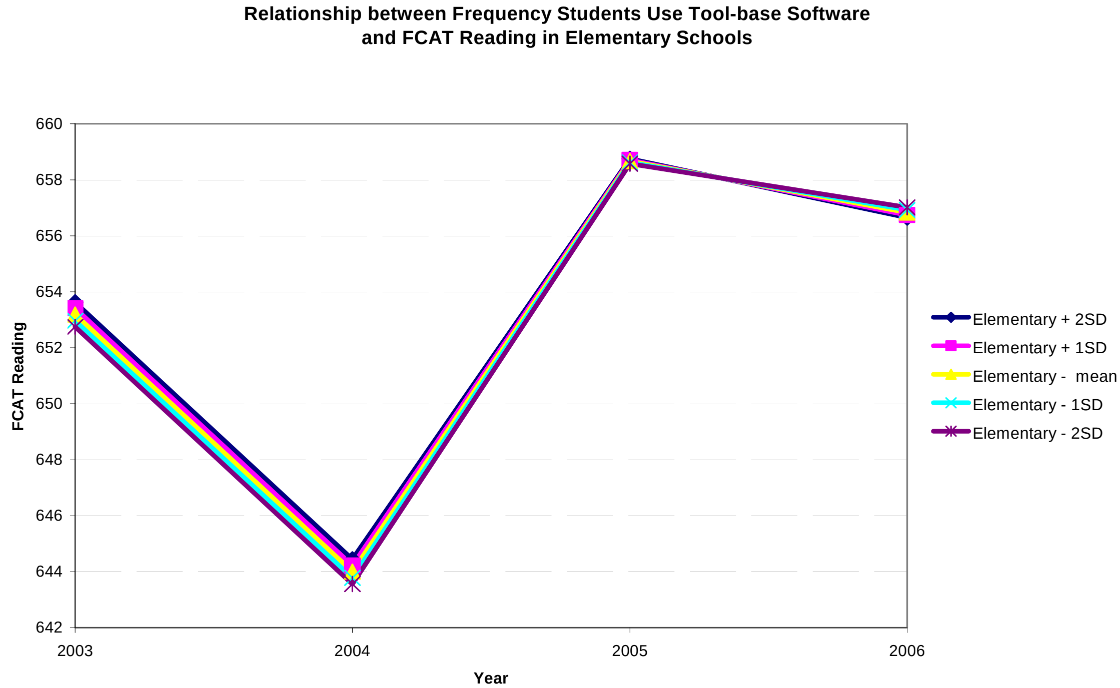

Figure 7. Relationship between Frequency Students Use Tool-base Software and FCAT Reading in Elementary Schools.

When the sample was restricted to just elementary and middle schools and percent of gifted students was included in the equation, there was a main effect with gifted, but no interactions of percent of gifted students in the school with time, time^2, or time^3. Thus, when all other factors were held equal, schools with highest percentages of gifted students began the study with the highest FCAT Reading scores, and this trend did not change over time (see Figure 8).

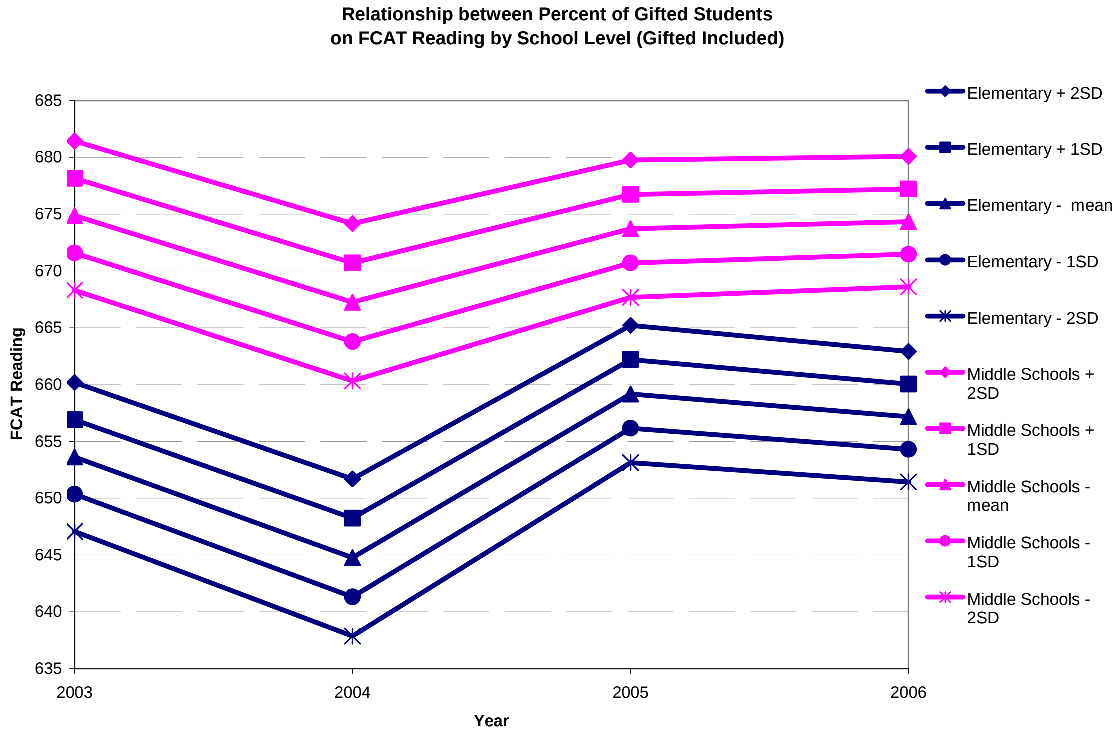

Figure 8. Relationship between Percent of Gifted Students on FCAT Reading by School Level (Gifted Included).

When examining the parameter estimates of the technology integration indicators within these data, there were significant main effects for relationships between three different variables and FCAT Reading scores: the percent of teachers who regularly use technology for administrative purposes, frequency that students use content software, and the level of technical support for hardware. In addition, these three technology integration indicators and time had significant interactions with FCAT reading scores. The interactions between time^2 and the percentage of teachers who regularly use technology for administrative purposes and the level of technical support for hardware with FCAT Reading scores were significant. There were no significant interactions between any technology integration variables and time^3. In order to visualize the significant relationships of each of these technology integration variables with FCAT reading, the trends are depicted in separate charts after controlling for all other factors.

There was a significant interaction with time and the percentage of teachers who regularly use technology for administrative purposes and FCAT reading scores. Each school level was examined separately. One and two standard deviations above the mean, the mean, and one and two standard deviations below the mean of levels of percentages of teachers who regularly use technology for administrative purposes were compared after controlling for all other factors. In 2003-04, all middle schools started with the same average FCAT Reading score (675) (see Figure 9). The scores for all middle schools decreased in 2004-05, with middle schools that were two standard deviations above the mean in percentages of teachers who regularly used technology for administrative purposes having the least decline (668), while all other levels had the same score (667). Although this one point difference was significant because there were so many schools in the sample, it did not have practical importance. The trend for all schools was up (674) in 2005-06. In 2006-07, schools at one and two standard deviations above the mean increased to (675), while schools at the mean and one and two standard deviations below the mean for percentages of teachers who use technology for administrative purposes remained at the same score (674). Again, this significant difference of one point did not have practical importance.

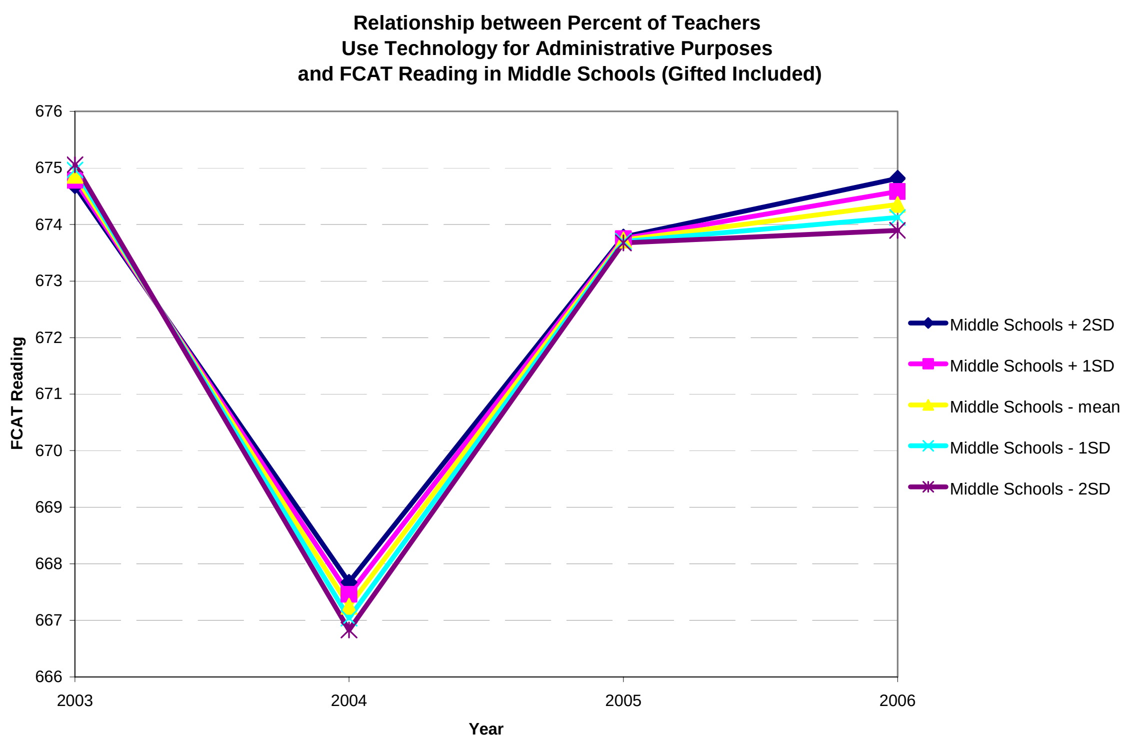

Figure 9. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and FCAT Reading in Middle Schools (Gifted Included).

The trends for elementary schools followed a very similar pattern to that of middle schools (see Figure 10). In 2003-04, elementary schools with two standard deviations above the mean of percentage of teachers who regularly use technology for administrative purposes were predicted to have one point lower (653) than elementary schools at all other standard deviations (654). Although this difference was significant, it did not have practical importance. In 2004-05 the average school FCAT reading score declined; however, schools with two standard deviations below the mean for percentage of teachers who regularly use technology for administrative purposes were predicted to decline the most (644), while schools with all other standard deviations were predicted to decline the least (645). The trend for elementary schools with all levels of percentage of teachers who regularly use technology for administrative purposes was up to 659 in 2005-06. In 2006-07, there was a decline to 658 for schools with two standard deviations above the mean of percentage of teachers who regularly use technology for administrative purposes, while all other levels declined to 657.

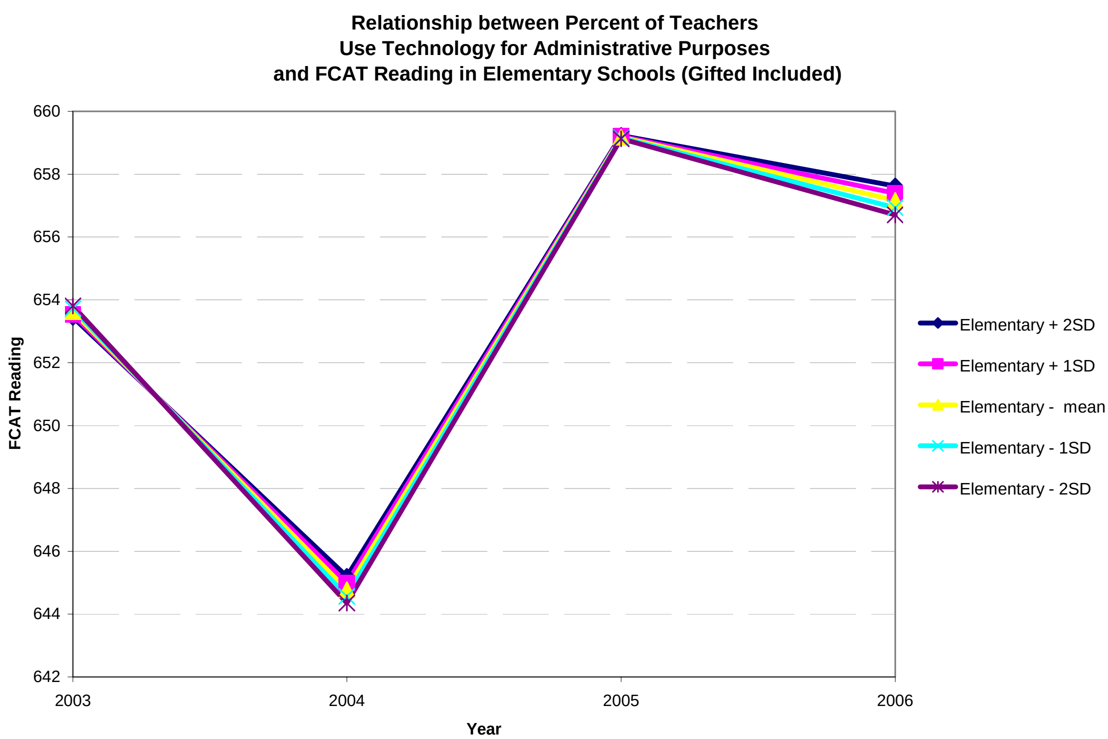

Figure 10. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and FCAT Reading in Elementary Schools (Gifted Included).

The interaction between time and the frequency that students use content software with FCAT Reading score for elementary schools and middle schools with gifted was significant. The interactions with $time^2$ and $time^3$ were not significant. Both levels of school have similar trends. Charts were made for each level of school to visualize the relationship between the frequency that students use content software and FCAT Reading achievement at one and two standard deviations above the mean, the mean, and one and two standard deviations below the mean.

The trends for middle school level at two standard deviations above the mean, the mean, and two standard deviations below the mean of frequency that students use content software were examined (see Figure 11). When controlling for all other variables, middle schools at all standard deviations of frequency that students use content software had the same FCAT Reading scores at each point of time. In 2003-04, middle schools had FCAT scores at 674. FCAT Reading scores declined to 667 in 2004-05, and then rebounded to 674 in both 2005-06 and 2006-07.

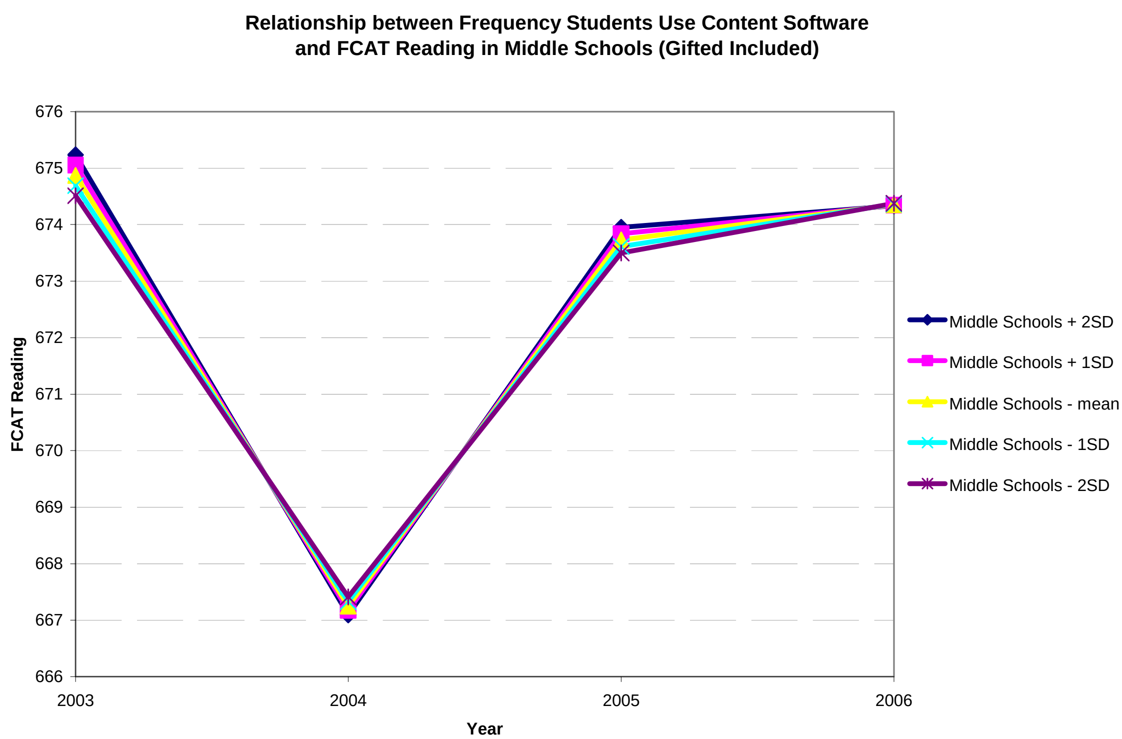

Figure 11. Relationship between Frequency that Students Use Content Software and FCAT Reading in Middle Schools (Gifted Included).

When controlling for all other variables, elementary schools at one and two standard deviations above the mean and at the mean for frequency that students use content software started with FCAT Reading scores at 654, while schools at one and two standard deviations below the mean started with scores at 653 in 2003-04. At all other points in time, all levels of frequency that students use content software had the same FCAT Reading scores. Scores declined between 2003-04 and 2004-05 (645), then rebounded in 2005-06 (667), and declined slightly in 2006-07 (657).

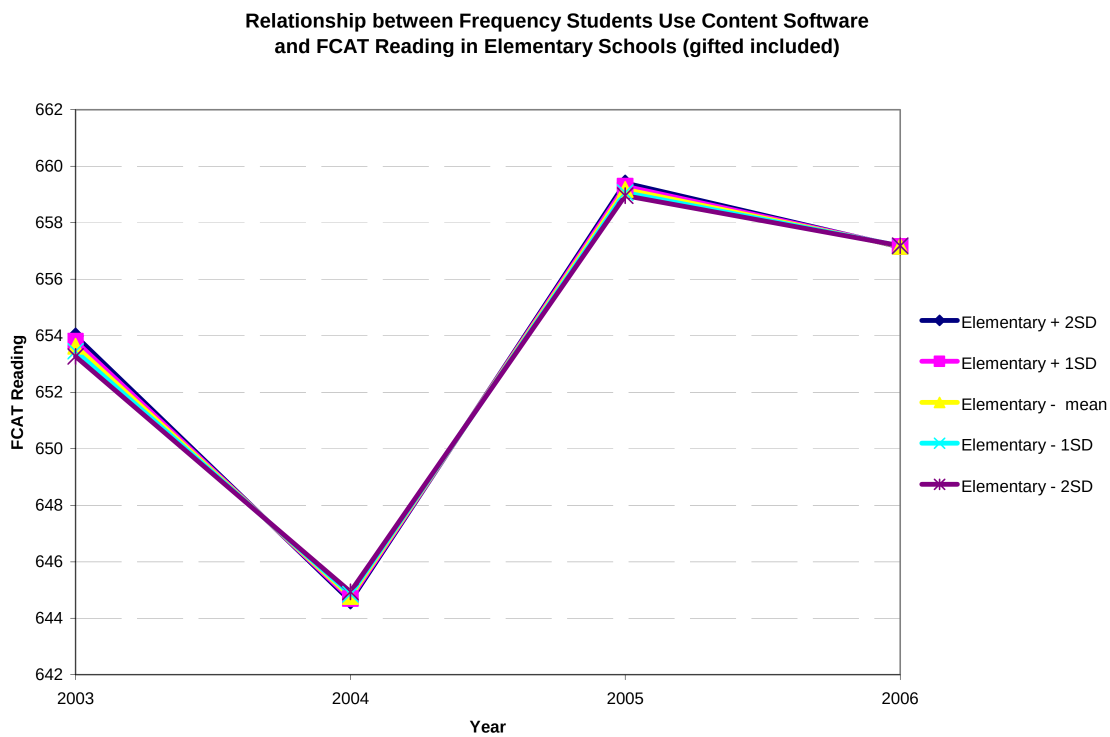

Figure 12. Relationship between Frequency that Students Use Content Software and FCAT Reading in Elementary Schools (Gifted Included).

The third significant relationship between technology integration variables and school FCAT Reading score was with the level of technical support for hardware. The interactions between both time and time^2 and the level of technical support for hardware and FCAT Reading scores were also significant. The interaction with time^3 was not significant. Elementary and middle schools have very similar trends. When examining middles schools with one and two standard deviations above the mean, the mean, and one and two standard deviations below the mean in level of technology support for hardware after controlling for all other variables, the FCAT Reading scores at each level at each point of time were the same (675 in 2003-04, 667 in 2004-05, and 674 in 2005-06 and 2005-07) (see Figure 13). After controlling for all other variables, elementary schools with one and two standard deviations above the mean and at the mean in level of technology support for hardware had a beginning FCAT Reading score in 2003-04 of 654, while elementary schools with one and two standard deviations below the mean had a beginning FCAT Reading score of 653 (see Figure 14). All FCAT Reading scores for all levels of technology support for hardware declined to 645 in 2004-05, and then rebounded to 659 in 2005-06 with a decline to 657 in 2006-07. There are no practical differences in FCAT Reading scores related to the level of technical support for hardware at either the middle or elementary school levels.

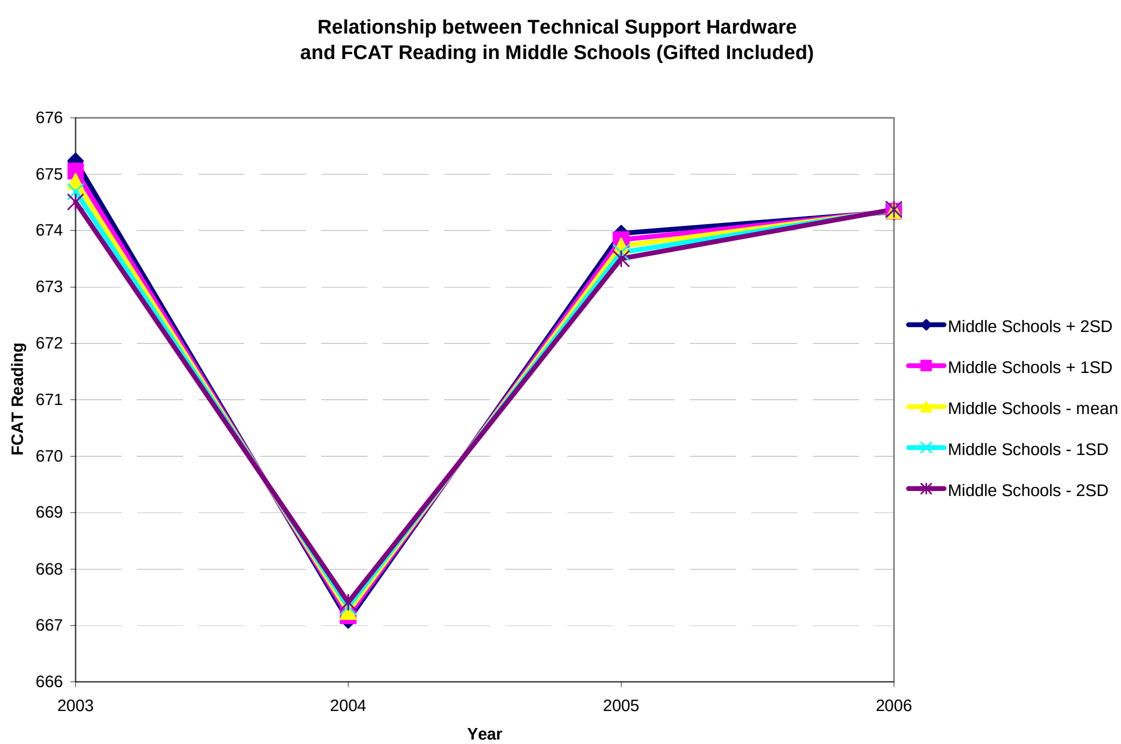

Figure 13. Relationship between Technical Support for Hardware and FCAT Reading in Middle Schools (Gifted Included).

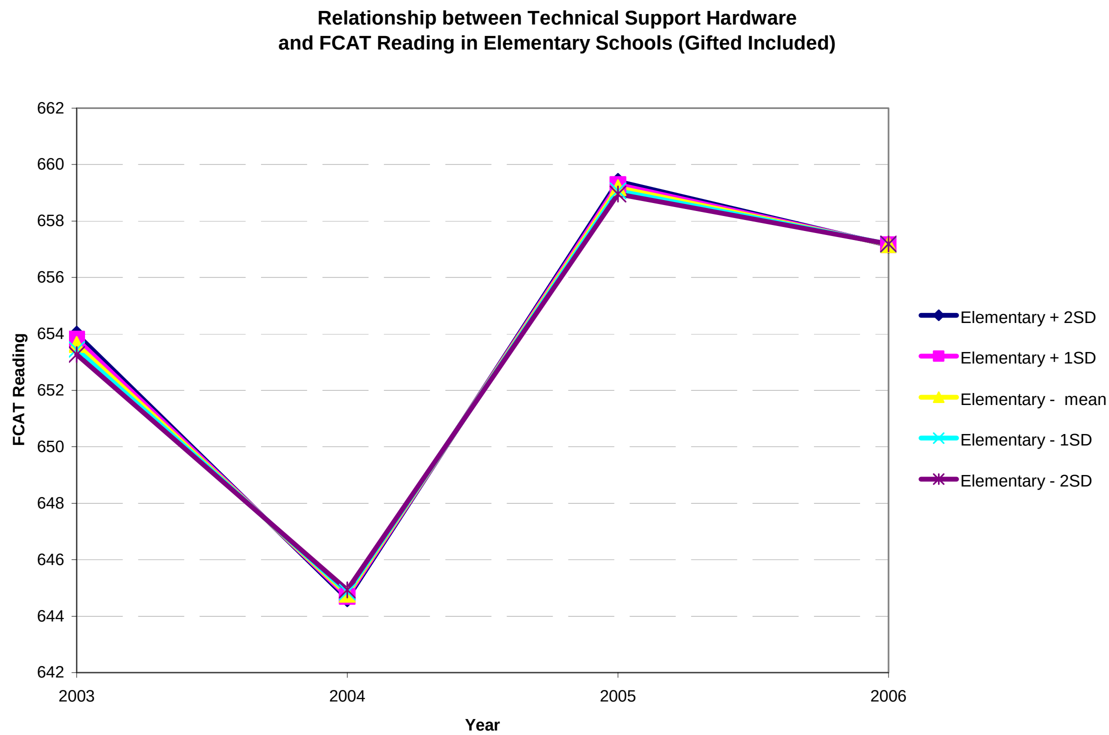

Figure 14. Relationship between Technical Support for Hardware and FCAT Reading in Elementary Schools (Gifted Included).

Hypothesis 2

The second analysis conducted to answer the first research question used the FCAT (NRT) Math outcome data to test the following hypothesis:

> H_2: After controlling for school level (elementary, middle, and high), school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality, mean school math achievement (FCAT NRT scaled scores for math) will have a positive relationship with indicators of technology integration.

The first step was to build the unconditional model. The unconditional model predicted the schools' FCAT Math from the average of FCAT Math for all schools. There were no other predictors. The average FCAT for all schools was 661.39 points (t (2300) = 1019.7, p <.0001).

Model 1: Unconditional Model
Level 1: FCAT Math = $\beta_0 + r$
Level 2: $\beta_0 = \gamma_{00} + u_0$
Mixed-Effects Model: FCAT Math = $\gamma_{00} + u_0 + r$

The intraclass correlation coefficient (ICC) was computed to determine the proportion of variance in the FCAT Math variable that is accounted for by the schools. The ICC was .95, which is high and supports using multi-level modeling for the analysis. The model fit statistics from this model were used as the baseline for model comparisons (see Table 28).

Next, time was added as a predictor to the equation to make the unconditional growth model (see Model 2a). The variance components from this analysis showed how much of the variance in the model was accounted for by time. Time was not significant in this equation (z = 1.55, p = 0.0611), which indicated that there was very little variance in the slopes between schools. Therefore, time was set as a fixed effect, and the model with time as a fixed effect was estimated.

Model 2a: Unconditional Growth Model
Level 1: FCAT Math = $\beta_0 + \beta_1$*Time + r
Level 2: $\beta_0 = \gamma_{00} + u_0$
$\beta_1 = \gamma_{10} + u_1$
Mixed-Effects Model: FCAT Math = $\gamma_{00} + \gamma_{10}$*Time + $u_0 + u_1$*Time + r

Both the intercept (t (2300) = 1005.83, p <.0001) and time (t (6902) = 76.69, p <.0001) were significant parameters. Although variance between schools increased slightly (1%), time accounted for 46% of the variance within schools (see Model 2b).

Model 2b: Unconditional Growth Model with Time Fixed
Level 1: FCAT Math = $\beta_0 + \beta_1$*Time + r
Level 2: $\beta_0 = \gamma_{00} + u_0$
$\beta_1 = \gamma_{10}$

Mixed-Effects Model: FCAT Math = $\gamma_{00} + \gamma_{10}$*Time + u_0 + r

To determine if the equation was not linear but curvilinear, time^2 was added to the equation so the variance could be compared. Results indicated that time^2 was significant (t (6901) = 32.47, p <.0001) and increased the variance explained by an additional 7% (see Model 2c). When time^3 was added to the equation with time^2, time^3 also was significant (t (6900) = -43.26, p <.0001), and all model fit indices improved. Although adding time^3 increased the amount of variance between schools, it increased the variance explained by an additional 10%. Consequently, both time^2 and time^3 were retained in the polynomial growth model equation (see Model 2d).

Model 2c: Quadratic Growth Model

Level 1: FCAT Math = $\beta_0 + \beta_1$*Time + β_2* Time^2 + r

Level 2: $\beta_0 = \gamma_{00} + u_0$

$\beta_1 = \gamma_{10}$

$\beta_2 = \gamma_{20}$

Mixed-Effects Model: FCAT Math = $\gamma_{00} + \gamma_{10}$*Time + γ_{20}* Time^2 + u_0 + r

Model 2d: Polynomial Growth Model

Level 1: FCAT Math = $\beta_0 + \beta_1$*Time + β_2* Time^2 + β_3* Time^3 + r

Level 2: $\beta_0 = \gamma_{00} + u_0$

$\beta_1 = \gamma_{10}$

$\beta_2 = \gamma_{20}$

$\beta_2 = \gamma_{30}$

Mixed-Effects Model: FCAT Math = $\gamma_{00} + \gamma_{10}$*Time + γ_{20}* Time^2 + γ_{30}* Time^3 + u_0 $^+$ r

Next, school level was added to the Polynomial Growth Model to predict Math (See Model 3). The significance of the parameter estimates determined if school level was significantly related to the FCAT Math and if there was an interaction with time. This model adjusted the mean school FCAT Math and the slope of FCAT Math growth for school level. The parameter estimates of school level, time, time^2, and time^3 were all significant. The interactions between time and both the school levels, time^2 and both the school levels, and time^3 and both the school levels relative to middle school were also significant. All model fit indices indicated improved fit with this model (Table 19). This model accounted for 76% of the between school variance and an additional 6% of the within school variance from the Polynomial Growth Model.

Model 3: school level as Predictor

Level 1: FCAT Math = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3* Time^3 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level

Mixed-Effects Model: FCAT Math = $\gamma_{00} + \gamma_{01}$*School Level + γ_{10}*Time + γ_{11}*School Level*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + u_0 + r

Table 19.

Model 3: Time, Time², Time³, and School Level as Predictors of Math

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		679.96	0.7409	2298	917.71	<.0001	**
Time		-5.525	0.6864	6894	-8.05	<.0001	**
$Time^2$		8.7969	0.6067	6894	14.5	<.0001	**
$Time^3$		-2.0103	0.1333	6894	-15.08	<.0001	**
School Level	Elementary	-39.7339	0.8428	6894	-47.15	<.0001	**
School Level	High	30.6202	1.1196	6894	27.35	<.0001	**
School Level	Middle	0	.	.	.	.	**
Time*School Level	Elementary	-11.0758	0.7808	6894	-14.19	<.0001	**
Time*School Level	High	-8.2523	1.0372	6894	-7.96	<.0001	**
Time*School Level	Middle	0	.	.	.	.	**
$Time^2$*School Level	Elementary	6.2525	0.6901	6894	9.06	<.0001	**
$Time^2$*School Level	High	6.6827	0.9167	6894	7.29	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	**
$Time^3$*School Level	Elementary	-0.7945	0.1517	6894	-5.24	<.0001	**
$Time^3$*School Level	High	-1.4124	0.2015	6894	-7.01	<.0001	**
$Time^3$*School Level	Middle	0	.	.	.	.	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	229.53	6.8721	33.4	<.0001	**
Residual	14.2093	0.2419	58.75	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added student demographic variables to the School Level Model. This model was estimated twice. The first time, the model was run with high school as a school level and all of the demographic variables except gifted (see Model 4a). The second time, the data were filtered to exclude high school as a school level and keep the gifted variable with middle and elementary schools (see Model 4b). The model fit statistics of the demographic model with all three school levels was compared with the School Level as Predictor Model to determine if there was a better fit (see Table 29). The significance of the parameter estimates determined which of the demographic variables remained in the predictor equation (see Table 20). The variance estimates showed the amount of the total variance that was accounted for by each model. When all of the demographics variables except gifted were added to the model, the intercept was significant and the average middle school started with FCAT Math score of 678.04 (t (2249) 1551.3, p <.0001). The parameter estimates for school level, time, time², time³, free or reduced lunch status, minority, and students with disabilities were significant. Only Limited English Proficiency (LEP) was not significant at the intercept, and its interactions with time, $time^2$, or $time^3$ were also not significant; therefore, it was dropped from the equation for the FCAT Math outcome models for all school levels without gifted. After LEP was dropped from the equation, all intercept parameters were significant (see Model 4a Part 2). Interactions with time were significant for school level and free or reduced lunch status. Interactions with minority and students with disabilities were not significant. Interactions with $time^2$ and $time^3$ were significant for school level and minority. Interactions with $time^3$ also were significant for free or reduced lunch status. All model fit indices indicated better fit with the addition of these demographics variables (see Table 29). Adding the demographics without LEP variables with school level explained 93% of the between school variance and 70% of the within school variance for a total of 92% of all variance explained.

Model 4a: Demographics by School Level (including High School and no Gifted)

Level 1: $\text{FCAT Math} = \beta_0 + \beta_1{*}\text{Time} + \beta_2{*}\text{Time}^2 + \beta_3{*}\text{Time}^3 + r$

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}{*}\text{School Level} + \gamma_{02}{*}\text{SES} + \gamma_{03}{*}\text{Minority} + \gamma_{04}{*}\text{ LEP} + \gamma_{05}{*}\text{ SWD} + u_0$

$\beta_1 = \gamma_{10} + \gamma_{11}{*}\text{School Level} + \gamma_{12}{*}\text{SES} + \gamma_{13}{*}\text{Minority} + \gamma_{14}{*}\text{ LEP} + \gamma_{15}{*}\text{ SWD}$

$\beta_2 = \gamma_{20} + \gamma_{21}{*}\text{School Level} + \gamma_{22}{*}\text{SES} + \gamma_{23}{*}\text{Minority} + \gamma_{24}{*}\text{ LEP} + \gamma_{25}{*}\text{ SWD}$

$\beta_3 = \gamma_{30} + \gamma_{31}{*}\text{School Level} + \gamma_{32}{*}\text{SES} + \gamma_{33}{*}\text{Minority} + \gamma_{34}{*}\text{ LEP} + \gamma_{35}{*}\text{ SWD}$

Mixed-Effects Model: $\text{FCAT Math} = \gamma_{00} + \gamma_{01}{*}\text{School Level} + \gamma_{02}{*}\text{SES} + \gamma_{03}{*}\text{Minority} + \gamma_{04}{*}\text{SWD} + \gamma_{05}{*}\text{LEP} + \gamma_{10}{*}\text{Time} + \gamma_{11}{*}\text{School Level*Time} + \gamma_{12}{*}\text{SES*Time} + \gamma_{13}{*}\text{Minority*Time} + \gamma_{14}{*}\text{SWD*Time} + \gamma_{15}{*}\text{LEP*Time} + \gamma_{20}{*}\text{Time}^2 + \gamma_{21}{*}\text{School Level*Time}^2 + \gamma_{22}{*}\text{SES*Time}^2 + \gamma_{23}{*}\text{Minority*Time}^2 + \gamma_{24}{*}\text{SWD*Time}^2 + \gamma_{25}{*}\text{LEP*Time}^2 + \gamma_{30}{*}\text{Time}^3 + \gamma_{31}{*}\text{School Level*Time}^3 + \gamma_{32}{*}\text{SES*Time}^3 + \gamma_{33}{*}\text{Minority*Time}^3 + \gamma_{34}{*}\text{SWD*Time}^3 + \gamma_{35}{*}\text{LEP*Time}^3 + u_0 + r$

Model 4a part 2: Demographics by School Level (including High School and no Gifted)

Level 1: $\text{FCAT Math} = \beta_0 + \beta_1{*}\text{Time} + \beta_2{*}\text{Time}^2 + \beta_3{*}\text{Time}^3 + r$

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}{*}\text{School Level} + \gamma_{02}{*}\text{SES} + \gamma_{03}{*}\text{Minority} + \gamma_{04}{*}\text{ SWD} + u_0$

$\beta_1 = \gamma_{10} + \gamma_{11}{*}\text{School Level} + \gamma_{12}{*}\text{SES} + \gamma_{13}{*}\text{Minority} + \gamma_{14}{*}\text{SWD}$

$\beta_2 = \gamma_{20} + \gamma_{21}{*}\text{School Level} + \gamma_{22}{*}\text{SES} + \gamma_{23}{*}\text{Minority} + \gamma_{24}{*}\text{ SWD}$

$\beta_3 = \gamma_{30} + \gamma_{31}{*}\text{School Level} + \gamma_{32}{*}\text{SES} + \gamma_{33}{*}\text{Minority} + \gamma_{34}{*}\text{SWD}$

Mixed-Effects Model: $\text{FCAT Math} = \gamma_{00} + \gamma_{01}{*}\text{School Level} + \gamma_{02}{*}\text{SES} + \gamma_{03}{*}\text{Minority} + \gamma_{04}{*}\text{SWD} + \gamma_{10}{*}\text{Time} + \gamma_{11}{*}\text{School Level*Time} + \gamma_{12}{*}\text{SES*Time} + \gamma_{13}{*}\text{Minority*Time} + \gamma_{14}{*}\text{SWD*Time} + \gamma_{20}{*}\text{Time}^2 + \gamma_{21}{*}\text{School Level*Time}^2 + \gamma_{22}{*}\text{SES*Time}^2 + \gamma_{23}{*}\text{Minority*Time}^2 + \gamma_{24}{*}\text{SWD*Time}^2 + \gamma_{30}{*}\text{Time}^3 + \gamma_{31}{*}\text{School Level*Time}^3 + \gamma_{32}{*}\text{SES*Time}^3 + \gamma_{33}{*}\text{Minority*Time}^3 + \gamma_{34}{*}\text{SWD*Time}^3 + u_0 + r$

Table 20.

Model 4a: Math predicted by Time, School Level, and Demographics Variables without Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		678.04	0.4371	2249	1551.3	<.0001	**
Time		-4.875	0.6887	6485	-7.08	<.0001	**
Time^2		8.7255	0.6062	6485	14.39	<.0001	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
$Time^3$		-2.0186	0.133	6485	-15.17	<.0001	**
School Level	Elementary	-37.1061	0.5004	6485	-74.15	<.0001	**
School Level	High	26.4232	0.6592	6485	40.08	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-4.3681	0.2024	6485	-21.58	<.0001	**
Minority		-6.6521	0.2491	6485	-26.7	<.0001	**
LEP		-0.09655	0.2155	6485	-0.45	0.6541	
Students with Disabilities		-2.3523	0.1496	6485	-15.72	<.0001	**
Time*School Level	Elementary	-12.3458	0.7963	6485	-15.5	<.0001	**
Time*School Level	High	-9.1177	1.0446	6485	-8.73	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-1.3473	0.4681	6485	-2.88	0.004	**
Time*Minority		-0.3481	0.4813	6485	-0.72	0.4695	
Time*LEP		0.736	0.3996	6485	1.84	0.0655	
Time*Students with Disabilities		-0.1192	0.3384	6485	-0.35	0.7246	
$Time^2$*School Level	Elementary	7.6205	0.7019	6485	10.86	<.0001	**
$Time^2$*School Level	High	6.9833	0.9198	6485	7.59	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	
$Time^2$*Free Reduced Lunch		-0.5084	0.4124	6485	-1.23	0.2177	
$Time^2$*Minority		1.1352	0.423	6485	2.68	0.0073	**
$Time^2$*LEP		-0.4588	0.3486	6485	-1.32	0.1881	
$Time^2$*Students with Disabilities		0.1103	0.2963	6485	0.37	0.7097	
$Time^3$*School Level	Elementary	-1.0988	0.1541	6485	-7.13	<.0001	**
$Time^3$*School Level	High	-1.4404	0.2018	6485	-7.14	<.0001	**
$Time^3$*School Level	Middle	0	.	.	.	.	
$Time^3$*Free Reduced Lunch		0.2132	0.09047	6485	2.36	0.0185	**
$Time^3$*Minority		-0.2906	0.0928	6485	-3.13	0.0017	**
$Time^3$*LEP		0.08966	0.07613	6485	1.18	0.2389	
$Time^3$*Students with Disabilities		-0.00899	0.06485	6485	-0.14	0.8898	
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		66.5352	2.4051		27.66	<.0001	**
Residual		13.2518	0.2446		54.17	<.0001	**

Note: * $p < .05$; ** $p < .01$

For the elementary and middle schools with gifted students, the unconditional model was estimated to provide a baseline with which to compare the demographics model. The growth model was estimated to determine if time was fixed or random. Time in this dataset was also fixed because the variance of the slope was not significant ($z = 0.71$, $p = 0.2397$). The results from the analysis in Model 4b indicated that the intercept, school level, time, $time^2$, $time^3$, free or reduced lunch status, minority, students with disabilities, and gifted were all significant (see Table 21). Although the intercept for LEP was not significant, the interaction of LEP and time was significant. LEP was kept in the models estimated with the elementary and middle schools with gifted students. Interactions between time and elementary school level, free or reduced lunch status, minority, LEP, and gifted were significant. Interactions between time^2 and minority, LEP, and gifted were significant. Interactions between time^3 and minority and gifted were significant. All model fit statistics indicated better model fit (see Table 29). When examining the variance of FCAT Math in elementary and middle schools, adding demographics variables to the equation explained 91% of the between school variance and 65% more of the within school variance. Two sets of analyses were conducted on the rest of the models in order to examine the relationship of gifted with technology integration as one of the predictors of school achievement.

Model 4b: Demographics by School Level (Elementary and Middle School only)

Level 1: $\text{FCAT Math} = \beta_0 + \beta_1{*}\text{Time} + \beta_2{*}\text{Time}^2 + \beta_3{*}\text{Time}^3 + r$

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}{*}\text{School Level} + \gamma_{02}{*}\text{SES} + \gamma_{03}{*}\text{Minority} + \gamma_{04}{*}\text{ LEP} + \gamma_{05}{*}\text{ SWD} + \gamma_{06}{*}\text{Gifted} + u_0$

$\beta_1 = \gamma_{10} + \gamma_{11}{*}\text{School Level} + \gamma_{12}{*}\text{SES} + \gamma_{13}{*}\text{Minority} + \gamma_{14}{*}\text{ LEP} + \gamma_{15}{*}\text{ SWD} + \gamma_{16}{*}\text{Gifted}$

$\beta_2 = \gamma_{20} + \gamma_{21}{*}\text{School Level} + \gamma_{22}{*}\text{SES} + \gamma_{23}{*}\text{Minority} + \gamma_{24}{*}\text{ LEP} + \gamma_{25}{*}\text{ SWD} + \gamma_{26}{*}\text{Gifted}$

$\beta_3 = \gamma_{30} + \gamma_{31}{*}\text{School Level} + \gamma_{32}{*}\text{SES} + \gamma_{33}{*}\text{Minority} + \gamma_{34}{*}\text{ LEP} + \gamma_{35}{*}\text{ SWD} + \gamma_{36}{*}\text{Gifted}$

Mixed-Effects Model: $\text{FCAT Math} = \gamma_{00} + \gamma_{01}{*}\text{School Level} + \gamma_{02}{*}\text{SES} + \gamma_{03}{*}\text{Minority} + \gamma_{04}{*}\text{SWD} + \gamma_{05}{*}\text{LEP} + \gamma_{06}{*}\text{Gifted} + \gamma_{10}{*}\text{Time} + \gamma_{11}{*}\text{School Level*Time} + \gamma_{12}{*}\text{SES*Time} + \gamma_{13}{*}\text{Minority*Time} + \gamma_{14}{*}\text{ LEP*Time} + \gamma_{15}{*}\text{ SWD*Time} + \gamma_{16}{*}\text{Gifted*Time} + \gamma_{20}{*}\text{Time}^2 + \gamma_{21}{*}\text{School Level*Time}^2 + \gamma_{22}{*}\text{SES*Time}^2 + \gamma_{23}{*}\text{Minority*Time}^2 + \gamma_{24}{*}\text{ LEP*Time}^2 + \gamma_{25}{*}\text{ SWD*Time}^2 + \gamma_{26}{*}\text{Gifted*Time}^2 + \gamma_{30}{*}\text{Time}^3 + \gamma_{31}{*}\text{School Level*Time}^3 + \gamma_{32}{*}\text{SES*Time}^3 + \gamma_{33}{*}\text{Minority*Time}^3 + \gamma_{34}{*}\text{ LEP*Time}^3 + \gamma_{35}{*}\text{ SWD*Time}^3 + \gamma_{36}{*}\text{Gifted*Time}^3 + u_0 + r$

Table 21.

Model 4b: Math predicted by Time, School Level, and Demographics Variables for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		677	0.3887	1819	1741.5	<.0001	**
Time		-4.9775	0.7084	4941	-7.03	<.0001	**
Time^2		8.5863	0.6249	4941	13.74	<.0001	**
Time^3		-1.9783	0.1372	4941	-14.42	<.0001	**
School Level	Elementary	-35.4603	0.4495	4941	-78.88	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-4.2951	0.2232	4941	-19.24	<.0001	**
Minority		-6.3278	0.2621	4941	-24.14	<.0001	**
LEP		0.2415	0.2118	4941	1.14	0.2542	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Students with Disabilities		-1.4269	0.1572	4941	-9.08	<.0001	**
Gifted		3.827	0.1833	4941	20.88	<.0001	**
Time*School Level	Elementary	-11.2979	0.8287	4941	-13.63	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-1.1402	0.5609	4941	-2.03	0.0421	*
Time*Minority		-1.1302	0.5721	4941	-1.98	0.0483	*
Time*LEP		1.0742	0.4422	4941	2.43	0.0152	*
Time*Students with Disabilities		-0.4457	0.3808	4941	-1.17	0.2419	
Time*Gifted		1.994	0.3971	4941	5.02	<.0001	**
$Time^2$*School Level	Elementary	7.0796	0.7313	4941	9.68	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	
$Time^2$*Free Reduced Lunch		-0.3689	0.494	4941	-0.75	0.4552	
$Time^2$*Minority		1.4852	0.5018	4941	2.96	0.0031	**
$Time^2$*LEP		-0.7827	0.385	4941	-2.03	0.0421	*
$Time^2$*Students with Disabilities		0.3768	0.3324	4941	1.13	0.2571	
$Time^2$*Gifted		-1.227	0.3468	4941	-3.54	0.0004	**
$Time^3$*School Level	Elementary	-1.0174	0.1606	4941	-6.33	<.0001	**
$Time^3$*School Level	Middle	0	.	.	.	.	
$Time^3$*Free Reduced Lunch		0.1603	0.1083	4941	1.48	0.1389	
$Time^3$*Minority		-0.3465	0.1099	4941	-3.15	0.0016	**
$Time^3$*LEP		0.1601	0.08381	4941	1.91	0.0562	
$Time^3$*Students with Disabilities		-0.06905	0.07251	4941	-0.95	0.341	
$Time^3$*Gifted		0.2084	0.07572	4941	2.75	0.0059	**

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	47.526	1.8734	25.37	<.0001	**
Residual	13.0255	0.2708	48.1	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added the variable that measures the School Learning Environment factors to the Demographics Model by School Level Model. These included teacher qualifications and positive learning environment. This model was estimated twice, first without the gifted population but all school levels (see model 5a) and then with elementary and middle school levels and the gifted population (see model 5b). When school learning environment factors were added with the demographic and school level variables for all school levels, the parameter estimates for the intercept, time, time^2, time^3, elementary and high school relative to middle school, free or reduced lunch status, minority, students with disabilities, teacher qualifications, and positive learning environment were significant (see Table 22). Significant interactions with time included elementary and high school relative to middle school, free or reduced lunch status, and positive learning environment. Significant interactions with time^2 and time^3 were elementary and high school, minority, and positive learning environment. Adding the student learning environment variables explained an additional 1% of the between school variance and explained 1% less of the within school variance for a total of 93% of all of the variance explained. All of the model fit indices indicated that this model fit the data better (see Table 28).

Model 5a: School Learning Environment with Demographics by School Level (All School Levels without Gifted)

Level 1: FCAT Math = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* SWD + γ_{05}* Teacher Qualifications + γ_{06}*Positive Learning Environment + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}*SWD + γ_{15}* Teacher Qualifications + γ_{16}*Positive Learning Environment

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* SWD + γ_{25}* Teacher Qualifications + γ_{26}*Positive Learning Environment

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* SWD + γ_{35}* Teacher Qualifications + γ_{36}*Positive Learning Environment

Mixed-Effects Model: FCAT Math = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* SWD + γ_{05}*Teacher Qualifications + γ_{06}* Positive Learning Environment + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}*SWD *Time + γ_{15}* Teacher Qualifications*Time + γ_{16}* Positive Learning Environment*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* SWD*Time^2 + γ_{25}* Teacher Qualifications*Time^2 + γ_{26}* Positive Learning Environment*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}*SWD*Time^3 + γ_{35}* Teacher Qualifications*Time^3 + γ_{36}* Positive Learning Environment*Time^3 + u_0 + r

Table 22.

Model 5a: Math Predicted by Demographics and Student Learning Environment by School Level (All School Levels without Gifted and LEP)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		680.14	0.4403	2298	1544.6	<.0001	**
Time		-5.504	0.8634	6867	-6.37	<.0001	**
Time^2		9.2097	0.7489	6867	12.3	<.0001	**
Time^3		-2.1354	0.1624	6867	-13.15	<.0001	**
School Level	Elementary	-39.8795	0.5171	6867	-77.12	<.0001	**
School Level	High	26.3373	0.6155	6867	42.79	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-4.1447	0.1922	6867	-21.56	<.0001	**
Minority		-6.1259	0.2129	6867	-28.77	<.0001	**
Students with Disabilities		-2.1066	0.1437	6867	-14.66	<.0001	**
Positive Learning Environment		1.6474	0.1513	6867	10.89	<.0001	**
Positive Teacher Qualifications		1.003	0.1138	6867	8.81	<.0001	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time*School Level	Elementary	-11.0835	1.064	6867	-10.42	<.0001	**
Time*School Level	High	-9.3217	1.0637	6867	-8.76	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-1.411	0.489	6867	-2.89	0.0039	**
Time*Minority		-0.4513	0.442	6867	-1.02	0.3074	
Time*Students with Disabilities		-0.4879	0.3396	6867	-1.44	0.1509	
Time*Positive Learning Environment		-0.7349	0.4571	6867	-1.61	0.1079	
Time*Positive Teacher Qualifications		0.8114	0.3249	6867	2.5	0.0125	*
$Time^2$*School Level	Elementary	6.3613	0.9335	6867	6.81	<.0001	**
$Time^2$*School Level	High	7.3264	0.9384	6867	7.81	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	
$Time^2$*Free Reduced Lunch		-0.2134	0.4348	6867	-0.49	0.6236	
$Time^2$*Minority		1.0957	0.3913	6867	2.8	0.0051	**
$Time^2$*Students with Disabilities		0.4279	0.2986	6867	1.43	0.1518	
$Time^2$*Positive Learning Environment		0.9942	0.409	6867	2.43	0.0151	*
$Time^2$*Positive Teacher Qualifications		-0.49	0.2848	6867	-1.72	0.0854	
$Time^3$*School Level	Elementary	-0.8004	0.204	6867	-3.92	<.0001	**
$Time^3$*School Level	High	-1.5226	0.206	6867	-7.39	<.0001	**
$Time^3$*School Level	Middle	0	.	.	.	.	
$Time^3$*Free Reduced Lunch		0.13	0.09581	6867	1.36	0.1749	
$Time^3$*Minority		-0.2709	0.08609	6867	-3.15	0.0017	**
$Time^3$*Students with Disabilities		-0.07848	0.06536	6867	-1.2	0.2299	
$Time^3$*Positive Learning Environment		-0.242	0.09033	6867	-2.68	0.0074	**
$Time^3$*Positive Teacher Qualifications		0.07683	0.06214	6867	1.24	0.2163	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	57.0301	2.1007	27.15	<.0001	**
Residual	13.8759	0.2505	55.39	<.0001	**

Note: * $p < .05$; ** $p < .01$

When the data were filtered to include only elementary and middle schools and gifted was also added to the equation, all intercept parameter estimates were significant (i.e., elementary school, time, $time^2$, $time^3$, free or reduced lunch status, minority, students with disabilities, teacher qualifications, and positive learning environment except for LEP). Significant interactions with time included elementary, free or reduced lunch status, minority, LEP, gifted, and teacher qualifications. Significant interactions with $time^2$

included elementary, minority, LEP, gifted, and positive learning environment. Significant interactions with $time^3$ included elementary, minority, LEP, gifted, and positive learning environment (see Table 23). This model demonstrated better fit than the previous model by all model fit indices (see

Table 29). It explained 1% more of the between school variance and the same amount of the within school variance as the previous model and explained 91% of all the variance.

Model 5b: School Learning Environment with Demographics by School Level (Elementary and Middle Schools with Gifted)

Level 1: FCAT Math = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}*Gifted + γ_{37}* Teacher Qualifications + γ_{38}* Positive Learning Environment

Mixed-Effects Model: FCAT Math = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}* LEP*Time^3 + γ_{35}* SWD*Time^3 + γ_{36}*Gifted*Time^3 + γ_{37}* Teacher Qualifications*Time^3 + γ_{38}* Positive Learning Environment*Time^3 + u_0 + r

Table 23.

Model 5b: Math Predicted by Demographics and Student Learning Environment by School Level for Elementary and Middle School with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		678.69	0.4319	1819	1571.4	<.0001	**
Time		-5.6609	0.9672	4933	-5.85	<.0001	**
Time^2		9.2683	0.8305	4933	11.16	<.0001	**
Time^3		-2.1431	0.179	4933	-11.97	<.0001	**
School Level	Elementary	-37.7309	0.5221	4933	-72.27	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-4.3582	0.2218	4933	-19.65	<.0001	**
Minority		-5.7845	0.2611	4933	-22.16	<.0001	**
LEP		0.05423	0.2072	4933	0.26	0.7935	
Students with Disabilities		-1.3258	0.1555	4933	-8.53	<.0001	**
Gifted		3.4228	0.1804	4933	18.97	<.0001	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Positive Learning Environment		1.3689	0.1921	4933	7.13	<.0001	**
Positive Teacher Qualifications		0.8872	0.128	4933	6.93	<.0001	**
Time*School Level	Elementary	-9.8653	1.2258	4933	-8.05	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-1.2316	0.6035	4933	-2.04	0.0413	*
Time*Minority		-1.3844	0.5835	4933	-2.37	0.0177	*
Time*LEP		1.2035	0.4567	4933	2.64	0.0084	**
Time*Students with Disabilities		-0.441	0.3872	4933	-1.14	0.2549	
Time*Gifted		1.9348	0.4058	4933	4.77	<.0001	**
Time*Positive Learning Environment		-1.1384	0.6059	4933	-1.88	0.0603	
Time*Positive Teacher Qualifications		0.8163	0.365	4933	2.24	0.0254	*
Time^2*School Level	Elementary	5.5149	1.0645	4933	5.18	<.0001	**
Time^2*School Level	Middle	0	.	.	.	.	
Time^2*Free Reduced Lunch		0.00502	0.5357	4933	0.01	0.9925	
Time^2*Minority		1.6451	0.5102	4933	3.22	0.0013	**
Time^2*LEP		-1.0317	0.3986	4933	-2.59	0.0097	**
Time^2*Students with Disabilities		0.3956	0.3379	4933	1.17	0.2418	
Time^2*Gifted		-1.2193	0.3542	4933	-3.44	0.0006	**
Time^2*Positive Learning Environment		1.3845	0.5353	4933	2.59	0.0097	**
Time^2*Positive Teacher Qualifications		-0.5752	0.3204	4933	-1.8	0.0726	
Time^3*School Level	Elementary	-0.6465	0.2312	4933	-2.8	0.0052	**
Time^3*School Level	Middle	0	.	.	.	.	
Time^3*Free Reduced Lunch		0.05508	0.1177	4933	0.47	0.6398	
Time^3*Minority		-0.3765	0.1116	4933	-3.37	0.0007	**
Time^3*LEP		0.2242	0.08686	4933	2.58	0.0099	**
Time^3*Students with Disabilities		-0.07603	0.07366	4933	-1.03	0.302	
Time^3*Gifted		0.2125	0.07729	4933	2.75	0.006	**
Time^3*Positive Learning Environment		-0.3302	0.1172	4933	-2.82	0.0049	**
Time^3*Positive Teacher Qualifications		0.1034	0.07005	4933	1.48	0.1401	
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		42.01	1.6722		25.12	<.0001	**
Residual		12.9766	0.2698		48.1	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added technology integration variables with the demographics, learning environment, and school level variables. These included student access to various types of software, teachers regularly using various types of software, frequency that students use various types of software, and technology support. This model was estimated twice, first without gifted population but all school levels (see model 6a) and then with elementary and middle school levels and gifted population (see model 6b). When the model was estimated with all school levels without gifted and LEP, the only significant technology parameter estimates were the percent of teachers who use technology for administrative purposes and the interaction of time, $time^2$, and $time^3$ with teachers' use of technology for administrative purposes (see Table 24). Other significant parameter estimates included the interactions with time and high school and elementary school relative to middle school, free or reduced lunch status, positive learning environment, and positive teacher qualifications. Significant interactions with $time^2$ and $time^3$ included elementary and high school relative to middle school, minority, and positive learning environment. Only one model fit index indicated that this model had better fit (see Table 28). No additional variance was explained with this model. One technology integration indicator was retained in the final model for all school levels without gifted, the percent of teachers who use technology for administrative purposes.

Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Level 1: FCAT Math = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* SWD + γ_{05}* Teacher Qualifications + γ_{06}* Positive Learning Environment + γ_{07}*Access Content SW + γ_{08}*Access Office SW + γ_{09}*Access Ad Prod SW + γ_{010}*Teachers Use Deliver Instruction + γ_{011}*Teachers use Admin + γ_{012}*Frequency Students Use Content + γ_{013}*Frequency Students Use Tool + γ_{014}*Technical Support Human + γ_{015}*Technical Support Hardware + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* SWD + γ_{15}* Teacher Qualifications + γ_{16}* Positive Learning Environment + γ_{17}*Access Content SW + γ_{18}*Access Office SW + γ_{19}*Access Ad Prod SW + γ_{110}*Teachers Use Deliver Instruction + γ_{111}*Teachers use Admin + γ_{112}*Frequency Students Use Content + γ_{113}*Frequency Students Use Tool + γ_{114}*Technical Support Human + γ_{115}*Technical Support Hardware
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}SWD + γ_{25}* Teacher Qualifications + γ_{26}* Positive Learning Environment + γ_{27}*Access Content SW + γ_{28}*Access Office SW + γ_{29}*Access Ad Prod SW + γ_{210}*Teachers Use Deliver Instruction + γ_{211}*Teachers use Admin + γ_{212}*Frequency Students Use Content + γ_{213}*Frequency Students Use Tool + γ_{214}*Technical Support Human + γ_{215}*Technical Support Hardware
$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* SWD + γ_{35}* Teacher Qualifications + γ_{36}* Positive Learning Environment + γ_{37}*Access Content SW + γ_{38}*Access Office SW + γ_{319}*Access Ad Prod SW + γ_{310}*Teachers Use Deliver Instruction + γ_{311}*Teachers use Admin + γ_{314}*Frequency Students Use Content + γ_{315}*Frequency Students Use Tool + γ_{316}*Technical Support Human + γ_{317}*Technical Support Hardware

Mixed-Effects Model: FCAT Math = γ_{00} + γ_{01}*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* SWD + γ_{05}* Teacher Qualifications + γ_{06}* Positive Learning Environment + γ_{07}*Access Content SW + γ_{08}*Access Office SW + γ_{09}*Access Ad Prod SW + γ_{010}*Teachers Use Deliver Instruction + γ_{011}*Teachers use Admin + γ_{012}*Frequency Students Use Content + γ_{013}*Frequency Students Use Tool + γ_{014}*Technical Support Human + γ_{015}*Technical Support Hardware + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* SWD *Time + γ_{15}*Teacher Qualifications*Time + γ_{16}* Positive Learning Environment*Time + γ_{17}*Access Content SW*Time + γ_{18}*Access Office SW*Time + γ_{19}*Access Ad Prod SW*Time + γ_{110}*Teachers Use Deliver Instruction*Time + γ_{111}*Teachers use Admin*Time + γ_{112}*Frequency Students Use Content*Time + γ_{113}*Frequency Students Use Tool*Time + γ_{114}*Technical Support Human*Time + γ_{115}*Technical Support Hardware*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* SWD*Time^2 + γ_{25}*Teacher Qualifications*Time^2 + γ_{26}* Positive Learning Environment*Time^2 + γ_{27}*Access Content SW*Time^2 + γ_{28}*Access Office SW*Time^2 + γ_{29}*Access Ad Prod SW*Time^2 + γ_{210}*Teachers Use Deliver Instruction*Time^2 + γ_{211}*Teachers use Admin*Time^2 + γ_{212}*Frequency Students Use Content*Time^2 + γ_{213}*Frequency Students Use Tool*Time^2 + γ_{214}*Technical Support Human*Time^2 + γ_{215}*Technical Support Hardware*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}*SWD*Time^3 + γ_{35}*Teacher Qualifications*Time^3 + γ_{36}* Positive Learning Environment*Time^3 + γ_{37}*Access Content SW*Time^3 + γ_{38}*Access Office SW*Time^3 + γ_{39}*Access Ad Prod SW*Time^3 + γ_{310}*Teachers Use Deliver Instruction*Time^3 + γ_{311}*Teachers use Admin*Time^3 + γ_{312}*Frequency Students Use Content*Time^3 + γ_{313}*Frequency Students Use Tool*Time^3 + γ_{314}*Technical Support Human*Time^3 + γ_{315}*Technical Support Hardware*Time^3 + u_0 + r

Table 24.

Model 6a: Math Predicted by Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted and LEP)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		680.17	0.4421	2298	1538.4	<.0001	**
Time		-5.9419	0.9043	6831	-6.57	<.0001	**
Time^2		9.5441	0.7855	6831	12.15	<.0001	**
Time^3		-2.1982	0.1703	6831	-12.91	<.0001	**
School Level	Elementary	-39.9183	0.5215	6831	-76.55	<.0001	**
School Level	High	26.261	0.6135	6831	42.8	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-4.3101	0.1957	6831	-22.03	<.0001	**
Minority		-6.0545	0.213	6831	-28.43	<.0001	**
Students with Disabilities		-2.0685	0.1436	6831	-14.41	<.0001	**
Positive Learning Environment		1.6887	0.1517	6831	11.13	<.0001	**
Positive Teacher Qualifications		0.9759	0.1139	6831	8.57	<.0001	**
Access Content Software		-0.01108	0.1061	6831	-0.1	0.9168	
Access Office Software		-0.00873	0.105	6831	-0.08	0.9337	
Access Advanced Production Software		-0.0507	0.1081	6831	-0.47	0.6391	
Teachers Use To Deliver Instruction		0.1053	0.1169	6831	0.9	0.3674	
Teachers Use For		-0.2504	0.1209	6831	-2.07	0.0383	*

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Administrative Purposes							
Frequency that students use content software		-0.07561	0.09745	6831	-0.78	0.4378	
Frequency Students Use Tool-Based Software		0.03286	0.1045	6831	0.31	0.7532	
Technical Support Human		0.04804	0.09561	6831	0.5	0.6154	
Technical Support Hardware		-0.04762	0.09287	6831	-0.51	0.6081	
Time*School Level	Elementary	-10.4764	1.1296	6831	-9.27	<.0001	**
Time*School Level	High	-9.0311	1.0785	6831	-8.37	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-1.3148	0.5	6831	-2.63	0.0086	**
Time*Minority		-0.2605	0.4475	6831	-0.58	0.5605	
Time*Students with Disabilities		-0.4827	0.3404	6831	-1.42	0.1562	
Time*Positive Learning Environment		-0.932	0.461	6831	-2.02	0.0432	*
Time*Positive Teacher Qualifications		0.7667	0.3288	6831	2.33	0.0197	*
Time*Access Content Software		0.1684	0.3766	6831	0.45	0.6547	
Time*Access Office Software		-0.3604	0.3705	6831	-0.97	0.3307	
Time*Access Advanced Production Software		0.6149	0.3764	6831	1.63	0.1023	
Time*Teachers Use To Deliver Instruction		-0.7755	0.4154	6831	-1.87	0.062	
Time*Teachers Use For Administrative Purposes		1.5909	0.4216	6831	3.77	0.0002	**
Time*Frequency that Students Use Content Software		-0.1084	0.3626	6831	-0.3	0.7651	
Time*Frequency Students Use Tool-Based Software		-0.05096	0.3817	6831	-0.13	0.8938	
Time*Technical Support Human		0.2935	0.3244	6831	0.9	0.3658	
Time*Technical Support Hardware		-0.1282	0.3315	6831	-0.39	0.6989	
$Time^2$*School Level	Elementary	5.9175	0.9951	6831	5.95	<.0001	**
$Time^2$*School Level	High	7.0793	0.9522	6831	7.43	<.0001	**
$Time^2$*School Level	Middle	0	.	.	.	.	
$Time^2$*Free Reduced Lunch		-0.2752	0.4461	6831	-0.62	0.5374	
$Time^2$*Minority		0.9581	0.3961	6831	2.42	0.0156	*
$Time^2$*Students with Disabilities		0.4094	0.2994	6831	1.37	0.1715	
$Time^2$*Positive Learning Environment		1.1369	0.4123	6831	2.76	0.0058	**
$Time^2$*Positive Teacher Qualifications		-0.4446	0.2898	6831	-1.53	0.1251	
$Time^2$*Access Content Software		-0.1988	0.3325	6831	-0.6	0.5499	
$Time^2$*Access Office		0.272	0.325	6831	0.84	0.4026	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Software							
Time^2*Access Advanced Production Software		-0.5203	0.331	6831	-1.57	0.116	
Time^2*Teach Use Deliver Instruction		0.5984	0.3675	6831	1.63	0.1036	
Time^2*Teach Use Administrative Purposes		-1.0999	0.3689	6831	-2.98	0.0029	**
Time^2*Frequency Student Use Content Software		0.1849	0.3211	6831	0.58	0.5647	
Time^2*Frequency Students Use Tool-Based Software		0.03957	0.343	6831	0.12	0.9082	
Time^2*Technical Support Human		-0.243	0.2868	6831	-0.85	0.397	
Time^2*Technical Support Hardware		0.0616	0.2916	6831	0.21	0.8327	
Time^3*School Level	Elementary	-0.7216	0.2177	6831	-3.32	0.0009	**
Time^3*School Level	High	-1.4644	0.2091	6831	-7	<.0001	**
Time^3*School Level	Middle	0	.	.	.	.	
Time^3*Free Reduced Lunch		0.1424	0.09852	6831	1.45	0.1484	
Time^3*Minority		-0.245	0.0871	6831	-2.81	0.0049	**
Time^3*Students with Disabilities		-0.07226	0.06554	6831	-1.1	0.2703	
Time^3*Positive Learning Environment		-0.2697	0.091	6831	-2.96	0.003	**
Time^3*Positive Teacher Qualifications		0.06669	0.06341	6831	1.05	0.293	
Time^3*Access Content Software		0.05345	0.07311	6831	0.73	0.4648	
Time^3*Access Office Software		-0.04888	0.07111	6831	-0.69	0.4919	
Time^3*Access Advanced Production Software		0.1126	0.07247	6831	1.55	0.1203	
Time^3*Teach Use Deliver Instruction		-0.1146	0.08082	6831	-1.42	0.1563	
Time^3*Teach Use Administrative Purposes		0.2113	0.08062	6831	2.62	0.0088	**
Time^3*Frequency Student Use Content Software		-0.03818	0.07053	6831	-0.54	0.5884	
Time^3*Frequency Students Use Tool-Based Software		-0.01826	0.07623	6831	-0.24	0.8107	
Time^3*Technical Support Human		0.04521	0.0631	6831	0.72	0.4737	
Time^3*Technical Support Hardware		-0.00677	0.06402	6831	-0.11	0.9158	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	56.2368	2.0688	27.18	<.0001	**
Residual	13.7986	0.249	55.43	<.0001	**

Note: * $p < .05$; ** $p < .01$

Similar results were found with the elementary and middle school data with gifted. Percent of teachers who regularly use technology for administrative purposes was a significant technology parameter estimate at the intercept and with its interaction with time, $time^2$, and $time^3$. An additional technology integration variable that had significant interactions with time, $time^2$, and $time^3$ was percent of teachers who regularly use technology to deliver instruction (see Table 25). Other significant parameter estimates included the intercept, time, $time^2$, $time^3$, elementary school, free or reduced lunch status, minority, students with disabilities, gifted, positive learning environment, and positive teacher qualifications. Significant interactions with time included LEP, gifted, positive learning environment, and positive teacher qualifications. Significant interactions with $time^2$ and $time^3$ included minority, LEP, gifted, and positive learning environment. Only the -2 Log Likelihood index indicated that this model had better fit (see Table 29). Moreover, adding the technology integration indicators to the model did not explain any additional variance. Two technology integration variables, teachers use technology for administrative purposes and teachers use technology to deliver instruction, were the only technology integration indicators retained in the final model for the data with elementary and middle schools and gifted in order to determine if the model fit improved without the noise from the technology integration variables that were not significant.

Model 6b: Technology Integration with Demographics and Student Learning Environment by School Level (Elementary and Middle Schools with Gifted)

Level 1: FCAT Math = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Access Content SW + γ_{010}*Access Office SW + γ_{011}*Access Ad Prod SW + γ_{012}*Teachers Use Deliver Instruction + γ_{013}*Teachers use Admin + γ_{014}*Frequency Students Use Content + γ_{015}*Frequency Students Use Tool + γ_{016}*Technical Support Human + γ_{017}*Technical Support Hardware + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + γ_{19}*Access Content SW + γ_{110}*Access Office SW + γ_{111}*Access Ad Prod SW + γ_{112}*Teachers Use Deliver Instruction + γ_{113}*Teachers use Admin + γ_{114}*Frequency Students Use Content + γ_{115}*Frequency Students Use Tool + γ_{116}*Technical Support Human + γ_{117}*Technical Support Hardware

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment + γ_{29}*Access Content SW + γ_{210}*Access Office SW + γ_{211}*Access Ad Prod SW + γ_{212}*Teachers Use Deliver Instruction + γ_{213}*Teachers use Admin + γ_{214}*Frequency Students Use Content + γ_{215}*Frequency Students Use Tool + γ_{216}*Technical Support Human + γ_{217}*Technical Support Hardware

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}*Gifted + γ_{37}* Teacher Qualifications + γ_{38}* Positive Learning Environment + γ_{39}*Access Content SW + γ_{310}*Access Office SW + γ_{311}*Access Ad Prod SW + γ_{312}*Teachers Use Deliver Instruction + γ_{313}*Teachers use Admin + γ_{314}*Frequency Students Use Content + γ_{315}*Frequency Students Use Tool + γ_{316}*Technical Support Human + γ_{317}*Technical Support Hardware

Mixed-Effects Model: $\text{FCAT Math} = \gamma_{00} + \gamma_{01}\text{*School Level} + \gamma_{02}\text{*SES} + \gamma_{03}\text{*Minority} + \gamma_{04}\text{* LEP} + \gamma_{05}\text{* SWD} + \gamma_{06}\text{*Gifted} + \gamma_{07}\text{* Teacher Qualifications} + \gamma_{08}\text{* Positive Learning Environment} + \gamma_{09}\text{*Access Content SW} + \gamma_{010}\text{*Access Office SW} + \gamma_{011}\text{*Access Ad Prod SW} + \gamma_{012}\text{*Teachers Use Deliver Instruction} + \gamma_{013}\text{*Teachers use Admin} + \gamma_{014}\text{*Frequency Students Use Content} + \gamma_{015}\text{*Frequency Students Use Tool} + \gamma_{016}\text{*Technical Support Human} + \gamma_{017}\text{*Technical Support Hardware} + \gamma_{10}\text{*Time} + \gamma_{11}\text{*School Level*Time} + \gamma_{12}\text{*SES*Time} + \gamma_{13}\text{*Minority*Time} + \gamma_{14}\text{* LEP *Time} + \gamma_{15}\text{* SWD *Time} + \gamma_{16}\text{*Gifted*Time} + \gamma_{17}\text{* Teacher Qualifications*Time} + \gamma_{18}\text{* Positive Learning Environment*Time} + \gamma_{19}\text{*Access Content SW*Time} + \gamma_{110}\text{*Access Office SW*Time} + \gamma_{111}\text{*Access Ad Prod SW*Time} + \gamma_{112}\text{*Teachers Use Deliver Instruction*Time} + \gamma_{113}\text{*Teachers use Admin*Time} + \gamma_{114}\text{*Frequency Students Use Content*Time} + \gamma_{115}\text{*Frequency Students Use Tool*Time} + \gamma_{116}\text{*Technical Support Human*Time} + \gamma_{117}\text{*Technical Support Hardware*Time} + \gamma_{20}\text{*Time}^2 + \gamma_{21}\text{*School Level*Time}^2 + \gamma_{22}\text{*SES*Time}^2 + \gamma_{23}\text{*Minority*Time}^2 + \gamma_{24}\text{* LEP*Time}^2 + \gamma_{25}\text{* SWD*Time}^2 + \gamma_{26}\text{*Gifted*Time}^2 + \gamma_{27}\text{* Teacher Qualifications*Time}^2 + \gamma_{28}\text{* Positive Learning Environment*Time}^2 + \gamma_{29}\text{*Access Content SW*Time}^2 + \gamma_{210}\text{*Access Office SW*Time}^2 + \gamma_{211}\text{*Access Ad Prod SW*Time}^2 + \gamma_{212}\text{*Teachers Use Deliver Instruction*Time}^2 + \gamma_{213}\text{*Teachers use Admin*Time}^2 + \gamma_{214}\text{*Frequency Students Use Content*Time}^2 + \gamma_{215}\text{*Frequency Students Use Tool*Time}^2 + \gamma_{216}\text{*Technical Support Human*Time}^2 + \gamma_{217}\text{*Technical Support Hardware*Time}^2 + \gamma_{30}\text{*Time}^3 + \gamma_{31}\text{*School Level*Time}^3 + \gamma_{32}\text{*SES*Time}^3 + \gamma_{33}\text{*Minority*Time}^3 + \gamma_{34}\text{* LEP*Time}^3 + \gamma_{35}\text{* SWD*Time}^3 + \gamma_{36}\text{*Gifted*Time}^3 + \gamma_{37}\text{* Teacher Qualifications*Time}^3 + \gamma_{38}\text{* Positive Learning Environment*Time}^3 + \gamma_{39}\text{*Access Content SW*Time}^3 + \gamma_{310}\text{*Access Office SW*Time}^3 + \gamma_{311}\text{*Access Ad Prod SW*Time}^3 + \gamma_{312}\text{*Teachers Use Deliver Instruction*Time}^3 + \gamma_{313}\text{*Teachers use Admin*Time}^3 + \gamma_{314}\text{*Frequency Students Use Content*Time}^3 + \gamma_{315}\text{*Frequency Students Use Tool*Time}^3 + \gamma_{316}\text{*Technical Support Human*Time}^3 + \gamma_{317}\text{*Technical Support Hardware*Time}^3 + u_0 + r$

Table 25.

Model 6b: Math Predicted by Technology Integration with Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		678.79	0.4361	1819	1556.4	<.0001	**
Time		-6.3563	1.0164	4897	-6.25	<.0001	**
Time^2		9.7723	0.8738	4897	11.18	<.0001	**
Time^3		-2.2345	0.1882	4897	-11.87	<.0001	**
School Level	Elementary	-37.8503	0.5293	4897	-71.51	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-4.4929	0.2256	4897	-19.91	<.0001	**
Minority		-5.7611	0.2608	4897	-22.09	<.0001	**
LEP		0.04658	0.2069	4897	0.23	0.8219	
Students with Disabilities		-1.2816	0.1552	4897	-8.26	<.0001	**
Gifted		3.378	0.1807	4897	18.69	<.0001	**
Positive Learning Environment		1.4189	0.1925	4897	7.37	<.0001	**
Positive Teacher Qualifications		0.8593	0.1278	4897	6.72	<.0001	**
Access Content Software		0.07175	0.1222	4897	0.59	0.557	
Access Office Software		0.02718	0.117	4897	0.23	0.8164	
Access Advanced Production Software		-0.2399	0.1227	4897	-1.96	0.0505	
Teachers Use To Deliver		0.14	0.1348	4897	1.04	0.299	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Instruction							
Teachers Use For Administrative Purposes		-0.3839	0.1419	4897	-2.71	0.0068	**
Frequency that Students Use Content Software		0.0308	0.1126	4897	0.27	0.7846	
Frequency Students Use Tool-Based Software		0.1761	0.1182	4897	1.49	0.1364	
Technical Support Human		0.0115	0.1114	4897	0.1	0.9178	
Technical Support Hardware		-0.1523	0.1045	4897	-1.46	0.145	
Time*School Level	Elementary	-8.9621	1.2995	4897	-6.9	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-1.0653	0.616	4897	-1.73	0.0838	
Time*Minority		-1.0811	0.5887	4897	-1.84	0.0664	
Time*LEP		1.1872	0.4576	4897	2.59	0.0095	**
Time*Students with Disabilities		-0.4095	0.3877	4897	-1.06	0.291	
Time*Gifted		2.0867	0.4101	4897	5.09	<.0001	**
Time*Positive Learning Environment		-1.3589	0.6096	4897	-2.23	0.0258	*
Time*Positive Teacher Qualifications		0.7588	0.3693	4897	2.05	0.04	*
Time*Access Content Software		0.2175	0.4258	4897	0.51	0.6094	
Time*Access Office Software		-0.2559	0.4123	4897	-0.62	0.5349	
Time*Access Advanced Production Software		0.8018	0.417	4897	1.92	0.0546	
Time*Teachers Use To Deliver Instruction		-1.1336	0.4761	4897	-2.38	0.0173	*
Time*Teachers Use For Administrative Purposes		2.1245	0.491	4897	4.33	<.0001	**
Time*Frequency that Students Use Content Software		-0.4436	0.4246	4897	-1.04	0.2962	
Time*Frequency Students Use Tool-Based Software		-0.2507	0.4339	4897	-0.58	0.5634	
Time*Technical Support Human		0.3625	0.3768	4897	0.96	0.336	
Time*Technical Support Hardware		0.3317	0.3718	4897	0.89	0.3724	
Time^2*School Level	Elementary	4.8721	1.1329	4897	4.3	<.0001	**
Time^2*School Level	Middle	0	.	.	.	.	
Time^2*Free Reduced Lunch		-0.1321	0.5476	4897	-0.24	0.8094	
Time^2*Minority		1.4278	0.5149	4897	2.77	0.0056	**
Time^2*LEP		-1.0087	0.3998	4897	-2.52	0.0117	*
Time^2*Students with Disabilities		0.3554	0.3383	4897	1.05	0.2936	
Time^2*Gifted		-1.3246	0.3574	4897	-3.71	0.0002	**
Time^2*Positive Learning Environment		1.5246	0.5383	4897	2.83	0.0046	**
Time^2*Positive Teacher		-0.5229	0.326	4897	-1.6	0.1088	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Qualifications							
Time^2*Access Content Software		-0.2945	0.3742	4897	-0.79	0.4313	
Time^2*Access Office Software		0.1636	0.3603	4897	0.45	0.6499	
Time^2*Access Advanced Production Software		-0.5955	0.366	4897	-1.63	0.1038	
Time^2*Teach Use Deliver Instruction		0.9558	0.4188	4897	2.28	0.0225	*
Time^2*Teach Use Administrative Purposes		-1.5112	0.4249	4897	-3.56	0.0004	**
Time^2*Frequency Student Use Content Software		0.4223	0.3747	4897	1.13	0.2597	
Time^2*Frequency Students Use Tool-Based Software		0.08314	0.3877	4897	0.21	0.8302	
Time^2*Technical Support Human		-0.2902	0.3304	4897	-0.88	0.3798	
Time^2*Technical Support Hardware		-0.2989	0.3253	4897	-0.92	0.3582	
Time^3*School Level	Elementary	-0.5332	0.2463	4897	-2.17	0.0304	*
Time^3*School Level	Middle	0	.	.	.	.	
Time^3*Free Reduced Lunch		0.08304	0.1205	4897	0.69	0.4908	
Time^3*Minority		-0.3336	0.1126	4897	-2.96	0.0031	**
Time^3*LEP		0.219	0.08715	4897	2.51	0.012	*
Time^3*Students with Disabilities		-0.06551	0.07373	4897	-0.89	0.3743	
Time^3*Gifted		0.2321	0.07791	4897	2.98	0.0029	**
Time^3*Positive Learning Environment		-0.3548	0.1178	4897	-3.01	0.0026	**
Time^3*Positive Teacher Qualifications		0.09245	0.07149	4897	1.29	0.196	
Time^3*Access Content Software		0.07482	0.08215	4897	0.91	0.3624	
Time^3*Access Office Software		-0.02649	0.07866	4897	-0.34	0.7363	
Time^3*Access Advanced Production Software		0.1212	0.08017	4897	1.51	0.1306	
Time^3*Teach Use Deliver Instruction		-0.2005	0.09183	4897	-2.18	0.0291	*
Time^3*Teach Use Administrative Purposes		0.2956	0.09225	4897	3.2	0.0014	*
Time^3*Frequency Student Use Content Software		-0.08079	0.08204	4897	-0.98	0.3248	
Time^3*Frequency Students Use Tool-Based Software		-0.01248	0.08581	4897	-0.15	0.8843	
Time^3*Technical Support Human		0.0511	0.07236	4897	0.71	0.4801	
Time^3*Technical Support Hardware		0.06885	0.07113	4897	0.97	0.3331	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	41.4305	1.6504	25.1	<.0001	**
Residual	12.86	0.2674	48.09	<.0001	**

Note: * $p < .05$; ** $p < .01$

The last models estimated in order to answer the second hypothesis predicting math achievement included all school levels, demographic, student learning environment, and significant technology integration variables. These models were different because the model fit to the data for all schools levels without gifted and LEP included one technology integration variable - percent of teachers who regularly use technology for administrative purposes (see model 7a); while the model fitted to the data with elementary and middle school levels and gifted included two technology integration variables – percent of teachers who regularly use technology for administrative purposes and percent of teachers who regularly use technology for delivery of instruction (see model 7b). For the model with all schools levels and no gifted or LEP, the same parameter estimates and interactions identified in the previous models as significant were significant again (see Table 26). Although, there was no difference in the percentage of variance explained in this model than was in the Demographic Model with Student Learning Environment by school level or the Technology Integration with Demographic and Student Learning Environment Model by school level, the AIC, AICC, and BIC indices all indicated better model fit (see Table 28). The level-1 residuals for the final model for predicting FCAT Math using all school levels without gifted ranged between -23.67 and 21.57 with a standard deviation of 3.25. Although there were outliers, skewness was -0.06 and kurtosis was 2.45, which would indicate that the residuals were evenly distributed with most around the mean. Distribution of the empirical bayes intercepts ranged between -31.16 and 41.52 with standard deviation of 7.30. Skewness was 0.47, and kurtosis was 1.32, which indicated that the residuals at level-2 were within acceptable range.

Final Model 7a: Significant Technology Integration Indicators with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Level 1: FCAT Math = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* SWD + γ_{05}*Teacher Qualifications + γ_{06}* Positive Learning Environment + γ_{07}*Teachers use Admin + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* SWD + γ_{15}*Teacher Qualifications + γ_{16}* Positive Learning Environment + γ_{17}*Teachers use Admin

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* SWD + γ_{25}*Teacher Qualifications + γ_{26}* Positive Learning Environment + γ_{27}*Teachers use Admin

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{04}* SWD + γ_{35}*Teacher Qualifications + γ_{36}* Positive Learning Environment + γ_{37}*Teachers use Admin

Mixed-Effects Model: FCAT Math = γ00 + γ01*School Level + γ02*SES + γ03*Minority + γ04* SWD + γ05*Teacher Qualifications + γ06* Positive Learning Environment + γ07*Teachers use Admin + γ10*Time + γ11*School Level*Time + γ12*SES*Time + γ13*Minority*Time + γ14* SWD*Time + γ15*Teacher Qualifications*Time + γ16* Positive Learning Environment*Time + γ17*Teachers use Admin*Time + γ20*Time^2 + γ21*School Level*Time^2 + γ22*SES*Time^2 + γ23*Minority*Time^2 + γ24* SWD*Time^2 + γ25*Teacher Qualifications*Time^2 + γ26* Positive Learning Environment*Time^2 + γ27*Teachers use Admin*Time^2 + γ30*Time^3 + γ31*School Level*Time^3 + γ32*SES*Time^3 + γ33*Minority*Time^3 + γ34* SWD*Time^3 + γ35*Teacher Qualifications*Time^3 + γ36* Positive Learning Environment*Time^3 + γ37*Teachers use Admin*Time^3 + u0 + r

Table 26.

Final Model 7a: Math Predicted by Significant Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted and LEP)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		680.23	0.4397	2298	1546.9	<.0001	**
Time		-5.997	0.873	6863	-6.87	<.0001	**
Time^2		9.5432	0.7569	6863	12.61	<.0001	**
Time^3		-2.1982	0.1641	6863	-13.4	<.0001	**
School Level	Elementary	-40.002	0.517	6863	-77.37	<.0001	**
School Level	High	26.2999	0.6131	6863	42.9	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-4.2872	0.1943	6863	-22.06	<.0001	**
Minority		-6.0819	0.2125	6863	-28.63	<.0001	**
Students with Disabilities		-2.0817	0.1435	6863	-14.51	<.0001	**
Positive Learning Environment		1.696	0.1513	6863	11.21	<.0001	**
Positive Teacher Qualifications		0.982	0.1138	6863	8.63	<.0001	**
Teachers Use For Administrative Purposes		-0.2258	0.09797	6863	-2.3	0.0212	*
Time*School Level	Elementary	-10.409	1.0798	6863	-9.64	<.0001	**
Time*School Level	High	-9.2119	1.0628	6863	-8.67	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-1.2348	0.4906	6863	-2.52	0.0119	*
Time*Minority		-0.2952	0.4438	6863	-0.67	0.5059	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time*Students with Disabilities		-0.4659	0.3393	6863	-1.37	0.1698	
Time*Positive Learning Environment		-0.8874	0.4587	6863	-1.93	0.0531	
Time*Positive Teacher Qualifications		0.8392	0.3246	6863	2.59	0.0098	**
Time*Teachers Use For Administrative Purposes		1.242	0.3389	6863	3.66	0.0002	**
Time^2*School Level	Elementary	5.9152	0.947	6863	6.25	<.0001	**
Time^2*School Level	High	7.2513	0.9377	6863	7.73	<.0001	**
Time^2*School Level	Middle	0	.	.	.	.	
Time^2*Free Reduced Lunch		-0.3253	0.4361	6863	-0.75	0.4557	
Time^2*Minority		0.9858	0.3927	6863	2.51	0.0121	*
Time^2*Students with Disabilities		0.3995	0.2983	6863	1.34	0.1806	
Time^2*Positive Learning Environment		1.0848	0.4104	6863	2.64	0.0082	**
Time^2*Positive Teacher Qualifications		-0.5057	0.2846	6863	-1.78	0.0756	
Time^2*Teach Use Administrative Purposes		-0.8462	0.2983	6863	-2.84	0.0046	**
Time^3*School Level	Elementary	-0.7174	0.2068	6863	-3.47	0.0005	**
Time^3*School Level	High	-1.5074	0.2059	6863	-7.32	<.0001	**
Time^3*School Level	Middle	0	.	.	.	.	
Time^3*Free Reduced Lunch		0.1531	0.09614	6863	1.59	0.1113	
Time^3*Minority		-0.2512	0.08633	6863	-2.91	0.0036	**
Time^3*Students with Disabilities		-0.07075	0.06531	6863	-1.08	0.2788	
Time^3*Positive Learning Environment		-0.2574	0.09059	6863	-2.84	0.0045	**
Time^3*Positive Teacher Qualifications		0.07983	0.06207	6863	1.29	0.1985	
Time^3*Teach Use Administrative Purposes		0.1671	0.0654	6863	2.56	0.0106	*

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	56.4906	2.0766	27.2	<.0001	**
Residual	13.8405	0.2496	55.44	<.0001	**

Note: * $p < .05$; ** $p < .01$

For the model with elementary and middle school levels and gifted, the same significant parameter estimates were identified as in the previous models (see Table 27). At the intercept, the estimates for time, time^2, time^3, elementary when compared to middle, free or reduced lunch status, minority, students with disabilities, gifted, positive learning environment, and positive teacher qualifications were significant. At the intercept LEP was not significant. Variables that had significant interactions with time were elementary, LEP, gifted, positive learning environment, and positive teacher qualifications. Variables with significant interactions with $time^2$ and $time^3$ were elementary, minority, LEP, gifted, and positive learning environment. When examining the technology indicators, as in the previous model, the intercept of percent of teachers who regularly use technology for administrative purposes was significant. Significant technology indicators with time included both the percent of teachers who regularly use technology to deliver instruction and the percent of teachers who use technology for administrative purposes. Significant technology indicators with $time^2$ and $time^3$ included the percent of teachers who use technology for administrative purposes. Although, there was no difference in the percentage of variance explained in this model than was in the Demographic Model with Student Learning Environment by school level or the Technology Integration with Demographic and Student Learning Environment Model by school level, the AIC, AICC, and BIC indices all indicated better model fit (see Table 29). The level-1 residuals for the final model for predicting FCAT Math using elementary and middle schools with gifted ranged between -23.46 and 22.13 with a standard deviation of 3.12. Although there were outliers, skewness was -0.01 and kurtosis was 2.74, which would indicate that the residuals were evenly distributed with most around the mean. Distribution of the empirical bayes intercepts ranged between -23.26 and 28.25 with standard deviation of 6.18. Skewness was 0.31, and kurtosis was 0.44, which indicated that the residuals at level-2 were also normally distributed.

Final Model 7b: Technology Integration with Demographics and Student Learning Environment by School Level (Elementary and Middle Schools with Gifted)

Level 1: FCAT Math = $\beta_0 + \beta_1$*Time + β_2*$Time^2$ + β_3*$Time^3$ + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Teachers Use Deliver Instruction + γ_{010}* Teachers use Admin + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + γ_{19}* Teachers Use Deliver Instruction + γ_{110}*Teachers use Admin

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment + γ_{29}* Teachers Use Deliver Instruction + γ_{210}*Teachers use Admin

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}*Gifted + γ_{37}* Teacher Qualifications + γ_{38}* Positive Learning Environment + γ_{39}* Teachers Use Deliver Instruction + γ_{310}*Teachers use Admin

Mixed-Effects Model: FCAT Math = γ_{00} + γ_{01}*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}* Teachers Use Deliver Instruction + γ_{010}*Teachers use Admin + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{19}* Teachers Use Deliver Instruction *Time + γ_{110}*Teachers use Admin*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + γ_{29}* Teachers Use Deliver Instruction*Time^2 + γ_{210}* Teachers use Admin*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}* LEP*Time^3 + γ_{35}* SWD*Time^3 + γ_{36}*Gifted*Time^3 + γ_{37}* Teacher Qualifications*Time^3 + γ_{38}* Positive Learning Environment*Time^3 + γ_{39}* Teachers Use Deliver Instruction*Time^3 + γ_{310}* Teachers use Admin*Time^3 + u_0 + r

Table 27.

Final Model 7b: Math Predicted by Significant Technology Integration with Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		678.81	0.4327	1819	1568.8	<.0001	**
Time		-6.2536	0.9859	4925	-6.34	<.0001	**
Time^2		9.6551	0.8469	4925	11.4	<.0001	**
Time^3		-2.2131	0.1825	4925	-12.13	<.0001	**
School Level	Elementary	-37.8793	0.5238	4925	-72.31	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-4.5121	0.224	4925	-20.14	<.0001	**
Minority		-5.7575	0.2604	4925	-22.11	<.0001	**
LEP		0.04982	0.2065	4925	0.24	0.8093	
Students with Disabilities		-1.3011	0.1553	4925	-8.38	<.0001	**
Gifted		3.3718	0.1801	4925	18.72	<.0001	**
Positive Learning Environment		1.4159	0.1924	4925	7.36	<.0001	**
Positive Teacher Qualifications		0.8636	0.1279	4925	6.75	<.0001	**
Teachers Use To Deliver Instruction		0.1154	0.1269	4925	0.91	0.3632	
Teachers Use For Administrative Purposes		-0.359	0.1341	4925	-2.68	0.0075	**
Time*School Level	Elementary	-9.0999	1.2532	4925	-7.26	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-0.9663	0.6052	4925	-1.6	0.1104	
Time*Minority		-1.1046	0.5861	4925	-1.88	0.0595	
Time*LEP		1.1634	0.4559	4925	2.55	0.0107	*
Time*Students with Disabilities		-0.417	0.387	4925	-1.08	0.2812	
Time*Gifted		2.1235	0.4074	4925	5.21	<.0001	**
Time*Positive Learning Environment		-1.3146	0.608	4925	-2.16	0.0306	*
Time*Positive Teacher Qualifications		0.8314	0.3645	4925	2.28	0.0226	*

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time*Teachers Use To Deliver Instruction		-0.882	0.448	4925	-1.97	0.049	*
Time*Teachers Use For Administrative Purposes		2.0823	0.4632	4925	4.5	<.0001	**
Time^2*School Level	Elementary	5.0284	1.0893	4925	4.62	<.0001	**
Time^2*School Level	Middle	0	.	.	.	.	
Time^2*Free Reduced Lunch		-0.1757	0.5374	4925	-0.33	0.7438	
Time^2*Minority		1.4354	0.5128	4925	2.8	0.0051	**
Time^2*LEP		-0.9941	0.398	4925	-2.5	0.0125	*
Time^2*Students with Disabilities		0.3661	0.3376	4925	1.08	0.2783	
Time^2*Gifted		-1.3546	0.3552	4925	-3.81	0.0001	**
Time^2*Positive Learning Environment		1.4849	0.5367	4925	2.77	0.0057	**
Time^2*Positive Teacher Qualifications		-0.5787	0.3199	4925	-1.81	0.0705	
Time^2*Teach Use Deliver Instruction		0.7232	0.3936	4925	1.84	0.0662	
Time^2*Teach Use Administrative Purposes		-1.5144	0.4023	4925	-3.76	0.0002	**
Time^3*School Level	Elementary	-0.56	0.2365	4925	-2.37	0.0179	*
Time^3*School Level	Middle	0	.	.	.	.	
Time^3*Free Reduced Lunch		0.09116	0.1182	4925	0.77	0.4404	
Time^3*Minority		-0.3355	0.1122	4925	-2.99	0.0028	**
Time^3*LEP		0.2157	0.08672	4925	2.49	0.0129	*
Time^3*Students with Disabilities		-0.06832	0.07359	4925	-0.93	0.3533	
Time^3*Gifted		0.2376	0.07747	4925	3.07	0.0022	**
Time^3*Positive Learning Environment		-0.3462	0.1174	4925	-2.95	0.0032	**
Time^3*Positive Teacher Qualifications		0.1038	0.06993	4925	1.48	0.1378	
Time^3*Teach Use Deliver Instruction		-0.1492	0.08613	4925	-1.73	0.0833	
Time^3*Teach Use Administrative Purposes		0.302	0.08757	4925	3.45	0.0006	**
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		41.5929	1.6533		25.16	<.0001	**
Residual		*12.9167*	*0.2683*		*48.14*	*<.0001*	**

Note: * $p < .05$; ** $p < .01$

The last step was to add in USDOE funded Magnet Schools and USDOE Technology Magnet Schools as variables in the model. Results of this model indicated that neither magnet school status nor technology magnet school status was a significant predictor of FCAT Math with either the data with all school levels without gifted or with the data with elementary and middle schools and gifted.

Table 28.

Model Fit Indices for Models Predicting FCAT Math Scores for All School Levels (without Gifted and LEP)

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 1: Math Predicted by Average Math of All Schools in Florida	71441.4	71447.4	71447.4	71464.6
Model 2a: Time as a Predictor of Math	67179.8	67191.8	67191.9	67226.3
Model 2b: Time as a Predictor of Math - Time Fixed	67187.7	67195.7	67195.7	67218.7
Quadratic Model 2c: $Time^2$ as a Predictor of Math	66206.6	66216.6	66216.6	66245.3
Polynomial Model 2d: $Time^3$ as a Predictor of Math	64550.4	64562.4	64562.4	64596.8
Model 3: Time, $Time^2$, $Time^3$, and School Level as Predictors of Math	60173.2	60201.2	60201.3	60281.6
Model 4a: Math predicted by Time, School Level, and Demographics Variables	57269	57321	57321.1	57470.2
Model 5a: Demographics and Student Learning Environment by School Level	56865	56933	56933.3	57128.2
Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level	56795.4	56935.4	56936.5	57337.3
Final Model 7a: Significant Technology Integration with Demographics and Student Learning Environment by School Level	56826.4	56902.4	56902.7	57120.6

Table 29.

Model Fit Indices for Models Predicting FCAT Math Scores for Elementary and Middle School Levels (with Gifted)

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 1: Math Predicted by Average Math of All Elementary and Middle Schools in Florida	59990.7	59996.7	59996.7	60013.5
Model 4b: Math predicted by Time, School Level, and Demographics Variables No High School includes gifted	41520.2	41580.2	41580.5	41745.5
Model 5b: Demographics and Teacher Qualifications by School Level	41293.9	41369.9	41370.4	41579.2
Model 6b: Technology Integration with Demographics and Teacher Qualifications by School Level	41224.5	41372.5	41374.2	41780.1

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Final Model 7b: Significant Technology Integration with Demographics and Student Learning Environment by School Level	41253.6	41345.6	41346.2	41598.9

The result of the analysis for all the models indicated that Hypothesis 2 was partially correct. When the sample included schools at all three school levels, there was a significant negative relationship between the percent of teachers who regularly use technology for administrative purposes and the intercept of school level FCAT Math achievement when all other school level, demographic, and school learning environment factors were controlled. Also, there were significant interactions between the percent of teachers who regularly use technology for administrative purposes and time, time^2, and time^3 with FCAT Math achievement. There was a significant positive interaction between time and time^3 with the percent of teachers who regularly use technology for administrative purposes with FCAT Math achievement, and a significant negative interaction between time^2 and the percent of teachers who regularly use technology for administrative purposes with FCAT Math achievement. These interactions resulted in an s-shaped curvilinear trend.

After controlling so that all other variables were held at the mean, the trend for each school level could be examined separately, by comparing schools with different levels in that teachers use technology for administrative purposes. Figure 15 illustrates the relationship between the percentage of teachers who regularly use technology for administrative purposes and average school FCAT Math score for high schools. Percentage of teachers who regularly use technology for administrative purposes were compared at one and two standard deviations below the mean, the mean, and one and two standard deviations above the mean. This allows the extreme cases of schools that have the percentage of teachers who regularly use technology for administrative purposes, +2 standard deviations above the mean, and schools that have the percentage of teachers who regularly use technology for administrative purposes the least often, -2 standard deviations below the mean to be compared. Schools that had the 2 standard deviations, 1 standard deviation and at the mean percentage of teachers who regularly use technology for administrative purposes started the study in 2003-04 with the highest FCAT Math scores (707) and schools that had 1 and 2 standard deviations above the mean of percentage of teachers who regularly use technology for administrative purposes had started with the lowest FCAT Math scores (706). This difference of one point was significant because there were so many schools in the sample; however, the practical importance was modest. The interaction between the percentage of teachers who regularly use technology for administrative purposes and time, time^2, and time^3 with FCAT Math scores was significant, so the slopes of the trends at each level were significantly curvilinear and s-shaped. By 2004-05, all high schools decreased their average FCAT Math scores; however, schools that had 2 standard deviations below the mean in the percentage of teachers who regularly use technology for administrative purposes had the greatest decline in scores. All high schools experienced gains in average FCAT Math scores between 2004-05 and 2005-06 (713 and 714) and then a decline between 2005-06 and 2006-07. High schools with 2 standard deviations above the mean decreased the least (one point to 713), while high schools with 2 standard deviations below the mean decreased the most (two points to 711).

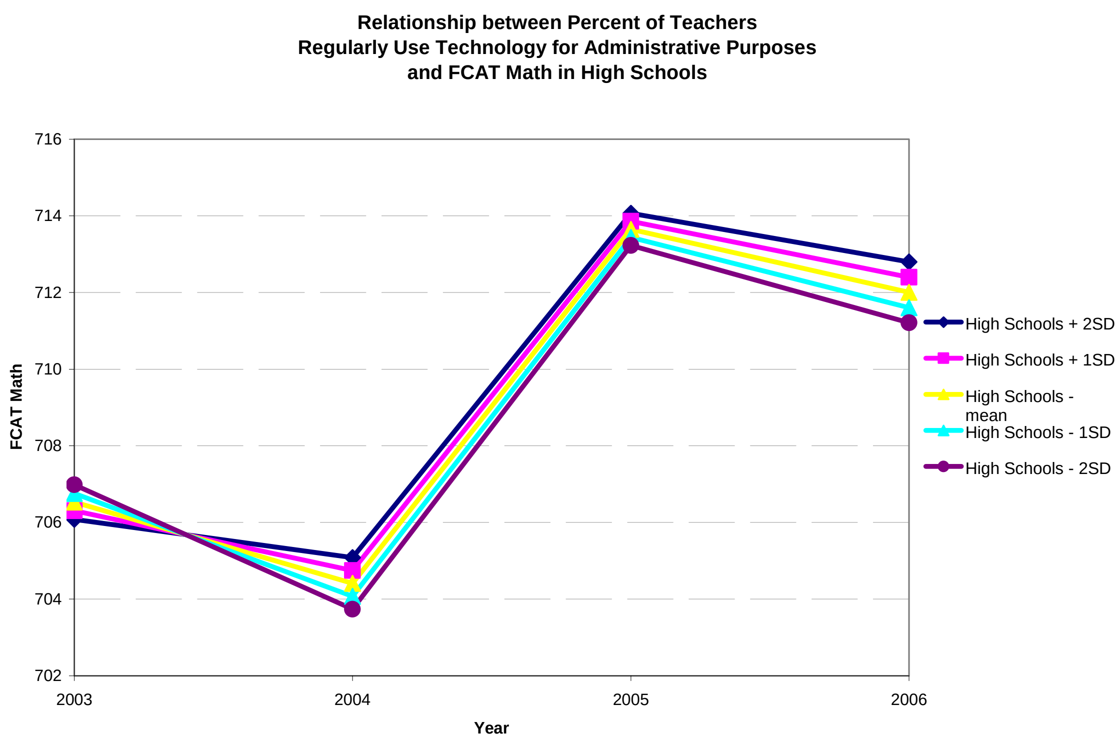

Figure 15. Relationship between the Percent of Teachers Who Regularly Use Technology for Administrative Purposes and FCAT Math in High Schools.

Middle schools had a similar beginning pattern to high school, that is, after controlling for all other factors, schools that were two standard deviations above the mean in the percentage of teachers who regularly use technology for administrative purposes had the lowest FCAT Math scores in 2003-04 (680), while those with two standard deviations below the mean had the highest scores (681). Although this difference of one point was significant due to the large sample size, the practical importance is modest. There were significant interactions between time, $time^2$, $time^3$ and the percentage of teachers in middle schools that regularly use technology for administrative purposes with FCAT Math scores (see Figure 16). Between 2003-04 and 2004-05 middle schools with 2 standard deviations below the mean maintained their FCAT Math scores (681) while all other levels increased their scores (-1SD = 681; Mean, +1SD, and +2SD = 682). After this all schools increased their FCAT Math score between 2004-05 and 2005-06 (-1SD = 688; Mean, +1SD, and +2SD = 689). Then between 2005-06 and 2006-07 differences expanded with different trends. Middle schools with two standard deviations below the mean remained at 688, while middle schools one standard deviation below the mean decreased to 688. Middle schools at the mean and one standard deviation above the mean remained the same, and middle schools with two standard deviations above the mean gained one point (690). Although these changes were significant, the practical importance is modest.

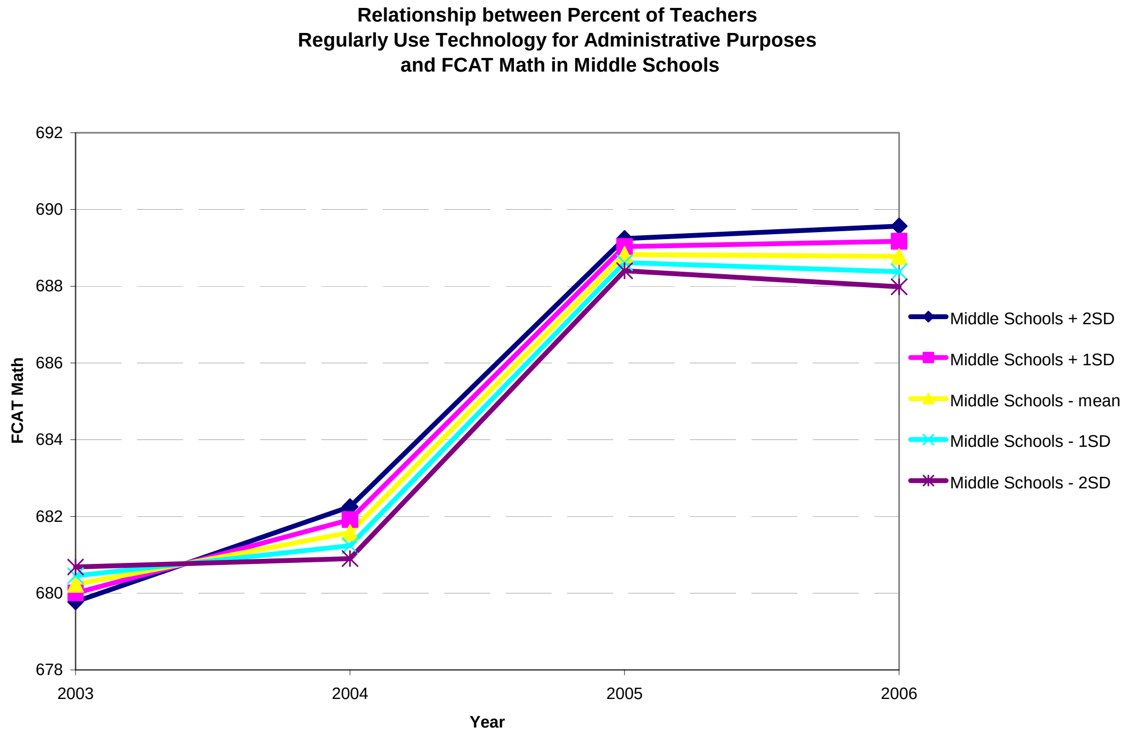

Figure 16. Relationship between the Percent of Teachers Who Regularly Use Technology for Administrative Purposes and FCAT Math in Middle Schools.

Elementary schools experienced a similar pattern to middle schools (see Figure 17). Schools with the lowest percent of teachers who regularly use technology for administrative purposes began the study with the highest FCAT Math score (641), while all other levels or standard deviations had the same score (640). Although this difference of one point was statistically significant, it had no practical importance. Between 2003-04 and 2004-05, elementary schools at the mean and one and two standard deviations below the mean experienced the greatest decline in FCAT Math scores (636), while elementary schools with one and two standard deviations above the mean experienced the least decline in mean FCAT Math scores (637). Between 2004-05 and 2005-06 all schools experienced gains in mean school FCAT Math scores (646). Between 2005-06 and 2006-07 all elementary schools continue to make gains with schools one and two standard deviations above the mean at 652 and schools at the mean, one and two standard deviations below the mean at 651. Although significant the differences of one FCAT Math score is not of practical importance.

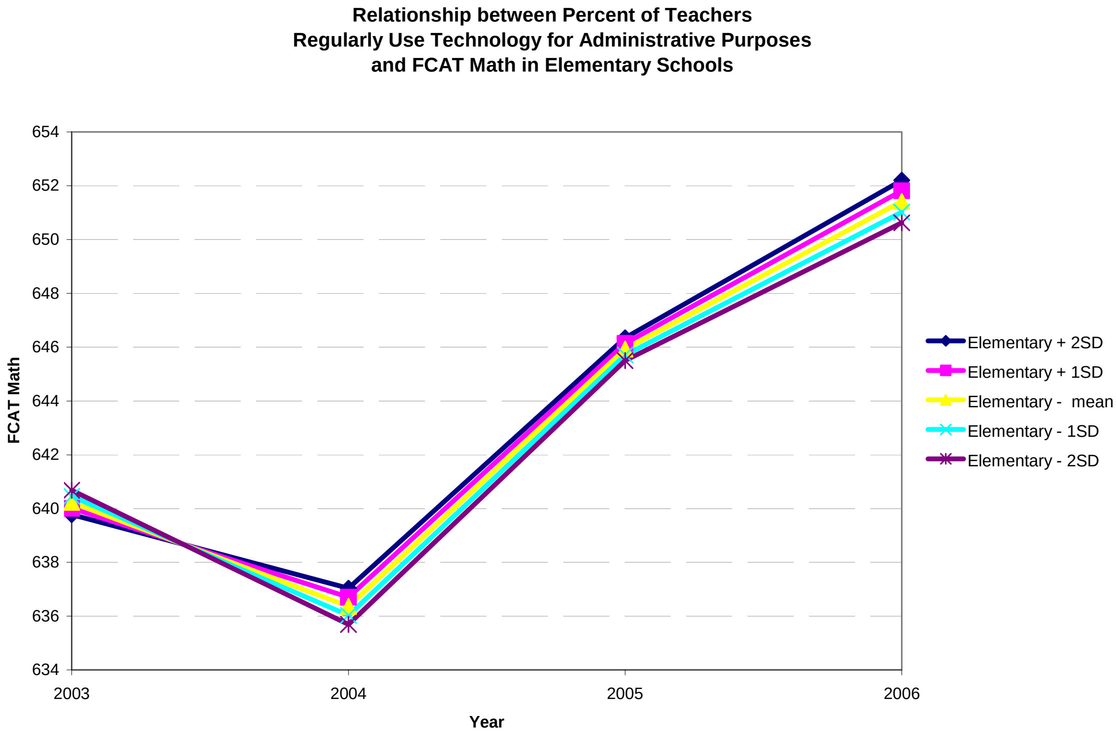

Figure 17. Relationship between the Percent of Teachers Who Regularly Use Technology for Administrative Purposes and FCAT Math in Elementary Schools.

When the sample was restricted to just elementary and middle schools and percent of gifted students was included in the equation, both the intercept of gifted and the interactions of percent of gifted students in the school with time, time^2, and time^3. Thus, when all other factors were held equal, schools with highest percentages of gifted students began the study with the highest FCAT Math scores, and the trends were not constant (see Figure 18). In addition, the trends were different at elementary and middle school level.

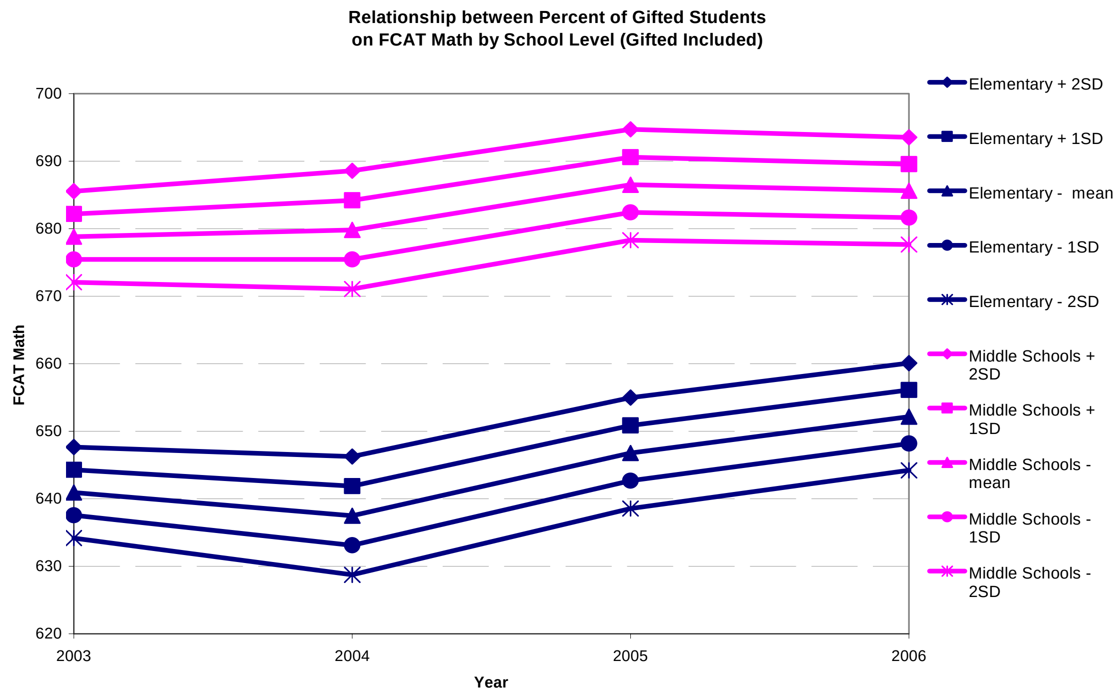

Figure 18. Relationship between Percent of Gifted Students on FCAT Math by School Level (Gifted Included).

When examining the parameter estimates of the technology integration indicators within these data, there were significant main effects for relationships between FCAT Math scores and the percent of teachers who regularly use technology for administrative purposes. In addition, there were significant interactions between time and two technology integration indicators: the percent of teachers who regularly use technology for delivery of instruction and the percent of teachers who regularly use technology for administrative purposes. The interactions between time^2 and time^3 and the percentage of teachers who regularly use technology for administrative purposes were significant. In order to visualize the significant relationships of each of these technology integration variables with FCAT Math, the trends are depicted in separate charts after controlling for all other factors.

There was a significant interaction with time and the percentage of teachers who regularly use technology for administrative purposes and FCAT Math scores for middle schools and elementary schools with gifted. Each school level was examined separately. One and two standard deviations above the mean, the mean, and one and two standard deviations below the mean of levels of percentages of teachers who regularly use technology for administrative purposes were compared after controlling for all other factors. In 2003-04, middle schools with two and one standard deviation below the mean started with the highest average FCAT Math score (675), while schools at the mean and one and two standard deviations above the mean had the lowest FCAT Math score (674) (see Figure 19). The scores for middle schools that were two standard deviations below the mean for percentages of teachers who use technology for administrative purposes decreased to 674 in 2004-05, and schools one standard deviation below the mean remained the same (675). Middle schools at the mean increased one point to 675, at one standard deviation above the mean increased two points to 676, and schools at two standard deviations above the mean increase three points to 677. All middle schools increased mean FCAT Math scores between 2004-05 and 2005-06 (-2 SD = 682; -1 SD, Mean, +1 SD, and +2 SD = 683). Between 2005-06 and 2006-07 middle schools at two standard deviations below the mean for percentages of teachers who use technology for administrative purposes remained the same at 682, and schools at the mean and one standard deviation above the mean remained the same at 683. Schools that were one standard deviation below the mean decreased to 682, while middle schools that were two standard deviations above the mean increased to 684 (see Figure 19). Again, this significant difference of two points between the extremes did not have practical importance.

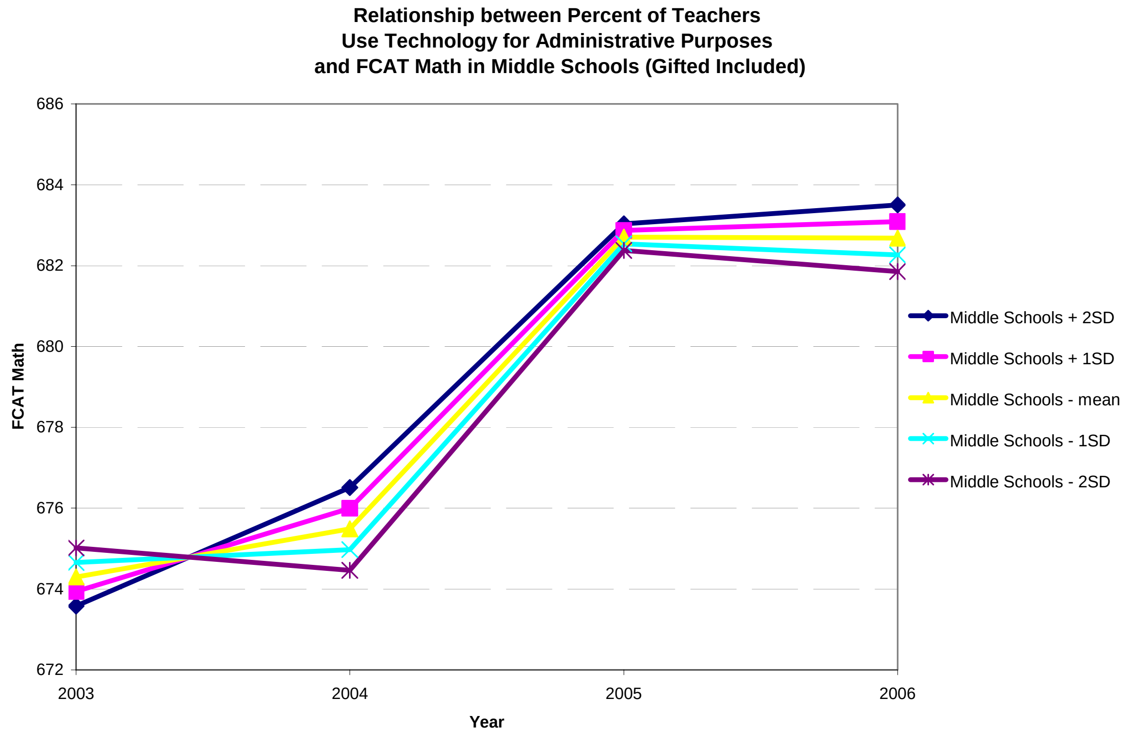

Figure 19. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and FCAT Math in Middle Schools (Gifted Included).

The trends for elementary schools followed a very similar pattern to that of middle schools (see Figure 20). In 2003-04, elementary schools with two standard deviations above the mean of percentage of teachers who regularly use technology for administrative purposes started with the lowest mean FCAT Math scores (640), while schools with two standard deviations below the mean started with the highest FCAT Math score (642). Elementary schools with all other levels of percentage of teachers who regularly use technology for administrative purposes started with mean FCAT Math score of 641. Although this difference was significant, the range of two points did not have practical importance. In 2004-05 the average school FCAT Math score declined; however, schools with the least or two standard deviations below the mean for percentage of teachers who regularly use technology for administrative purposes declined six points (636), while elementary schools with two standard deviations above the mean declined only one point (639). The trend for elementary schools with all levels of percentage of teachers who regularly use technology for administrative purposes was up in 2005-06. In 2006-07 (-2 SD = 646; -1 SD, Mean +1 SD, and +2 SD = 647). Elementary school mean FCAT Math scores continued to increase in 2006-07, but at different rates (-2 SD = 651; -1 SD, and Mean = 652; +1 SD and +2 SD = 653).

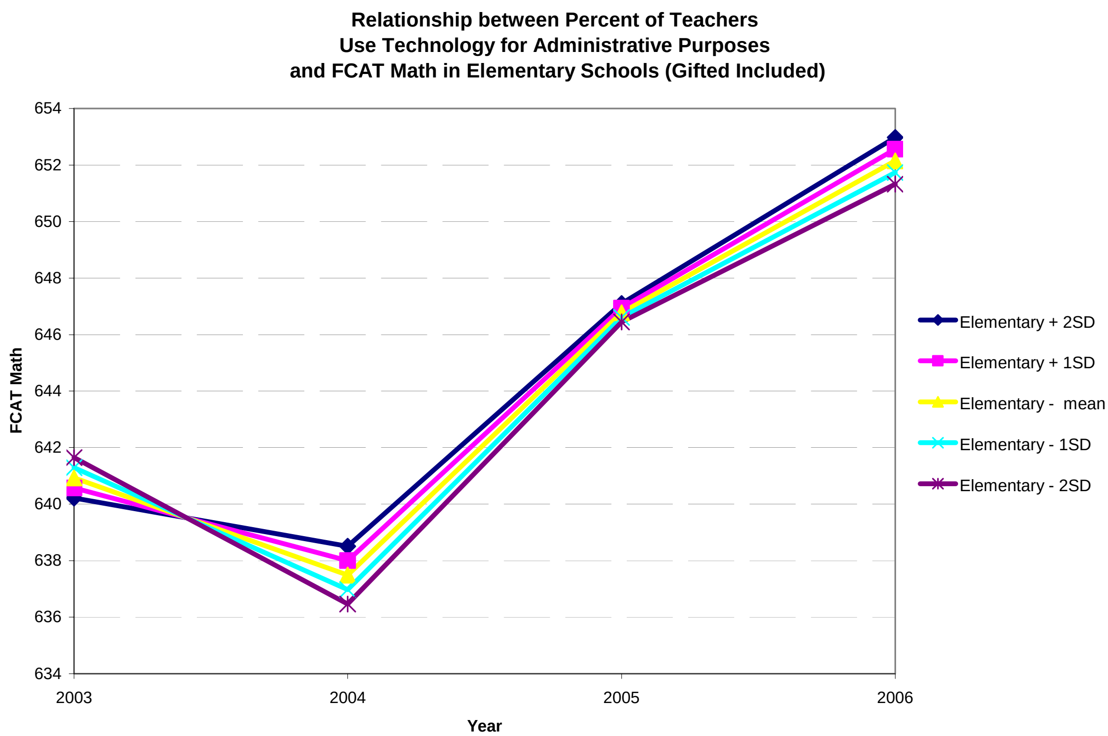

Figure 20. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and FCAT Math in Elementary Schools (Gifted Included).

The differences in standard deviations of intercept of the percentage of teachers who regularly use technology for delivery of instruction were not significant at the intercept for predicting FCAT Math scores for elementary schools and middle schools with gifted. However, the interaction between time and the percentage of teachers who regularly use technology for delivery of instruction with FCAT Math score was significant. The interactions with $time^2$ and $time^3$ were not significant. Both levels of school have similar trends. Charts were made for each level of school to visualize the relationship between the percentage of teachers who regularly use technology for delivery of instruction and FCAT Math achievement at one and two standard deviations above the mean, the mean, and one and two standard deviations below the mean.

The trends for middle school level at two standard deviations above the mean, the mean, and two standard deviations below the mean of the percentage of teachers who regularly use technology for delivery of instruction were examined (see Figure 21). When controlling for all other variables, middle schools at two standard deviations above the mean of the percentage of teachers who regularly use technology for delivery of instruction had the highest FCAT Math scores (675) at the intercept, while all other levels had 674. Between 2003-04 and 2004-05 middle schools at two standard deviations above the mean of percent of teachers who regularly use technology for delivery of instruction maintained their FCAT math scores (675), while middle schools at the mean and one standard deviation above the mean increased to 675. Schools with one and two standard deviations below the mean of percent of teachers who regularly use technology for delivery of instruction had the greatest increase in mean FCAT Math scores to 676. Between 2004-05 and 2005-06 middle schools at all levels of percent of teachers who regularly use technology for delivery of instruction increased mean FCAT Math score to 683, which remained the same through 2006-07.

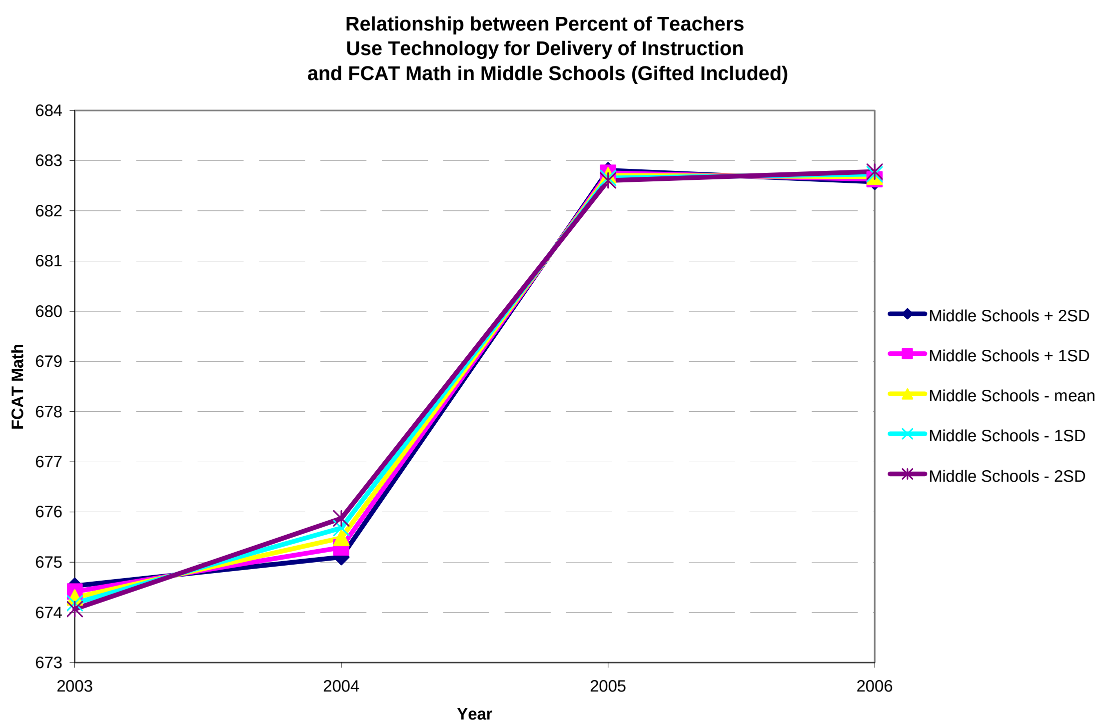

Figure 21. Relationship between the Percentage of Teachers Who Regularly Use Technology for Delivery of Instruction and FCAT Math in Middle Schools (Gifted Included).

When controlling for all other variables, elementary schools at all levels for percent of teachers who regularly use technology for delivery of instruction started with FCAT Math scores at 641 (see Figure

22). Between 2003-04 and 2004-05 elementary schools that were at the mean and one and two standard deviations above the mean had decreases of 4 points in mean FCAT Math scores (637), while elementary schools that were one and two standard deviations below the mean in percent of teachers who regularly use technology for delivery of instruction 3 points in mean FCAT Math score (638). Between 2004-05 and 2005-06 elementary schools at all levels of percent of teachers who regularly use technology for delivery of instruction increased their mean FCAT Math to 647 and then increased again to 652 in 2006-07.

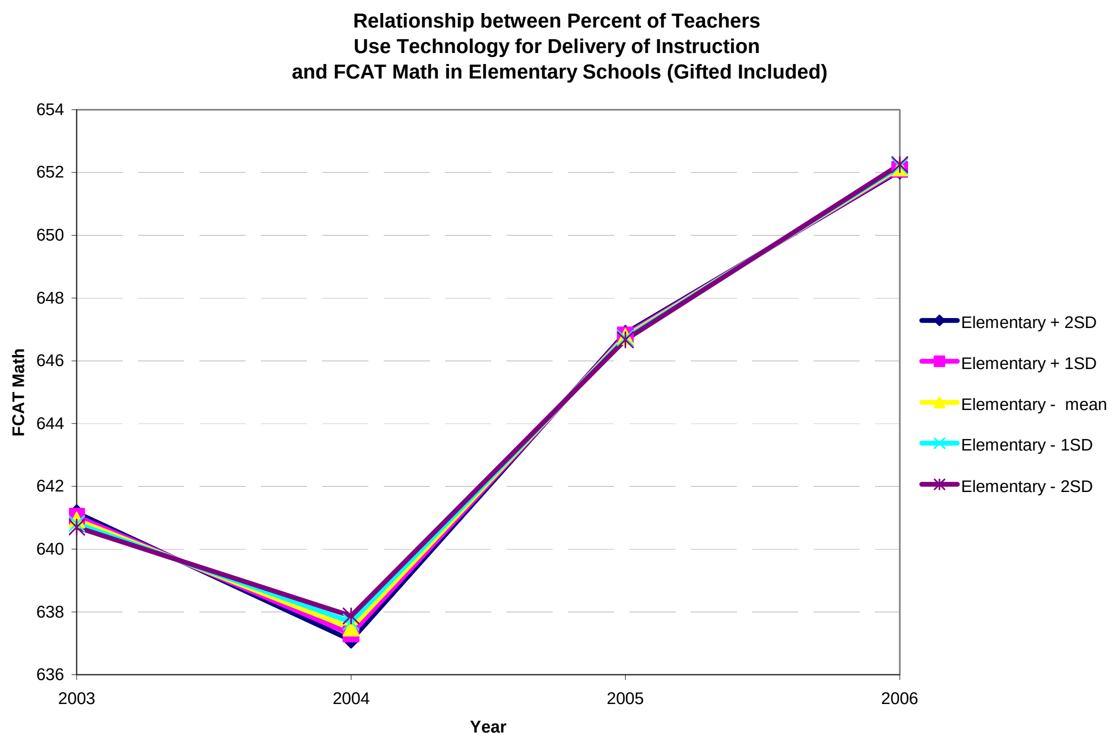

Figure 22. Relationship between the Percentage of Teachers Who Regularly Use Technology for Delivery of Instruction and FCAT Math in Elementary Schools (Gifted Included).

Hypothesis 3

The third analysis conducted to answer the first research question used the FCAT Writing outcome data to test the following hypothesis:

> H_3: After controlling for school level (elementary, middle, and high), school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality, mean school writing achievement (FCAT rubric scores for Writing) will have a positive relationship with indicators of technology integration.

The first step was to build the unconditional model. The unconditional model predicted the schools' FCAT Writing from the average of FCAT Writing for all schools. There were no other predictors. The average FCAT for all schools was 3.809 points (t (2263) = 654.42, p <.0001). This model explained 34% of the within schools variance and 66% of the between schools variance.

Model 1: Unconditional Model
Level 1: FCAT Writing = $\beta_0 + r$
Level 2: $\beta_0 = \gamma_{00} + u_0$
Mixed-Effects Model: FCAT Writing = $\gamma_{00} + u_0 + r$

The intraclass correlation coefficient (ICC) was computed to determine the proportion of variance in the FCAT Writing variable that is accounted for by the schools. The ICC was .66, which is high, indicates nested data, and supports using multi-level modeling for the analysis. The model fit statistics from this model were used as the baseline for model comparisons (see Table 28).

Next, time was added as a predictor to the equation to make the unconditional growth model (see Model 2a). The variance components from this analysis showed how much of the variance in the model was accounted for by time. Time was significant in this equation (z = 14.6, p = <.0001), which indicated that there was variance in the slopes between schools. Therefore, time was set as a random effect, and the model was estimated.

Model 2a: Unconditional Growth Model
Level 1: FCAT Writing = $\beta_0 + \beta_1$*Time + r
Level 2: $\beta_0 = \gamma_{00} + u_0$
$\beta_1 = \gamma_{10} + u_1$

Mixed-Effects Model: FCAT Writing = $\gamma_{00} + \gamma_{10}$*Time + $u_0 + u_1$*Time + r

Both the intercept (t (2263) = 582.39, p <.0001) and time (t (2263) = 42.39, p <.0001) were significant parameters. The variance between schools increased by 14%, and the variance explained within schools increased (10%) when time was added to the model. To determine if the equation was not linear but curvilinear, time^2 was added to the equation so the variance could be compared. Results indicated that time^2 was significant (t (6901) = 32.47, p <.0001); however, adding time^2 did not explain any additional variance (see Model 2b). When time^3 was added to the equation with time^2, time^3 was also significant (t (6900) = -43.26, p <.0001), and all model fit indices improved. Although adding time^3 increased the amount of variance between schools, it increased the variance explained within schools by an additional 2%. Consequently, both $time^2$ and $time^3$ were retained in the polynomial growth model equation (see Model 2c).

Model 2b: Quadratic Growth Model
Level 1: FCAT Writing = $\beta_0 + \beta_1$*Time + β_2* $Time^2$ + r
Level 2: $\beta_0 = \gamma_{00} + u_0$
$\beta_1 = \gamma_{10} + u_1$
$\beta_2 = \gamma_{20}$

Mixed-Effects Model: FCAT Writing = $\gamma_{00} + \gamma_{10}$*Time + γ_{20}* $Time^2$ + $u_0 + u_1$ + r

Model 2c: Polynomial Growth Model
Level 1: FCAT Writing = $\beta_0 + \beta_1$*Time + β_2* $Time^2$ + β_3* $Time^3$ + r
Level 2: $\beta_0 = \gamma_{00} + u_0$
$\beta_1 = \gamma_{10} + u_1$
$\beta_2 = \gamma_{20}$
$\beta_2 = \gamma_{30}$

Mixed-Effects Model: FCAT Writing = $\gamma_{00} + \gamma_{10}$*Time + γ_{20}* $Time^2$ + γ_{30}* $Time^3$ + $u_0 + u_1$ + r

Next, school level was added to the Polynomial Growth Model to predict FCAT Writing (see Model 3). The significance of the parameter estimates determined if school level was significantly related to the FCAT Writing and if there was an interaction with time. This model adjusted the mean school FCAT Writing and the slope of FCAT Writing growth for school level. The parameter estimates for the intercept, time, $time^2$, $time^3$, and elementary school level when compared to middle school were all significant. The interactions between time, $time^2$, and $time^3$ with high school level compared to middle school were all significant. The interaction between $time^3$ and elementary school relative to middle school was also significant. All model fit indices indicated improved fit with this model (Table 39), even though they were negative, because lower fit statistics indicate better fit (Luke, 2004).

> The deviance for Model 1 is -332. The deviance for Model 2 is -334.5. A lower deviance always implies better fit…The level-2 slopes model (Model 3) [-353.8] is significantly better (Luke, 2004, p. 34)

This model still did not account for any additional between school variance, but did account for an additional 2% of the within school variance from the Polynomial Growth Model.

Model 3: School Level as Predictor

Level 1: FCAT Writing = $\beta_0 + \beta_1$*Time + β_2*$Time^2$ + β_3* $Time^3$ + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level
$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level

Mixed-Effects Model: FCAT Writing = γ_{00} + γ_{01}*School Level + γ_{10}*Time + γ_{11}*School Level*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + u_0 + u_1 + r

Table 30.

Model 3: Time, Time^2, Time^3, and School Level as Predictors of Writing

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		3.7927	0.0145	2261	261.6	<.0001	**
Time		-0.0876	0.02506	2261	-3.5	0.0005	**
Time^2		0.1389	0.02202	4522	6.31	<.0001	**
Time^3		-0.02407	0.00484	4522	-4.97	<.0001	**
School Level	Elementary	-0.1512	0.0165	4522	-9.16	<.0001	**
School Level	High	0.03239	0.02179	4522	1.49	0.1372	
School Level	Middle	0	.	.	.	.	
Time*School Level	Elementary	0.03876	0.02852	4522	1.36	0.1742	
Time*School Level	High	0.1059	0.03767	4522	2.81	0.005	**
Time*School Level	Middle	0	.	.	.	.	
Time^2*School Level	Elementary	0.004747	0.02506	4522	0.19	0.8498	
Time^2*School Level	High	-0.1164	0.0331	4522	-3.52	0.0004	**
Time^2*School Level	Middle	0	.	.	.	.	
Time^3*School Level	Elementary	-0.01115	0.005508	4522	-2.02	0.043	*
Time^3*School Level	High	0.01945	0.007275	4522	2.67	0.0075	**
Time^3*School Level	Middle	0	.	.	.	.	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	0.07343	0.00258	28.46	<.0001	**
$\tau_{(1,0)}$	-0.00483	0.000571	-8.47	<.0001	**
$\tau_{(1,1)}$	0.003258	0.00022	14.78	<.0001	**
Residual	0.01843	0.000387	47.58	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added student demographic variables to the School Level Model. This model was estimated twice. The first time, the model was estimated with high school as a school level and all of the demographic variables except gifted (see Model 4a). The second time, the data were filtered to exclude high school as a school level and keep the gifted variable with middle and elementary schools (see Model 4b). The model fit statistics of the demographic model with all three school levels was compared with the School Level as Predictor Model to determine if there was a better fit (see Table 39). The significance of the parameter estimates determined which of the demographic variables remained in the predictor equation (see Table 31). The variance estimates showed the amount of the total variance that was accounted for by each model. When all of the demographics variables except gifted were added to the model, the intercept was significant and the average middle school started with FCAT Writing score of 3.75 (t (2219) = 304.15, p <.0001). The parameter estimates for time, time^2, time^3, school level, free or reduced lunch status, minority, LEP, and students with disabilities were significant (see Model 4a). Interactions with time and time^2 were significant for high school level relative to middle school. Interactions with elementary school and time^3 were significant. All model fit indices indicated better fit with the addition of these demographics variables (see Table 39). Adding the demographics variables with school level explained 36% of the between school variance and 48% of the within school variance for a total of 40% of all variance explained.

Model 4a: Demographics by School Level (including High School and no Gifted)
Level 1: FCAT Writing = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD
$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD

Mixed-Effects Model: FCAT Writing = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}*SWD + γ_{05}*LEP + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}*SWD*Time + γ_{15}*LEP*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}*SWD*Time^2 + γ_{25}*LEP*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}*SWD*Time^3 + γ_{35}*LEP*Time^3 + u_0 + u_1 + r

Table 31.

Model 4a: Writing predicted by Time, School Level, and Demographics Variables No Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		3.7531	0.01234	2219	304.15	<.0001	**
Time		-0.07979	0.02597	2198	-3.07	0.0021	**
Time2		0.1446	0.02269	4210	6.37	<.0001	**
Time3		-0.02588	0.004978	4210	-5.2	<.0001	**
School Level	Elementary	-0.08797	0.0142	4210	-6.19	<.0001	**
School Level	High	-0.06373	0.01853	4210	-3.44	0.0006	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-0.1338	0.007245	4210	-18.47	<.0001	**
Minority		0.02856	0.008061	4210	3.54	0.0004	**
LEP		-0.02587	0.006946	4210	-3.72	0.0002	**
Disabilities		-0.06912	0.005461	4210	-12.66	<.0001	**
Time*School Level	Elementary	0.006534	0.03003	4210	0.22	0.8278	
Time*School Level	High	0.08497	0.03916	4210	2.17	0.0301	*
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-0.02532	0.01776	4210	-1.43	0.1541	
Time*Minority		-0.02819	0.01823	4210	-1.55	0.1221	
Time*LEP		0.01336	0.01506	4210	0.89	0.3752	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time*Disabilities		-0.00319	0.0128	4210	-0.25	0.8031	
Time2*School Level	Elementary	0.02574	0.02628	4210	0.98	0.3274	
Time2*School Level	High	-0.09024	0.03425	4210	-2.63	0.0085	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		0.0214	0.01553	4210	1.38	0.1684	
Time2*Minority		0.01391	0.0159	4210	0.87	0.3817	
Time2*LEP		0.007535	0.01304	4210	0.58	0.5633	
Time2*Disabilities		0.001642	0.01113	4210	0.15	0.8827	
Time3*School Level	Elementary	-0.01502	0.005769	4210	-2.6	0.0093	**
Time3*School Level	High	0.01369	0.007515	4210	1.82	0.0685	
Time3*School Level	Middle	0	.	.	.	.	
Time3*Free Reduced L		-0.00472	0.003404	4210	-1.39	0.1658	
Time3*Minority		-0.00192	0.003486	4210	-0.55	0.5821	
Time3*LEP		-0.00247	0.002845	4210	-0.87	0.3859	
Time3*Disabilities		7.53E-06	0.002432	4210	0	0.9975	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	0.04318	0.00176	24.53	<.0001	**
$\tau_{(1,0)}$	-0.00471	0.0005	-9.43	<.0001	**
$\tau_{(1,1)}$	0.003181	0.000227	14.04	<.0001	**
Residual	0.0183	0.000397	46.12	<.0001	**

Note: * $p < .05$; ** $p < .01$

For the elementary and middle schools with gifted students, the unconditional model was estimated to provide a baseline with which to compare the demographics model. The growth model was estimated to determine if time was fixed or random. Time in this dataset was also random because there was significant variance in the slope ($z = 43.78$, $p = <.0001$). The results from the analysis in Model 4b indicated that the intercept, school level, time, time^2, time^3, free or reduced lunch status, minority, LEP, students with disabilities, and gifted were all significant (see Table 32). The only significant interaction was between time^3 and elementary when compared to middle school. All of the model fit statistics indicated better model fit (see Table 40). When examining the variance of FCAT Writing in elementary and middle schools, adding demographics variables to the equation explained 36% of the between school variance and 51% of the within school variance. Two sets of analyses were conducted on the rest of the models in order to examine the relationship of gifted with technology integration as one of the predictors of school achievement.

Model 4b: Demographics by School Level (Elementary and Middle School only)

Level 1: $FCAT\ Writing = \beta_0 + \beta_1{*}Time + \beta_2{*}Time^2 + \beta_3{*}Time^3 + r$

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}{*}School\ Level + \gamma_{02}{*}SES + \gamma_{03}{*}Minority + \gamma_{04}{*}\ LEP + \gamma_{05}{*}\ SWD + \gamma_{06}{*}Gifted + u_0$

$\beta_1 = \gamma_{10} + \gamma_{11}{*}School\ Level + \gamma_{12}{*}SES + \gamma_{13}{*}Minority + \gamma_{14}{*}\ LEP + \gamma_{15}{*}\ SWD + \gamma_{16}{*}Gifted + u_1$

$\beta_2 = \gamma_{20} + \gamma_{21}{*}School\ Level + \gamma_{22}{*}SES + \gamma_{23}{*}Minority + \gamma_{24}{*}\ LEP + \gamma_{25}{*}\ SWD + \gamma_{26}{*}Gifted$

$\beta_3 = \gamma_{30} + \gamma_{31}{*}School\ Level + \gamma_{32}{*}SES + \gamma_{33}{*}Minority + \gamma_{34}{*}\ LEP + \gamma_{35}{*}\ SWD + \gamma_{36}{*}Gifted$

Mixed-Effects Model: $FCAT\ Writing = \gamma_{00} + \gamma_{01}{*}School\ Level + \gamma_{02}{*}SES + \gamma_{03}{*}Minority + \gamma_{04}{*}SWD + \gamma_{05}{*}LEP + \gamma_{06}{*}Gifted + \gamma_{10}{*}Time + \gamma_{11}{*}School\ Level{*}Time + \gamma_{12}{*}SES{*}Time + \gamma_{13}{*}Minority{*}Time + \gamma_{14}{*}\ LEP{*}Time + \gamma_{15}{*}\ SWD{*}Time + \gamma_{16}{*}Gifted{*}Time + \gamma_{20}{*}Time^2 + \gamma_{21}{*}School\ Level{*}Time^2 + \gamma_{22}{*}SES{*}Time^2 + \gamma_{23}{*}Minority{*}Time^2 + \gamma_{24}{*}\ LEP{*}Time^2 + \gamma_{25}{*}\ SWD{*}Time^2 + \gamma_{26}{*}Gifted{*}Time^2 + \gamma_{30}{*}Time^3 + \gamma_{31}{*}School\ Level{*}Time^3 + \gamma_{32}{*}SES{*}Time^3 + \gamma_{33}{*}Minority{*}Time^3 + \gamma_{34}{*}\ LEP{*}Time^3 + \gamma_{35}{*}\ SWD{*}Time^3 + \gamma_{36}{*}Gifted{*}Time^3 + u_0 + u_1 + r$

Table 32.

Model 4b: write predicted by Time, School Level, and Demographics Variables No High School includes Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		3.7384	0.01268	1792	294.8	<.0001	**
Time		-0.05448	0.02749	1725	-1.98	0.0477	*
Time2		0.1186	0.02408	3154	4.93	<.0001	**
Time3		-0.02014	0.005284	3154	-3.81	0.0001	**
School Level	Elementary	-0.06702	0.01473	3154	-4.55	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-0.117	0.008646	3154	-13.53	<.0001	**
Minority		0.02455	0.009529	3154	2.58	0.01	*
LEP		-0.01788	0.007535	3154	-2.37	0.0177	*
Students with Disabilities		-0.05299	0.006174	3154	-8.58	<.0001	**
Gifted		0.0714	0.0066	3154	10.82	<.0001	**
Time*School Level	Elementary	0.005895	0.03216	3154	0.18	0.8545	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-0.01305	0.02192	3154	-0.6	0.5517	
Time*Minority		-0.0376	0.02235	3154	-1.68	0.0926	
Time*LEP		0.01729	0.01716	3154	1.01	0.3136	
Time*Students with Disabilities		0.002766	0.01481	3154	0.19	0.8519	
Time*Gifted		-0.00719	0.01543	3154	-0.47	0.6415	
Time2*School Level	Elementary	0.03046	0.02818	3154	1.08	0.2799	
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		0.01128	0.01915	3154	0.59	0.5558	
Time2*Minority		0.02529	0.01944	3154	1.3	0.1933	
Time2*LEP		0.000242	0.01482	3154	0.02	0.987	
Time2*Students with Disabilities		-0.00294	0.01284	3154	-0.23	0.8188	
Time2*Gifted		0.000789	0.01337	3154	0.06	0.9529	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time3*School Level	Elementary	-0.01651	0.006187	3154	-2.67	0.0077	**
Time3*School Level	Middle	0	.	.	.	.	
Time3*Free Reduced Lunch		-0.00248	0.004192	3154	-0.59	0.5536	
Time3*Minority		-0.00475	0.004252	3154	-1.12	0.264	
Time3*LEP		-0.00061	0.003225	3154	-0.19	0.8496	
Time3*Students with Disabilities		0.000877	0.002797	3154	0.31	0.7538	
Time3*Gifted		0.000129	0.002916	3154	0.04	0.9648	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	0.04291	0.00199	21.57	<.0001	**
$\tau_{(1,0)}$	-0.00545	0.000598	-9.11	<.0001	**
$\tau_{(1,1)}$	0.003522	0.000279	12.61	<.0001	**
Residual	0.01905	0.000473	40.23	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added the variable that measures the School Learning Environment factors to the Demographics Model by School Level Model. These included teacher qualifications and positive learning environment. This model was estimated twice, first without gifted population but all school levels (see model 5a) and then with elementary and middle school levels and gifted population (see model 5b). When school learning environment factors were added with the demographic and school level variables for all school levels, the parameter estimates for the intercept, time^2, time^3, elementary and high school relative to middle school, free or reduced lunch status, minority, LEP, students with disabilities, teacher qualifications, and positive learning environment were significant (see Table 33). Time was the only variable that was not significant. The only significant interactions between time, time^2, and time^3 were with high school relative to middle school. Adding the student learning environment variables explained an additional 5% of the between school variance and maintained the same within school variance for a total of 43% of all of the variance explained. All of the model fit indices indicated that this model fit the data better (see Table 39).

Model 5a: School Learning Environment with Demographics by School Level (All School Levels without Gifted)
Level 1: FCAT Writing = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}*Positive Learning Environment + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}*LEP + γ_{15}*SWD + γ_{16}* Teacher Qualifications + γ_{17}*Positive Learning Environment + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}* Teacher Qualifications + γ_{27}*Positive Learning Environment

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{6}* Teacher Qualifications + γ_{37}*Positive Learning Environment

Mixed-Effects Model: FCAT Writing = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}*LEP*Time + γ_{15}*SWD *Time + γ_{16}* Teacher Qualifications*Time + γ_{17}* Positive Learning Environment*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}* Teacher Qualifications*Time^2 + γ_{27}* Positive Learning Environment*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}*LEP*Time^3 + γ_{35}*SWD*Time^3 + γ_{36}* Teacher Qualifications*Time^3 + γ_{37}* Positive Learning Environment*Time^3 + $u_0 + u_1 + r$

Table 33.

Model 5a: Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		3.8014	0.01415	2219	268.72	<.0001	**
Time		-0.04363	0.03273	2198	-1.33	0.1826	
Time2		0.106	0.02804	4202	3.78	0.0002	**
Time3		-0.01751	0.006065	4202	-2.89	0.0039	**
School Level	Elementary	-0.1521	0.01703	4202	-8.93	<.0001	**
School Level	High	-0.06334	0.01832	4202	-3.46	0.0006	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-0.1205	0.007406	4202	-16.27	<.0001	**
Minority		0.03718	0.008151	4202	4.56	<.0001	**
LEP		-0.03167	0.006865	4202	-4.61	<.0001	**
Students with Disabilities		-0.06198	0.005491	4202	-11.29	<.0001	**
Positive Learning Environment		0.03944	0.006373	4202	6.19	<.0001	**
Positive Teacher Qualifications		0.03127	0.004659	4202	6.71	<.0001	**
Time*School Level	Elementary	-0.03113	0.04054	4202	-0.77	0.4426	
Time*School Level	High	0.09486	0.04006	4202	2.37	0.0179	*
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-0.01133	0.01936	4202	-0.59	0.5584	
Time*Minority		-0.02507	0.01873	4202	-1.34	0.1807	
Time*LEP		0.00713	0.0154	4202	0.46	0.6434	
Time*Students with Disabilities		0.002793	0.01313	4202	0.21	0.8315	
Time*Positive Learning Environment		0.02237	0.01797	4202	1.24	0.2133	
Time*Positive Teacher Qualifications		0.004514	0.0123	4202	0.37	0.7137	
Time2*School Level	Elementary	0.06425	0.03515	4202	1.83	0.0676	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time2*School Level	High	-0.09504	0.03502	4202	-2.71	0.0067	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		0.01051	0.01707	4202	0.62	0.538	
Time2*Minority		0.01014	0.01629	4202	0.62	0.5338	
Time2*LEP		0.01104	0.01337	4202	0.83	0.4091	
Time2*Students with Disabilities		-0.00405	0.01139	4202	-0.36	0.7223	
Time2*Positive Learning Environment		-0.01875	0.01594	4202	-1.18	0.2395	
Time2*Positive Teacher Qualifications		-0.00872	0.01068	4202	-0.82	0.4139	
Time3*School Level	Elementary	-0.02335	0.007659	4202	-3.05	0.0023	**
Time3*School Level	High	0.01441	0.007677	4202	1.88	0.0605	
Time3*School Level	Middle	0	.	.	.	.	
Time3*Free Reduced L		-0.00231	0.003752	4202	-0.62	0.5379	
Time3*Minority		-0.00121	0.003568	4202	-0.34	0.734	
Time3*LEP		-0.00312	0.002921	4202	-1.07	0.2862	
Time3*Students with Disabilities		0.001183	0.002488	4202	0.48	0.6343	
Time3*Positive Learning Environment		0.003886	0.003508	4202	1.11	0.2681	
Time3*Positive Teacher Qualifications		0.002476	0.002325	4202	1.06	0.287	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	0.04012	0.001663	24.13	<.0001	**
$\tau_{(1,0)}$	-0.0045	0.000484	-9.31	<.0001	**
$\tau_{(1,1)}$	0.003094	0.000224	13.81	<.0001	**
Residual	0.01828	0.000396	46.15	<.0001	**

Note: * $p < .05$; ** $p < .01$

When the data were filtered to include only elementary and middle schools and gifted was also added to the equation, all intercept parameter estimates, elementary school, time^2, time^3, free or reduced lunch status, minority, LEP, students with disabilities, teacher qualifications, and positive learning environment were significant. Time was the only parameter that was not significant. The only significant interaction was between time^3 and elementary (see Table 34). This model demonstrated better fit than the previous model by all model fit indices (see Table 40). It explained 2% more of the between school variance and the same amount of the within school variance than the previous model and explained 45% of all the variance.

Model 5b: School Learning Environment with Demographics by School Level (Elementary and Middle Schools with Gifted)

Level 1: FCAT Writing = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}*Gifted + γ_{37}* Teacher Qualifications + γ_{38}* Positive Learning Environment

Mixed-Effects Model: FCAT Writing = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}* LEP*Time^3 + γ_{35}* SWD*Time^3 + γ_{36}*Gifted*Time^3 + γ_{37}* Teacher Qualifications*Time^3 + γ_{38}* Positive Learning Environment*Time^3 + $u_0 + u_1$ + r

Table 34.

Model 5b: Demographics and Student Learning Environment by School Level for Elementary and Middle School with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		3.7837	0.01579	1792	239.59	<.0001	**
Time		-0.0523	0.03765	1725	-1.39	0.165	
Time2		0.1017	0.03201	3146	3.18	0.0015	**
Time3		-0.01523	0.00689	3146	-2.21	0.0272	*
School Level	Elementary	-0.1281	0.01949	3146	-6.58	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-0.107	0.008804	3146	-12.15	<.0001	**
Minority		0.03147	0.009764	3146	3.22	0.0013	**
LEP		-0.02388	0.00757	3146	-3.16	0.0016	**
Students with Disabilities		-0.04995	0.006211	3146	-8.04	<.0001	**
Gifted		0.06232	0.006676	3146	9.34	<.0001	**
Positive Learning Environment		0.03653	0.008343	3146	4.38	<.0001	**
Positive Teacher Qualifications		0.02362	0.005412	3146	4.36	<.0001	**
Time*School Level	Elementary	0.008295	0.04781	3146	0.17	0.8623	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-0.00783	0.02362	3146	-0.33	0.7402	
Time*Minority		-0.03798	0.02282	3146	-1.66	0.0962	
Time*LEP		0.01399	0.01772	3146	0.79	0.4298	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time*Students with Disabilities		0.005403	0.01507	3146	0.36	0.72	
Time*Gifted		-0.00462	0.01577	3146	-0.29	0.7694	
Time*Positive Learning Environment		0.000179	0.02374	3146	0.01	0.994	
Time*Positive Teacher Qualifications		-0.00434	0.0142	3146	-0.31	0.7597	
Time2*School Level	Elementary	0.04715	0.04112	3146	1.15	0.2515	
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		0.00436	0.02081	3146	0.21	0.8341	
Time2*Minority		0.02404	0.01977	3146	1.22	0.2242	
Time2*LEP		0.003689	0.01536	3146	0.24	0.8102	
Time2*Students with Disabilities		-0.00594	0.01306	3146	-0.45	0.6494	
Time2*Gifted		0.000945	0.01365	3146	0.07	0.9448	
Time2*Positive Learning Environment		-0.00946	0.0208	3146	-0.45	0.6492	
Time2*Positive Teacher Qualifications		-0.0025	0.01237	3146	-0.2	0.8398	
Time3*School Level	Elementary	-0.02192	0.008914	3146	-2.46	0.014	*
Time3*School Level	Middle	0	.	.	.	.	
Time3*Free Reduced Lunch		-0.00051	0.004566	3146	-0.11	0.9118	
Time3*Minority		-0.00447	0.004319	3146	-1.03	0.3011	
Time3*LEP		-0.0015	0.003346	3146	-0.45	0.6538	
Time3*Students with Disabilities		0.001534	0.002843	3146	0.54	0.5895	
Time3*Gifted		-0.00019	0.002977	3146	-0.06	0.9486	
Time3*Positive Learning Environment		0.003115	0.004542	3146	0.69	0.4928	
Time3*Positive Teacher Qualifications		0.001369	0.002702	3146	0.51	0.6124	
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		0.04163	0.001942		21.44	<.0001	**
$\tau_{(1,0)}$		-0.00532	0.00059		-9.03	<.0001	**
$\tau_{(1,1)}$		0.003493	0.000278		12.56	<.0001	**
Residual		0.01896	0.000471		40.25	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added technology integration variables with the demographics, learning environment, and school level variables. These included student access to various types of software, teachers regularly using various types of software, frequency that students use various types of software, and technology support. This model was estimated twice, first without gifted population but all school levels (see model 6a) and then with elementary and middle school levels and gifted population (see model

6b). When the model was estimated with all school levels without gifted, the only significant technology parameter estimate was the frequency that students use content software (see Table 35). Other significant parameter estimates included the intercept, time^2, time^3, elementary and high school relative to middle school, free or reduced lunch status, minority, LEP, students with disabilities, positive learning environment, and positive teacher qualifications. Time was the only parameter that was not significant. The interactions of time and time^2 with high school relative to middle school and the interaction of time^3 with elementary school relative to middle school were also significant. Only -2 Log Likelihood index of model fit indicated that this model had better fit (see Table 39). This model explained no additional variance. One technology integration indicator was retained in the final model for all school levels without gifted, the frequency that students use content software.

Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Level 1: FCAT Writing = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Access Content SW + γ_{09}*Access Office SW + γ_{010}*Access Ad Prod SW + γ_{011}*Teachers Use Deliver Instruction + γ_{012}*Teachers use Admin + γ_{013}*Frequency Students Use Content + γ_{014}*Frequency Students Use Tool + γ_{015}*Technical Support Human + γ_{016}*Technical Support Hardware + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}* Teacher Qualifications + γ_{17}* Positive Learning Environment + γ_{18}*Access Content SW + γ_{19}*Access Office SW + γ_{110}*Access Ad Prod SW + γ_{111}*Teachers Use Deliver Instruction + γ_{112}*Teachers use Admin + γ_{113}*Frequency Students Use Content + γ_{114}*Frequency Students Use Tool + γ_{115}*Technical Support Human + γ_{116}*Technical Support Hardware + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}* Teacher Qualifications + γ_{27}* Positive Learning Environment + γ_{28}*Access Content SW + γ_{29}*Access Office SW + γ_{210}*Access Ad Prod SW + γ_{211}*Teachers Use Deliver Instruction + γ_{212}*Teachers use Admin + γ_{213}*Frequency Students Use Content + γ_{214}*Frequency Students Use Tool + γ_{215}*Technical Support Human + γ_{216}*Technical Support Hardware
$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}* Teacher Qualifications + γ_{37}* Positive Learning Environment + γ_{38}*Access Content SW + γ_{39}*Access Office SW + γ_{310}*Access Ad Prod SW + γ_{311}*Teachers Use Deliver Instruction + γ_{312}*Teachers use Admin + γ_{313}*Frequency Students Use Content + γ_{314}*Frequency Students Use Tool + γ_{315}*Technical Support Human + γ_{316}*Technical Support Hardware

Mixed-Effects Model: FCAT Writing = γ_{00} + γ_{01}*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Access Content SW + γ_{09}*Access Office SW + γ_{010}*Access Ad Prod SW + γ_{011}*Teachers Use Deliver Instruction + γ_{012}*Teachers use Admin + γ_{013}*Frequency Students Use Content + γ_{014}*Frequency Students Use Tool + γ_{015}*Technical Support Human + γ_{016}*Technical Support Hardware + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Teacher Qualifications*Time + γ_{17}* Positive Learning Environment*Time + γ_{18}*Access Content SW*Time + γ_{19}*Access Office SW*Time + γ_{110}*Access Ad Prod SW*Time + γ_{111}*Teachers Use Deliver Instruction*Time + γ_{112}*Teachers use Admin*Time + γ_{113}*Frequency Students Use Content*Time + γ_{114}*Frequency Students Use Tool*Time + γ_{115}*Technical Support Human*Time + γ_{116}*Technical Support Hardware*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Teacher Qualifications*Time^2 + γ_{27}* Positive Learning Environment*Time^2 + γ_{28}*Access Content SW*Time^2 + γ_{29}*Access Office SW*Time^2 + γ_{210}*Access Ad Prod SW*Time^2 + γ_{211}*Teachers Use Deliver Instruction*Time^2 + γ_{212}*Teachers use Admin*Time^2 + γ_{213}*Frequency Students Use Content*Time^2 + γ_{214}*Frequency Students Use Tool*Time^2 + γ_{215}*Technical Support Human*Time^2 + γ_{216}*Technical Support Hardware*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}* LEP*Time^3 + γ_{35}* SWD*Time^3 + γ_{36}*Teacher Qualifications*Time^3 + γ_{37}* Positive Learning Environment*Time^3 + γ_{38}*Access Content SW*Time^3 + γ_{39}*Access Office SW*Time^3 + γ_{310}*Access Ad Prod SW*Time^3 + γ_{311}*Teachers Use Deliver Instruction*Time^3 + γ_{312}*Teachers use Admin*Time^3 + γ_{313}*Frequency Students Use Content*Time^3 + γ_{314}*Frequency Students Use Tool*Time^3 + γ_{315}*Technical Support Human*Time^3 + γ_{316}*Technical Support Hardware*Time^3 + u_0 + u_1 + r

Table 35.

Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		3.7976	0.01437	2219	264.29	<.0001	**
Time		-0.05663	0.03441	2198	-1.65	0.1	
Time2		0.1181	0.02954	4166	4	<.0001	**
Time3		-0.01994	0.006387	4166	-3.12	0.0018	**
School Level	Elementary	-0.147	0.01741	4166	-8.44	<.0001	**
School Level	High	-0.06442	0.01839	4166	-3.5	0.0005	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-0.1196	0.007533	4166	-15.88	<.0001	**
Minority		0.03726	0.008172	4166	4.56	<.0001	**
LEP		-0.03057	0.006881	4166	-4.44	<.0001	**
Students with Disabilities		-0.06104	0.005481	4166	-11.14	<.0001	**
Positive Learning Environment		0.03802	0.006388	4166	5.95	<.0001	**
Positive Teacher Qualifications		0.03128	0.004661	4166	6.71	<.0001	**
Access Content Software		0.007328	0.004649	4166	1.58	0.115	
Access Office Software		-0.00217	0.004609	4166	-0.47	0.6378	
Access Advanced Production Software		-0.00567	0.004704	4166	-1.21	0.2279	
Teachers Use to Deliver		0.002398	0.005145	4166	0.47	0.6412	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Instruction							
Teachers Use for Administrative Purposes		-0.00102	0.005295	4166	-0.19	0.8468	
Frequency that Students Use Content Software		-0.01284	0.004256	4166	-3.02	0.0026	**
Frequency Students Use Tool-Based Software		0.007223	0.004579	4166	1.58	0.1147	
Technical Support Human		-0.00369	0.004219	4166	-0.88	0.3816	
Technical Support Hardware		-0.00452	0.004065	4166	-1.11	0.2662	
Time*School Level	Elementary	-0.01378	0.04319	4166	-0.32	0.7496	
Time*School Level	High	0.09666	0.04068	4166	2.38	0.0175	*
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-0.00916	0.01978	4166	-0.46	0.6434	
Time*Minority		-0.01948	0.01896	4166	-1.03	0.3043	
Time*LEP		0.004152	0.01548	4166	0.27	0.7886	
Time*Students with Disabilities		0.005154	0.01315	4166	0.39	0.6951	
Time*Positive Learning Environment		0.0242	0.01812	4166	1.34	0.1818	
Time*Positive Teacher Qualifications		0.002198	0.01247	4166	0.18	0.8601	
Time*Access Content Software		-0.0102	0.01453	4166	-0.7	0.4827	
Time*Access Office Software		0.01321	0.01443	4166	0.92	0.3602	
Time*Access Advanced Production Software		0.0116	0.01442	4166	0.8	0.4212	
Time*Teachers Use to Deliver Instruction		0.003405	0.01614	4166	0.21	0.8329	
Time*Teachers Use for Administrative Purposes		0.01203	0.01641	4166	0.73	0.4636	
Time*Frequency that Students Use Content Software		0.000921	0.01408	4166	0.07	0.9478	
Time*Frequency Students Use Tool-Based Software		-0.00387	0.01488	4166	-0.26	0.7948	
Time*Technical Support Human		0.0101	0.01262	4166	0.8	0.4239	
Time*Technical Support Hardware		0.007637	0.01285	4166	0.59	0.5523	
Time2*School Level	Elementary	0.0477	0.03762	4166	1.27	0.2049	
Time2*School Level	High	-0.09453	0.03559	4166	-2.66	0.0079	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		0.006524	0.01747	4166	0.37	0.7089	
Time2*Minority		0.006105	0.01649	4166	0.37	0.7113	
Time2*LEP		0.01324	0.01345	4166	0.98	0.3248	
Time2*Students with Disabilities		-0.00664	0.01141	4166	-0.58	0.5609	
Time2*Positive Learning Environment		-0.02039	0.01606	4166	-1.27	0.2043	
Time2*Positive Teacher		-0.00613	0.01089	4166	-0.56	0.5733	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Qualifications							
Time2*Access Content Software		0.007102	0.01259	4166	0.56	0.5726	
Time2*Access Office Software		-0.00558	0.01247	4166	-0.45	0.6549	
Time2*Access Advanced Production Software		-0.00765	0.01249	4166	-0.61	0.5403	
Time2*Teachers Use to Deliver Instruction		-0.00457	0.014	4166	-0.33	0.7442	
Time2*Teachers Use for Administrative Purposes		-0.00971	0.01412	4166	-0.69	0.4918	
Time2*Frequency that Students Use Content Software		0.006991	0.01225	4166	0.57	0.5681	
Time2*Frequency Students Use Tool-Based Software		-0.00509	0.01309	4166	-0.39	0.6975	
Time2*Technical Support Human		-0.00567	0.01099	4166	-0.52	0.6056	
Time2*Technical Support Hardware		0.002376	0.0111	4166	0.21	0.8306	
Time3*School Level	Elementary	-0.02003	0.008207	4166	-2.44	0.0147	*
Time3*School Level	High	0.01433	0.007806	4166	1.84	0.0664	
Time3*School Level	Middle	0	.	.	.	.	
Time3*Free Reduced Lunch		-0.00133	0.003847	4166	-0.35	0.7298	
Time3*Minority		-0.00042	0.00361	4166	-0.12	0.9065	
Time3*LEP		-0.0036	0.002939	4166	-1.22	0.2209	
Time3*Students with Disabilities		0.001799	0.002492	4166	0.72	0.4704	
Time3*Positive Learning Environment		0.004256	0.003534	4166	1.2	0.2286	
Time3*Positive Teacher Qualifications		0.001818	0.002379	4166	0.76	0.4446	
Time3*Access Content Software		-0.00119	0.002757	4166	-0.43	0.6666	
Time3*Access Office Software		0.000633	0.002725	4166	0.23	0.8164	
Time3*Access Advanced Production Software		0.001412	0.002726	4166	0.52	0.6044	
Time3*Teachers Use to Deliver Instruction		0.001177	0.003068	4166	0.38	0.7012	
Time3*Teachers Use for Administrative Purposes		0.0021	0.003077	4166	0.68	0.4949	
Time3*Frequency that Students Use Content Software		-0.00182	0.002679	4166	-0.68	0.497	
Time3*Frequency Students Use Tool-Based Software		0.00149	0.002896	4166	0.51	0.6069	
Time3*Technical Support Human		0.001105	0.002411	4166	0.46	0.6469	
Time3*Technical Support Hardware		-0.00164	0.002431	4166	-0.68	0.4995	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	0.03988	0.001656	24.08	<.0001	**
$\tau_{(1,0)}$	-0.00436	0.000479	-9.09	<.0001	**
$\tau_{(1,1)}$	0.003014	0.000222	13.59	<.0001	**
Residual	0.01818	0.000395	46.08	<.0001	**

Note: * $p < .05$; ** $p < .01$

No technology indicator was significant with the elementary and middle school data with gifted. The parameter estimates for the intercept, elementary school relative to middle school, time^2, time^3, free or reduced lunch status, minority, LEP, students with disabilities, gifted, teacher qualifications, and positive learning environment were significant. Time was not significant. The only interaction that was significant was time^{3}and elementary relative to middle school (see Table 36). Only the -2 Log Likelihood index indicated that this model had better fit (see Table 40). Adding the technology integration indicators to the model did not explain any additional variance in the model. Because there were no significant technology indicators, all technology indicators were dropped from the model when magnet school status was added.

Model 6b: Technology Integration with Demographics and Student Learning Environment by School Level (Elementary and Middle Schools with Gifted)
Level 1: FCAT Writing = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Access Content SW + γ_{010}*Access Office SW + γ_{011}*Access Ad Prod SW + γ_{012}*Teachers Use Deliver Instruction + γ_{013}*Teachers use Admin + γ_{014}*Frequency Students Use Content + γ_{015}*Frequency Students Use Tool + γ_{016}*Technical Support Human + γ_{017}*Technical Support Hardware + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + γ_{19}*Access Content SW + γ_{110}*Access Office SW + γ_{111}*Access Ad Prod SW + γ_{112}*Teachers Use Deliver Instruction + γ_{113}*Teachers use Admin + γ_{114}*Frequency Students Use Content + γ_{115}*Frequency Students Use Tool + γ_{116}*Technical Support Human + γ_{117}*Technical Support Hardware + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment + γ_{29}*Access Content SW + γ_{210}*Access Office SW + γ_{211}*Access Ad Prod SW + γ_{212}*Teachers Use Deliver Instruction + γ_{213}*Teachers use Admin + γ_{214}*Frequency Students Use Content + γ_{215}*Frequency Students Use Tool + γ_{216}*Technical Support Human + γ_{217}*Technical Support Hardware

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}*Gifted + γ_{37}* Teacher Qualifications + γ_{38}* Positive Learning Environment + γ_{39}*Access Content SW + γ_{310}*Access Office SW + γ_{311}*Access Ad Prod SW + γ_{312}*Teachers Use Deliver Instruction + γ_{313}*Teachers use Admin + γ_{314}*Frequency Students Use Content + γ_{315}*Frequency Students Use Tool + γ_{316}*Technical Support Human + γ_{317}*Technical Support Hardware

Mixed-Effects Model: FCAT Writing = γ_{00} + γ_{01}*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Access Content SW + γ_{010}*Access Office SW + γ_{011}*Access Ad Prod SW + γ_{012}*Teachers Use Deliver Instruction + γ_{013}*Teachers use Admin + γ_{014}*Frequency Students Use Content + γ_{015}*Frequency Students Use Tool + γ_{016}*Technical Support Human + γ_{017}*Technical Support Hardware + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{19}*Access Content SW*Time + γ_{110}*Access Office SW*Time + γ_{111}*Access Ad Prod SW*Time + γ_{112}*Teachers Use Deliver Instruction*Time + γ_{113}*Teachers use Admin*Time + γ_{114}*Frequency Students Use Content*Time + γ_{115}*Frequency Students Use Tool*Time + γ_{116}*Technical Support Human*Time + γ_{117}*Technical Support Hardware*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + γ_{29}*Access Content SW*Time^2 + γ_{210}*Access Office SW*Time^2 + γ_{211}*Access Ad Prod SW*Time^2 + γ_{212}*Teachers Use Deliver Instruction*Time^2 + γ_{213}*Teachers use Admin*Time^2 + γ_{214}*Frequency Students Use Content*Time^2 + γ_{215}*Frequency Students Use Tool*Time^2 + γ_{216}*Technical Support Human*Time^2 + γ_{217}*Technical Support Hardware*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}* LEP*Time^3 + γ_{35}* SWD*Time^3 + γ_{36}*Gifted*Time^3 + γ_{37}* Teacher Qualifications*Time^3 + γ_{38}* Positive Learning Environment*Time^3 + γ_{39}*Access Content SW*Time^3 + γ_{310}*Access Office SW*Time^3 + γ_{311}*Access Ad Prod SW*Time^3 + γ_{312}*Teachers Use Deliver Instruction*Time^3 + γ_{313}*Teachers use Admin*Time^3 + γ_{314}*Frequency Students Use Content*Time^3 + γ_{315}*Frequency Students Use Tool*Time^3 + γ_{316}*Technical Support Human*Time^3 + γ_{317}*Technical Support Hardware*Time^3 + u_0 + u_1 + r

Table 36.

Model 6b: Technology Integration with Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		3.7821	0.01609	1792	235.03	<.0001	**
Time		-0.06294	0.03962	1725	-1.59	0.1124	
Time2		0.1118	0.03374	3110	3.32	0.0009	**
Time3		-0.0174	0.007258	3110	-2.4	0.0166	*
School Level	Elementary	-0.1259	0.01994	3110	-6.31	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-0.1057	0.008973	3110	-11.78	<.0001	**
Minority		0.03066	0.009804	3110	3.13	0.0018	**
LEP		-0.02294	0.007585	3110	-3.02	0.0025	**
Students with Disabilities		-0.04931	0.006202	3110	-7.95	<.0001	**
Gifted		0.06242	0.006706	3110	9.31	<.0001	**
Positive Learning Environment		0.03538	0.008356	3110	4.23	<.0001	**
Positive Teacher Qualifications		0.02375	0.005408	3110	4.39	<.0001	**
Access Content Software		0.008497	0.005475	3110	1.55	0.1207	
Access Office Software		0.000562	0.005219	3110	0.11	0.9143	
Access Advanced Production Software		-0.00391	0.005461	3110	-0.72	0.4744	
Teachers Use to Deliver		0.001141	0.006011	3110	0.19	0.8494	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*
Instruction						
Teachers Use for Administrative Purposes		-0.00236	0.006299	3110	-0.37	0.7077
Frequency that Students Use Content Software		-0.00972	0.005023	3110	-1.93	0.0531
Frequency Students Use Tool-Based Software		0.003688	0.005274	3110	0.7	0.4844
Technical Support Human		-0.00595	0.004975	3110	-1.2	0.2317
Technical Support Hardware		-0.00712	0.004676	3110	-1.52	0.128
Time*School Level	Elementary	0.02292	0.05075	3110	0.45	0.6516
Time*School Level	Middle	0	.	.	.	.
Time*Free Reduced Lunch		-0.01032	0.02419	3110	-0.43	0.6697
Time*Minority		-0.03125	0.02308	3110	-1.35	0.1758
Time*LEP		0.009833	0.01779	3110	0.55	0.5806
Time*Students with Disabilities		0.00877	0.01511	3110	0.58	0.5618
Time*Gifted		-0.00676	0.01596	3110	-0.42	0.672
Time*Positive Learning Environment		0.004399	0.02391	3110	0.18	0.854
Time*Positive Teacher Qualifications		-0.00789	0.0144	3110	-0.55	0.5837
Time*Access Content Software		-0.00417	0.01691	3110	-0.25	0.8054
Time*Access Office Software		0.000143	0.01635	3110	0.01	0.993
Time*Access Advanced Production Software		0.001623	0.01645	3110	0.1	0.9214
Time*Teachers Use to Deliver Instruction		0.009942	0.01891	3110	0.53	0.5991
Time*Teachers Use for Administrative Purposes		0.00786	0.01947	3110	0.4	0.6864
Time*Frequency that Students Use Content Software		-0.0018	0.01684	3110	-0.11	0.9148
Time*Frequency Students Use Tool-Based Software		0.005861	0.01729	3110	0.34	0.7346
Time*Technical Support Human		0.01917	0.01486	3110	1.29	0.197
Time*Technical Support Hardware		0.02102	0.01479	3110	1.42	0.1555
Time2*School Level	Elementary	0.03295	0.04384	3110	0.75	0.4524
Time2*School Level	Middle	0	.	.	.	.
Time2*Free Reduced Lunch		0.003323	0.02133	3110	0.16	0.8762
Time2*Minority		0.01923	0.02	3110	0.96	0.3363
Time2*LEP		0.007586	0.01544	3110	0.49	0.6232
Time2*Students with Disabilities		-0.00932	0.01309	3110	-0.71	0.4764
Time2*Gifted		0.003252	0.0138	3110	0.24	0.8138
Time2*Positive Learning Environment		-0.01381	0.02094	3110	-0.66	0.5097
Time2*Positive Teacher		0.000841	0.01262	3110	0.07	0.9469

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Qualifications							
Time2*Access Content Software		0.000846	0.01462	3110	0.06	0.9539	
Time2*Access Office Software		0.002699	0.01409	3110	0.19	0.8482	
Time2*Access Advanced Production Software		0.00179	0.01425	3110	0.13	0.9	
Time2*Teachers Use to Deliver Instruction		-0.01033	0.01637	3110	-0.63	0.5282	
Time2*Teachers Use for Administrative Purposes		-0.00621	0.01661	3110	-0.37	0.7087	
Time2*Frequency that Students Use Content Software		0.01002	0.01465	3110	0.68	0.4941	
Time2*Frequency Students Use Tool-Based Software		-0.01237	0.01519	3110	-0.81	0.4155	
Time2*Technical Support Human		-0.01336	0.01287	3110	-1.04	0.2994	
Time2*Technical Support Hardware		-0.00575	0.01275	3110	-0.45	0.6521	
Time3*School Level	Elementary	-0.01891	0.009519	3110	-1.99	0.0471	*
Time3*School Level	Middle	0	.	.	.	.	
Time3*Free Reduced Lunch		-0.00006	0.004686	3110	-0.01	0.9906	
Time3*Minority		-0.00348	0.004368	3110	-0.8	0.4263	
Time3*LEP		-0.00242	0.003365	3110	-0.72	0.4716	
Time3*Students with Disabilities		0.002351	0.002851	3110	0.82	0.4096	
Time3*Gifted		-0.00073	0.003006	3110	-0.24	0.8093	
Time3*Positive Learning Environment		0.00411	0.004572	3110	0.9	0.3687	
Time3*Positive Teacher Qualifications		0.000586	0.002766	3110	0.21	0.8322	
Time3*Access Content Software		0.00017	0.003205	3110	0.05	0.9577	
Time3*Access Office Software		-0.00079	0.003073	3110	-0.26	0.798	
Time3*Access Advanced Production Software		-0.00076	0.003116	3110	-0.24	0.808	
Time3*Teachers Use to Deliver Instruction		0.002396	0.003582	3110	0.67	0.5036	
Time3*Teachers Use for Administrative Purposes		0.001487	0.003603	3110	0.41	0.6798	
Time3*Frequency that Students Use Content Software		-0.00255	0.003202	3110	-0.79	0.4267	
Time3*Frequency Students Use Tool-Based Software		0.002975	0.003354	3110	0.89	0.3751	
Time3*Technical Support Human		0.002882	0.002816	3110	1.02	0.3063	
Time3*Technical Support Hardware		-0.0003	0.002783	3110	-0.11	0.9148	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	0.04139	0.001936	21.38	<.0001	**
$\tau_{(1,0)}$	-0.00519	0.000585	-8.87	<.0001	**
$\tau_{(1,1)}$	0.003402	0.000275	12.36	<.0001	**
Residual	0.01885	0.000469	40.17	<.0001	**

Note: * $p < .05$; ** $p < .01$

The last model estimated in order to answer the third hypothesis for predicting FCAT Writing achievement included all school levels, demographic, student learning environment, and significant technology integration variables. These models were different because the model fit to the data for all schools levels without gifted included one technology integration variable – frequency that students use content software (see model 7a). The final model fitted to the data with elementary and middle school levels and gifted included no technology integration variables. For the model with all schools levels and without gifted, the same parameter estimates and interactions identified in the previous models as significant were significant again (see Table 37). Although there was no difference in the percentage of variance explained in this model than was in the Demographic Model with Student Learning Environment by school level or the Technology Integration with Demographic and Student Learning Environment Model by school level, the AIC, AICC, and BIC indices all indicated better model fit (see Table 39). The level-1 residuals for the final model for predicting FCAT Writing using all school levels without gifted ranged between -0.53 and 0.48 with a standard deviation of 0.11. Although there were outliers, skewness was -0.09 and kurtosis was 0.87, which would indicate that the residuals were evenly distributed. Distribution of the empirical bayes intercepts ranged between -0.58 and 0.70 with standard deviation of 0.18. Skewness was 0.38, and kurtosis was 0.56, which indicated that the intercept residuals at level-2 were also normally distributed. Distribution of the empirical bayes slopes ranged between -0.19 and 0.16 with standard deviation of 0.04. Skewness was 0.17, and kurtosis was 1.18, which indicated that the slope residuals at level-2 were within acceptable range.

Final Model 7a: Significant Technology Integration Indicators with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Level 1: FCAT Writing = $\beta_0 + \beta_1$*Time + β_2*Time^2 + β_3*Time^3 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Frequency Students Use Content + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}* Teacher Qualifications + γ_{17}* Positive Learning Environment + γ_{18}*Frequency Students Use Content + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}* Teacher Qualifications + γ_{27}* Positive Learning Environment + γ_{28}*Frequency Students Use Content

$\beta_3 = \gamma_{30} + \gamma_{31}$*School Level + γ_{32}*SES + γ_{33}*Minority + γ_{34}* LEP + γ_{35}* SWD + γ_{36}* Teacher Qualifications + γ_{37}* Positive Learning Environment + γ_{38}*Frequency Students Use Content

Mixed-Effects Model: FCAT Writing = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Frequency Students Use Content + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Teacher Qualifications*Time + γ_{17}* Positive Learning Environment*Time + γ_{18}*Frequency Students Use Content*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Teacher Qualifications*Time^2 + γ_{27}* Positive Learning Environment*Time^2 + γ_{28}*Frequency Students Use Content*Time^2 + γ_{30}*Time^3 + γ_{31}*School Level*Time^3 + γ_{32}*SES*Time^3 + γ_{33}*Minority*Time^3 + γ_{34}* LEP*Time^3 + γ_{35}* SWD*Time^3 + γ_{36}*Teacher Qualifications*Time^3 + γ_{37}* Positive Learning Environment*Time^3 + γ_{38}*Frequency Students Use Content*Time^3 + γ_{310}*Teachers use Admin*Time^3 + $u_0 + u_1 + r$

Table 37.

Final Model 7a: Significant Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		3.7984	0.01416	2219	268.16	<.0001	**
Time		-0.04304	0.03294	2198	-1.31	0.1915	
Time2		0.1071	0.0282	4198	3.8	0.0001	**
Time3		-0.0178	0.006098	4198	-2.92	0.0035	**
School Level	Elementary	-0.1481	0.01707	4198	-8.67	<.0001	**
School Level	High	-0.06466	0.0183	4198	-3.53	0.0004	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-0.1201	0.007399	4198	-16.23	<.0001	**
Minority		0.03788	0.008142	4198	4.65	<.0001	**
LEP		-0.03106	0.006858	4198	-4.53	<.0001	**
Students with Disabilities		-0.06171	0.005483	4198	-11.26	<.0001	**
Positive Learning Environment		0.03906	0.006364	4198	6.14	<.0001	**
Positive Teacher Qualifications		0.03128	0.004652	4198	6.72	<.0001	**
Frequency that Students Use Content Software		-0.01147	0.004053	4198	-2.83	0.0047	**
Time*School Level	Elementary	-0.03231	0.04084	4198	-0.79	0.429	
Time*School Level	High	0.1003	0.04014	4198	2.5	0.0125	*
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-0.00986	0.01949	4198	-0.51	0.6128	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time*Minority		-0.02561	0.01874	4198	-1.37	0.1718	
Time*LEP		0.006756	0.01541	4198	0.44	0.6611	
Time*Students with Disabilities		0.003128	0.01314	4198	0.24	0.8118	
Time*Positive Learning Environment		0.02404	0.01798	4198	1.34	0.1813	
Time*Positive Teacher Qualifications		0.004747	0.01232	4198	0.39	0.7	
Time*Frequency that Students Use Content Software		0.0049	0.01276	4198	0.38	0.701	
Time2*School Level	Elementary	0.06313	0.03538	4198	1.78	0.0744	
Time2*School Level	High	-0.09909	0.03509	4198	-2.82	0.0048	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		0.008596	0.0172	4198	0.5	0.6173	
Time2*Minority		0.01034	0.0163	4198	0.63	0.5259	
Time2*LEP		0.01119	0.01338	4198	0.84	0.4029	
Time2*Students with Disabilities		-0.00447	0.0114	4198	-0.39	0.6948	
Time2*Positive Learning Environment		-0.0201	0.01595	4198	-1.26	0.2077	
Time2*Positive Teacher Qualifications		-0.00913	0.0107	4198	-0.85	0.3935	
Time2*Frequency that Students Use Content Software		0.002287	0.01102	4198	0.21	0.8355	
Time3*School Level	Elementary	-0.02303	0.007703	4198	-2.99	0.0028	**
Time3*School Level	High	0.0152	0.007694	4198	1.98	0.0483	*
Time3*School Level	Middle	0	.	.	.	.	
Time3*Free Reduced Lunch		-0.0019	0.003783	4198	-0.5	0.6164	
Time3*Minority		-0.00123	0.003571	4198	-0.34	0.7315	
Time3*LEP		-0.00314	0.002923	4198	-1.08	0.282	
Time3*Students with Disabilities		0.001281	0.00249	4198	0.51	0.6069	
Time3*Positive Learning Environment		0.004171	0.003511	4198	1.19	0.235	
Time3*Positive Teacher Qualifications		0.002561	0.002331	4198	1.1	0.272	
Time3*Frequency that Students Use Content Software		-0.00074	0.002405	4198	-0.31	0.7598	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	0.03993	0.001658	24.09	<.0001	**
$\tau_{(1,0)}$	-0.00441	0.000481	-9.15	<.0001	**
$\tau_{(1,1)}$	0.003048	0.000223	13.67	<.0001	**
Residual	0.01829	0.000396	46.13	<.0001	**

Note: * $p < .05$; ** $p < .01$

The last step was to add in USDOE funded Magnet Schools and USDOE Technology Magnet Schools as variables in the model. Results of this model indicated that neither the interaction between time nor $time^2$ with U.S. technology magnet school was a significant predictor of FCAT Writing with the data at all school levels without gifted; however, the interaction between time and $time^2$ with U.S. magnet school status was a significant predictor of FCAT Writing (see Table 38). Neither U.S. magnet school status nor U.S. technology magnet school status were significant with the data with elementary and middle schools and gifted.

Table 38.

Model 8a: Magnet Schools with Significant Technology Integration Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		3.7697	0.0689	2217	54.71	<.0001	**
Time		-0.07478	0.1494	2196	-0.5	0.6166	
Time2		0.06203	0.1299	4194	0.48	0.6329	
Time3		0.001923	0.02848	4194	0.07	0.9462	
School Level	Elementary	-0.1491	0.01709	4194	-8.73	<.0001	**
School Level	High	-0.06492	0.0183	4194	-3.55	0.0004	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		-0.1197	0.0074	4194	-16.18	<.0001	**
Minority		0.03851	0.00818	4194	4.71	<.0001	**
LEP		-0.03138	0.006869	4194	-4.57	<.0001	**
Students with Disabilities		-0.0617	0.00549	4194	-11.24	<.0001	**
Positive Learning Environment		0.03928	0.006365	4194	6.17	<.0001	**
Positive Teacher Qualifications		0.03131	0.00465	4194	6.73	<.0001	**
Frequency that Students Use Content Software		-0.0117	0.004055	4194	-2.89	0.0039	**
Not a Technology Magnet School - US		-0.00367	0.07864	4194	-0.05	0.9627	
Technology Magnet School - US		0	.	.	.	.	
Not a US Magnet School		0.03393	0.04088	4194	0.83	0.4066	
US Magnet School		0	.	.	.	.	
Time*School Level	Elementary	-0.02877	0.04083	4194	-0.7	0.4811	
Time*School Level	High	0.1026	0.0401	4194	2.56	0.0105	*
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		-0.01147	0.01949	4194	-0.59	0.5563	
Time*Minority		-0.02806	0.01877	4194	-1.49	0.1351	
Time*LEP		0.008347	0.01542	4194	0.54	0.5884	
Time*Students with Disabilities		0.004177	0.01315	4194	0.32	0.7507	
Time*Positive		0.02444	0.01797	4194	1.36	0.1739	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Learning Environment							
Time*Positive Teacher Qualifications		0.004482	0.0123	4194	0.36	0.7157	
Time*Frequency that Students Use Content Software		0.00452	0.01275	4194	0.35	0.723	
Time*Not a Technology Magnet School - US		0.2215	0.1702	4194	1.3	0.1932	
Time*Technology Magnet School - US		0	.	.	.	.	
Time*Not a US Magnet School		-0.1955	0.08854	4194	-2.21	0.0273	*
Time*US Magnet School		0	.	.	.	.	
Time2*School Level	Elementary	0.06002	0.03536	4194	1.7	0.0897	
Time2*School Level	High	-0.1012	0.03506	4194	-2.89	0.0039	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		0.01012	0.0172	4194	0.59	0.5563	
Time2*Minority		0.01261	0.01633	4194	0.77	0.4399	
Time2*LEP		0.009714	0.01339	4194	0.73	0.4681	
Time2*Students with Disabilities		-0.00503	0.01141	4194	-0.44	0.6594	
Time2*Positive Learning Environment		-0.02067	0.01595	4194	-1.3	0.1949	
Time2*Positive Teacher Qualifications		-0.00874	0.01069	4194	-0.82	0.4134	
Time2*Frequency that Students Use Content Software		0.002916	0.01101	4194	0.26	0.7911	
Time2*Not a Technology Magnet School - US		-0.112	0.1484	4194	-0.75	0.4505	
Time2*Technology Magnet School - US		0	.	.	.	.	
Time*Not a US Magnet School		0.1623	0.07758	4194	2.09	0.0365	*
Time*US Magnet School		0	.	.	.	.	
Time3*School Level	Elementary	-0.02234	0.007699	4194	-2.9	0.0037	**
Time3*School Level	High	0.01563	0.007686	4194	2.03	0.042	*
Time3*School Level	Middle	0	.	.	.	.	
Time3*Free Reduced Lunch		-0.00224	0.003782	4194	-0.59	0.5541	
Time3*Minority		-0.00172	0.003575	4194	-0.48	0.63	
Time3*LEP		-0.00282	0.002924	4194	-0.96	0.3348	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time3*Students with Disabilities		0.001341	0.002492	4194	0.54	0.5905	
Time3*Positive Learning Environment		0.004286	0.00351	4194	1.22	0.2222	
Time3*Positive Teacher Qualifications		0.00246	0.002328	4194	1.06	0.2909	
Time3*Frequency that Students Use Content Software		-0.0009	0.002403	4194	-0.37	0.7078	
Time3*Not a Technology Magnet School - US		0.01144	0.03259	4194	0.35	0.7257	
Time3*Technology Magnet School - US		0	.	.	.	.	
Time3*Not a US Magnet School		-0.03231	0.01706	4194	-1.89	0.0582	
Time3*US Magnet School		0	.	.	.	.	
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		0.03995	0.001657		24.11	<.0001	**
$\tau_{(1,0)}$		-0.00442	0.000481		-9.18	<.0001	**
$\tau_{(1,1)}$		0.003055	0.000223		13.71	<.0001	**
Residual		0.01824	0.000395		46.13	<.0001	**

Note: * $p < .05$; ** $p < .01$

Table 39.

Model Fit Indices for Models Predicting FCAT Writing Scores for All School Levels (without Gifted and LEP)

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 1: Writing Predicted by Average Writing of All Schools in Florida	346.8	352.8	352.8	370
Model 2a: Time as a Predictor of Writing	-2168	-2156	-2156	-2121.7
Quadratic Model 2b: $Time^2$ as a Predictor of Writing	-2173.7	-2159.7	-2159.6	-2119.6
Polynomial Model 2c: $Time^3$ as a Predictor of Writing	-2341.7	-2325.7	-2325.7	-2279.9
Model 3: Time, $Time^2$, $Time^3$, and School Level as Predictors of Writing	-2847.8	-2815.8	-2815.8	-2724.2
Model 4a: Writing predicted by Time, School Level, and Demographics Variables	-3939.6	-3875.6	-3875.3	-3693

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 5a: Demographics and Student Learning Environment by School Level	-4121.8	-4041.8	-4041.4	-3813.5
Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level	-4176.2	-4024.2	-4022.8	-3590.5
Final Model 7a: Significant Technology Integration with Demographics and Student Learning Environment by School Level	-4132.5	-4044.5	-4044	-3793.4
Model 8a: Magnet Schools with Significant Technology Integration Demographics and Student Learning Environment by School Level (All School Levels without Gifted)	-4146	-4042	-4041.3	-3745.3

Table 40.

Model Fit Indices for Models Predicting FCAT Writing Scores for Elementary and Middle School Levels (with Gifted)

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 1: Writing Predicted by Average Writing of All Elementary and Middle Schools in Florida	-261.6	-251.6	-251.6	-223.8
Model 4b: Writing predicted by Time, School Level, and Demographics Variables No High School includes gifted	-2815.5	-2751.5	-2751.1	-2575.7
Model 5b: Demographics and Teacher Qualifications by School Level	-2885.7	-2805.7	-2805.2	-2586
Model 6b: Technology Integration with Demographics and Teacher Qualifications by School Level	-2933.4	-2781.4	-2779.7	-2364
Final Model 7b: Significant Technology Integration with Demographics and Student Learning Environment by School Level	-2898.5	-2802.5	-2801.8	-2538.9

The result of the analysis for all the models indicated that Hypothesis 3 was partially correct. When the sample included schools at all three school levels, there was a significant negative relationship between the frequency that students use content software and the intercept of school level FCAT Writing achievement when all other school level, demographic, and school learning environment factors were controlled. These interactions resulted in an s-shaped curvilinear trend.

After controlling so that all other variables were held at the mean, the trend for each school level could be examined separately, by comparing schools with different levels that students use content software. Figure 23 illustrates the relationship between the frequency that students use content software and average school FCAT Writing score for high schools. The frequency that students use content software was compared at one and two standard deviations below the mean, the mean, and one and two standard deviations above the mean. This allows the extreme cases of schools that have the frequency that students use content software the most often, +2 standard deviations above the mean, to be compared with schools that have students who use content software the least often, -2 standard deviations below the mean. Schools that had the 2 standard deviations above the mean in frequency that students use content software started the study in 2003-04 with the lowest FCAT Writing scores (3.71) and schools that had 2 standard deviations below the mean in frequency that students use content software started with the highest FCAT Writing scores (3.76). This difference of 0.05 point was significant because there were so many schools in the sample; however, the practical importance was modest. The differences between these extremes narrowed over time. In 2005-06 all levels of frequency that students used content software had the same mean FCAT Writing score. In 2006-07 schools with 2 standard deviations above the mean in frequency that students used content software had the highest scores and schools with 2 standard deviations below the mean in frequency that students used content software had the lowest scores.

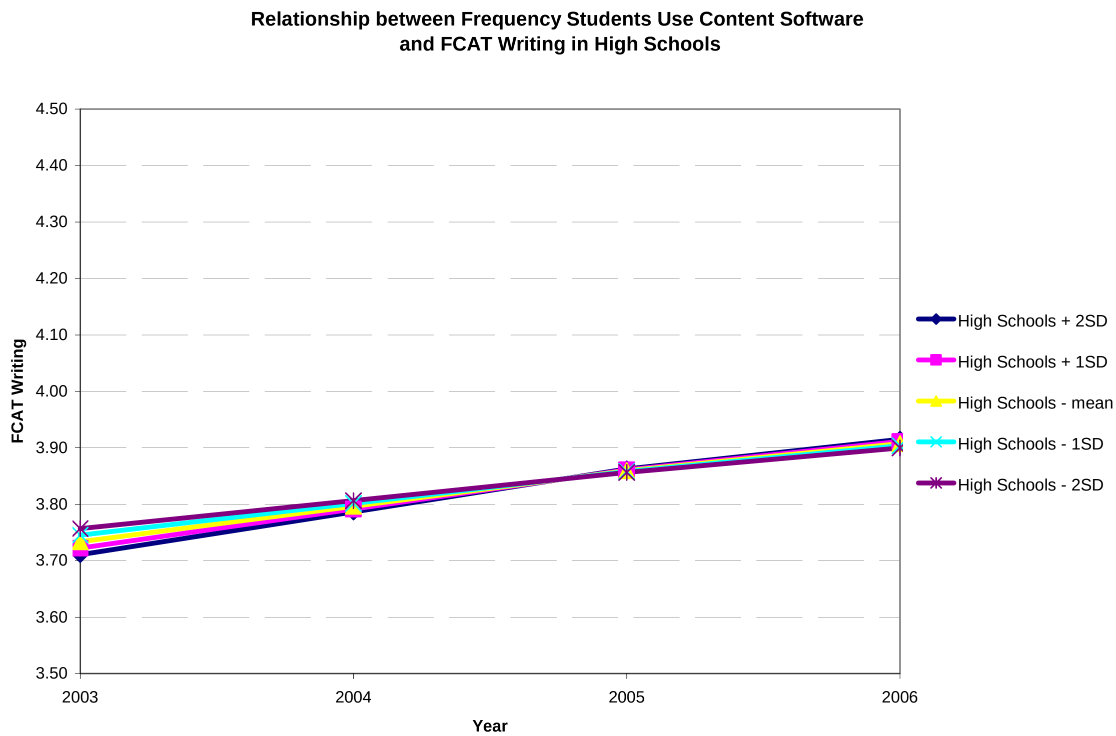

Figure 23. Relationship between Frequency that students use content software and FCAT Writing in high schools.

Middle schools had a similar beginning pattern to high school, that is, after controlling for all other factors, schools that were two standard deviations above the mean in the frequency that students use content software had the lowest FCAT Writing scores in 2003-04 (3.78), while those with two standard deviations below the mean had the highest scores (3.82). Although this difference of 0.04 point was significant due to the large sample size, the practical importance is modest (see Figure 24). In 2005-06 the mean FCAT Writing score for schools at all levels of frequency that students use content software was the same (4.00). In 2006-07 schools with 1 and 2 standard deviations above the mean had the highest score (4.16), while schools that were 2 standard deviations below the mean had the lowest score (4.14). The slope of these changes was not significant.

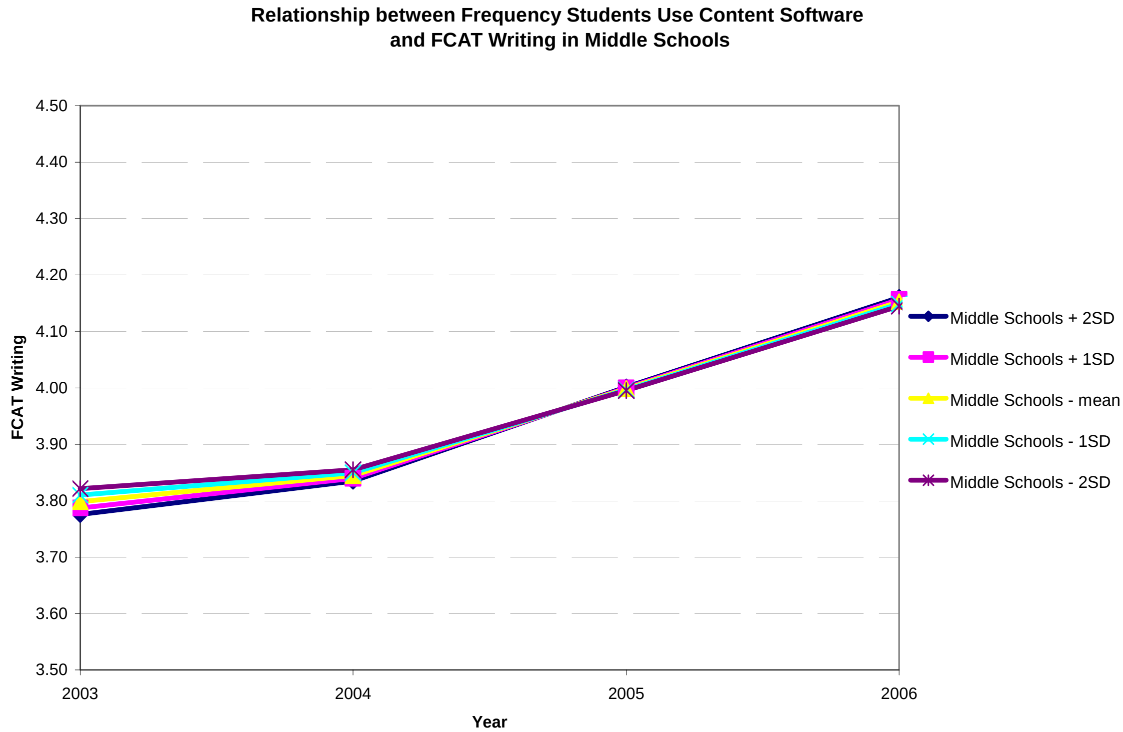

Figure 24. Relationship between Frequency that Students Use Content Software and FCAT Writing in Middle Schools.

Elementary schools experienced a similar pattern to middle schools (see Figure 25). Schools with the lowest level of frequency that students use content software began the study with the highest FCAT Writing score (3.67), while schools with the highest level of frequency that students use content software had the lowest FCAT Writing score (3.63). Although this difference of 0.04 point was statistically significant, it had modest practical importance. In 2005-06 and 2006-07 schools with one and two standard deviations above the mean had the highest score (3.86) while school at the mean and with one and two standard deviations below the mean had the lowest score (3.85). However the slope of the interaction between time and the frequency that students use content software was not significant.

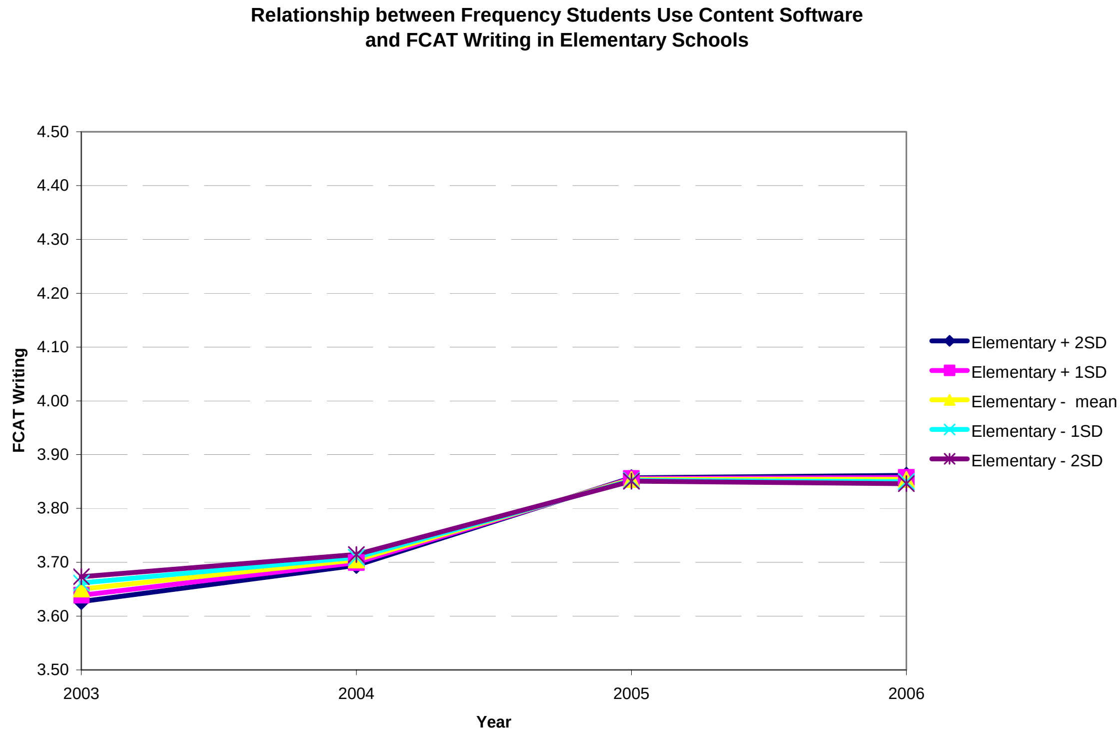

Figure 25. Relationship between Frequency that students use content software and FCAT Writing in elementary schools.

When the sample was restricted to just elementary and middle schools and percent of gifted students was included in the equation, both the intercept of gifted and the interactions of percent of gifted students in the school with time, time^2, and time^3 were significant. Thus, when all other factors were held equal, schools with highest percentages of gifted students began the study with the highest FCAT Writing scores, and the trends were not linear (see Figure 26). In addition, the trends were different at elementary and middle school level. There were no significant technology integration indicators with this dataset.

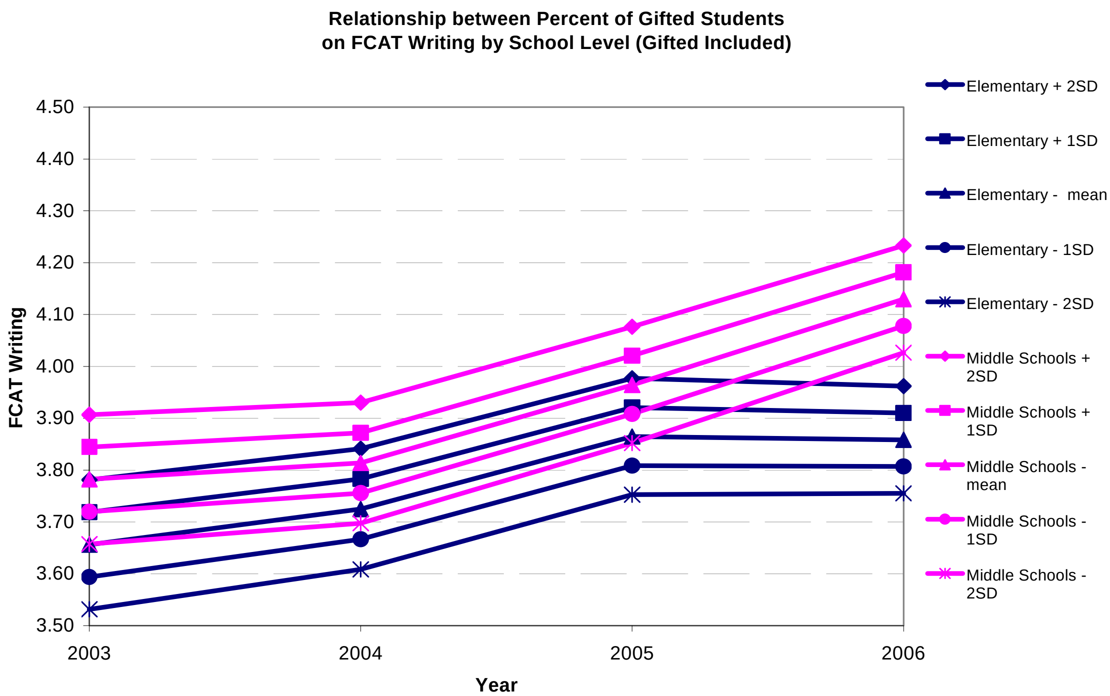

Figure 26. Relationship between Percent of Gifted Students on FCAT Writing by School Level (Gifted Included).

Research Question 2

> What is the relationship between indicators of technology integration and changes in mediating outcomes of absence rate and student misconduct, when controlling for school level, school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality?

The second research question was answered by conducting multi-level models with the student misconduct and absence rates. Absence rate was measured by the percent of students who were absent more than 21 days per year. Misconduct was measured with a composite variable created from the sum of the mean percent of students in in-school suspensions, mean percent of students in out-of-school suspensions, and the mean number of crime incidents per student.

Hypothesis 1

The first analysis conducted to answer the second research question used the student absences outcome data to test the following hypothesis:

H_1: After controlling for school level (elementary, middle, and high), school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality, mean school percent of students with more than 21 days absent variable will have a negative relationship with indicators of technology integration.

The first step was to build the unconditional model. The unconditional model predicted the schools' percent of students absent more than 21 days from the average of the percent of students absent more than 21 days for all schools. There were no other predictors. The average percent of students absent more than 21 days for all schools was 9.00 (t (2311) = 76.03, p <.0001).

Model 1: Unconditional Model
Level 1: Student Absences = $\beta_0 + r$
Level 2: $\beta_0 = \gamma_{00} + u_0$
Mixed-Effects Model: Student Absences = $\gamma_{00} + u_0 + r$

The intraclass correlation coefficient (ICC) was computed to determine the proportion of variance in the percent of students absent more than 21 days variable that is accounted for by the schools. The ICC was .76, which is high and supports using multi-level modeling for the analysis. The model fit statistics from this model were used as the baseline for model comparisons.

The next step added time to the predictor equation (see Model 2a). The variance components from this analysis showed how much of the variance in the model was accounted for by time. The variance in the slopes between schools was significant. Therefore, time was set as a random effect, and the model was estimated. Both the intercept (t (2311) = 74.16, p <.0001) and time (t (2311) = 11.29, p <.0001) were significant parameters. However, time explained 18% of the variance between schools and accounted for 18% of the variance within schools.

Model 2a: Unconditional Growth Model
Level 1: Student Absences = $\beta_0 + \beta_1$*Time + r
Level 2: $\beta_0 = \gamma_{00} + u_0$
$\beta_1 = \gamma_{10} + u_1$

Mixed-Effects Model: Student Absences = $\gamma_{00} + \gamma_{10}$*Time + $u_0 + u_1$*Time + r

To determine if the equation was not linear but curvilinear, time^2 was added to the equation so the variance could be compared. Results indicated that time^2 was significant (t (2311) = -6.56, p <.0001), and it increased the within school variance explained by 2% over the Growth Model (see Model 2b). Because the trends included on three points in time, time^3 was not added to the equation. Consequently, time and time^2 were retained in the quadratic growth model equation.

Model 2b: Quadratic Growth Model
Level 1: Student Absences = $\beta_0 + \beta_1$*Time + β_2* Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + u_0$
$\beta_1 = \gamma_{10} + u_1$
$\beta_2 = \gamma_{20}$

Mixed-Effects Model: Student Absences = $\gamma_{00} + \gamma_{10}$*Time + γ_{20}* Time^2 + $u_0 + u_1$ + r

Next, school level was added to the Quadratic Growth Model to predict misconduct (See Model 3). The significance of the parameter estimates determined if school level was significantly related to the percent of students absent more than 21 days and if there was an interaction with time. This model adjusted the mean school percent of students absent more than 21 days and the slope of percent of students absent more than 21 days for school level. The parameter estimates of elementary school and high school relative to middle school and time and time^2 were significant at the intercept. All of the interactions between time and time^2 with elementary and high school relative to middle school were significant (see Table 41). All model fit indices indicated improved fit with this model (see Table 52). This model accounted for an additional 27% of the between school variance and an additional 1% of the within school variance from the Quadratic Growth Model.

Model 3: School Level as Predictor

Level 1: Student Absences = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Type + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Type

Mixed-Effects Model: Student Absences = $\gamma_{00} + \gamma_{01}$*School Type + γ_{10}*Time + γ_{11}*School Type*Time + γ_{20}*Time^2 + γ_{21}*School Type*Time^2 + $u_0 + u_1$ + r

Table 41.

Model 3: Time, Time Squared, and School Type as Predictors of Student Absences

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		10.8563	0.2291	2309	47.39	<.0001	**
Time		0.8426	0.3286	2309	2.56	0.0104	*
Time^2		-0.3558	0.1554	2309	-2.29	0.0221	*
School Level	Elementary	-4.571	0.2606	2309	-17.54	<.0001	**
School Level	High	3.035	0.3457	2309	8.78	<.0001	**
School Level	Middle	0	.	.	.	.	
Time*School Level	Elementary	1.144	0.3737	2309	3.06	0.0022	**
Time*School Level	High	-1.0712	0.4959	2309	-2.16	0.0309	*
Time*School Level	Middle	0	.	.	.	.	
Time^2*School Level	Elementary	-0.3293	0.1768	2309	-1.86	0.0626	*
Time^2*School Level	High	0.8016	0.2346	2309	3.42	0.0006	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
$Time^2$*School Level	Middle	0	.	.	.	.	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	16.2216	0.6765	23.98	<.0001	**
$\tau_{(1,0)}$	2.3649	0.2456	9.63	<.0001	**
$\tau_{(1,1)}$	1.4602	0.1823	8.01	<.0001	**
Residual	7.1823	0.2112	34	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added student demographic variables to the School Level Model. This model was run twice. The first time, the model was estimated with elementary, middle, and high school as school levels and all of the demographic variables except gifted, because gifted is not a designation at the high school level (see Model 4a). The second time, the data were filtered to exclude high school as a school level and keep the gifted variable with middle and elementary schools (see Model 4b). The model fit statistics of the demographic model with all three school levels was compared with the School Level as Predictor Model to determine if there was a better fit (see Table 52). The significance of the parameter estimates determined which of the demographic variables remained in the predictor equation (see Table 42). The variance estimates showed the amount of the total variance that was accounted for by each model. When all of the demographic variables except gifted were added to the model (see Model 4a), the intercept was significant and the average middle school started with 11.18 (t (2259) = 53.38, p <.0001) percent of students absent more than 21 days. The parameter estimates for elementary and high school level relative to middle, free or reduced lunch status, minority, limited English proficiency (LEP), and students with disabilities were significant, while the parameter estimate for time and $time^2$ were not significant. There were significant interactions between time and elementary relative to middle school, free or reduced lunch status, and LEP, while interactions between time and minority and students with disabilities were not significant. $Time^2$ had significant interactions with elementary and high schools relative to middle school. No other demographic variables had significant interactions with $time^2$. All model fit indices indicated better fit with the addition of these demographics variables (see Table 52). Adding the demographics variables with school level explained 64% of the between school variance and 18% of the within school variance for a total of 53% of all variance explained.

Model 4a: Demographics by School Level (including High School and no Gifted)
Level 1: Student Absences = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Type + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Type + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD

Mixed-Effects Model: Student Absences = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}*SWD + γ_{05}*LEP + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}*SWD*Time + γ_{15}*LEP*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}*SWD*Time^2 + γ_{25}*LEP*Time^2 + $u_0 + u_1$ + r

Table 42.

Model 4a: Student Absences Predicted by Time, School Type, and Demographics Variables (No Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		11.1805	0.2094	2259	53.38	<.0001	**
Time		0.5675	0.3473	2203	1.63	0.1024	
Time2		-0.2634	0.1646	2092	-1.6	0.1097	
School Level	Elementary	-5.125	0.2409	2092	-21.27	<.0001	**
School Level	High	4.241	0.3157	2092	13.43	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		1.1772	0.1234	2092	9.54	<.0001	**
Minority		0.8634	0.1365	2092	6.32	<.0001	**
LEP		-0.2918	0.1173	2092	-2.49	0.013	*
Students with Disabilities		1.1264	0.09194	2092	12.25	<.0001	**
Time*School Level	Elementary	1.5591	0.4011	2092	3.89	0.0001	**
Time*School Level	High	-0.7698	0.5253	2092	-1.47	0.1429	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.645	0.2358	2092	2.74	0.0063	**
Time*Minority		-0.1982	0.2428	2092	-0.82	0.4143	
Time*LEP		-0.4186	0.2024	2092	-2.07	0.0387	*
Time*Students with Disabilities		-0.04916	0.1712	2092	-0.29	0.7741	
Time2*School Level	Elementary	-0.5769	0.1903	2092	-3.03	0.0025	**
Time2*School Level	High	0.6845	0.2492	2092	2.75	0.0061	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.1385	0.1123	2092	-1.23	0.2176	
Time2*Minority		-0.07399	0.115	2092	-0.64	0.5202	
Time2*LEP		0.1246	0.09537	2092	1.31	0.1916	
Time2*Students with Disabilities		0.09235	0.08101	2092	1.14	0.2544	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	10.5658	0.5508	19.18	<.0001	**
$\tau_{(1,0)}$	2.0808	0.2254	9.23	<.0001	**
$\tau_{(1,1)}$	0.954	0.1841	5.18	<.0001	**
Residual	7.4587	0.2288	32.61	<.0001	**

Note: * $p < .05$; ** $p < .01$

The results from the analysis in Model 4b indicated that the intercept, elementary relative to middle school, time, time^2, free or reduced lunch status, minority, LEP, students with disabilities, and gifted were all significant (see Table 43). Interactions between time and elementary relative to middle school, free or reduced lunch status, minority, LEP, students with disabilities, and gifted were significant. Interactions between time^2 and elementary relative to middle school and free and reduced lunch status were significant. Because the parameter for gifted was significant in this model, an unconditional model using the same population with high schools filtered out, predicting student absences with average student absences for all schools was estimated in order to compare the fit of this model. All of the model fit statistics indicated better model fit (see Table 53). When examining the variance of student absences in elementary and middle schools, adding demographics variables to the equation explained 78% of the between school variance and 22% of the within school variance. Two sets of analyses were conducted on the rest of the models in order to examine the relationship of gifted with technology integration as one of the predictors of student absences.

Model 4b: Demographics by School Level (Elementary and Middle School only)

Level 1: Student Absences = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Type + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Type + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted

Mixed-Effects Model: Student Absences = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}*SWD + γ_{05}*LEP + γ_{06}*Gifted + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP*Time + γ_{15}* SWD*Time + γ_{16}*Gifted*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + $u_0 + u_1$ + r

Table 43.

Model 4b: Student Absences predicted by Time, School Level, and Demographics Variables for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		11.1249	0.1643	1825	67.73	<.0001	**
Time		0.7269	0.3297	1704	2.2	0.0276	*
Time2		-0.3203	0.1563	1537	-2.05	0.0406	*
School Level	Elementary	-5.1788	0.1909	1537	-27.13	<.0001	**
School Level	Middle	0	.	.	.	.	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Free Reduced Lunch		1.2449	0.1154	1537	10.79	<.0001	**
Minority		0.4983	0.1251	1537	3.98	<.0001	**
LEP		-0.3201	0.09813	1537	-3.26	0.0011	**
Students with Disabilities		0.8943	0.0809	1537	11.05	<.0001	**
Gifted		-0.4848	0.08652	1537	-5.6	<.0001	**
Time*School Level	Elementary	1.4777	0.3853	1537	3.83	0.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.9815	0.2601	1537	3.77	0.0002	**
Time*Minority		-0.6107	0.2661	1537	-2.29	0.0219	*
Time*LEP		-0.5341	0.2064	1537	-2.59	0.0098	**
Time*Students with Disabilities		0.0817	0.1776	1537	0.46	0.6456	*
Time*Gifted		-0.00272	0.1858	1537	-0.01	0.9883	*
Time2*School Level	Elementary	-0.5112	0.1828	1537	-2.8	0.0052	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.2825	0.1237	1537	-2.28	0.0225	*
Time2*Minority		0.1419	0.1262	1537	1.12	0.2611	
Time2*LEP		0.1705	0.09744	1537	1.75	0.0803	
Time2*Students with Disabilities		0.06487	0.0841	1537	0.77	0.4406	
Time2*Gifted		0.04103	0.08722	1537	0.47	0.6382	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	4.2996	0.3812	11.28	<.0001	**
$\tau_{(1,0)}$	2.532	0.1913	13.24	<.0001	**
$\tau_{(1,1)}$	1.119	0.1856	6.03	<.0001	**
Residual	6.2437	0.2201	28.37	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added the variables that measure the school learning environment factors to the Demographics Model by School Level Model. These included teacher qualifications and positive learning environment. The composite variable for positive learning environment used in all the analyses of the other outcomes included the variable percent of students absent less than 21 days. In order to prevent collinearity, the composite variable for positive learning environment was recalculated without the variable for student absences before the model was estimated. This model was estimated twice, first without gifted population but included all school levels (see model 5a) and then with elementary and middle school levels and gifted population (see model 5b). When school learning environment factors were added with the demographic and school level variables for all school levels, the parameter estimates for the intercept, elementary and high school relative to middle school, free or reduced lunch status, minority, students with disabilities, and positive learning environment were significant, while time, $time^2$, LEP, and teacher qualifications were not significant (see Table 44). Significant interactions with time and $time^2$ included elementary schools relative to middle schools, free and reduced lunch status, and LEP, and positive learning environment. Adding the student learning environment variables explained an additional 2% of the between school variance and explained an additional 1% of the within school variance for a total of 55% of all of the variance explained. All of the model fit indices indicated that this model fit the data better (see Table 52).

Model 5a: School Learning Environment with Demographics by School Level (all school levels without gifted and LEP)
Level 1: Student Absences = $\beta_0 + \beta_1$*Time + β_2*$Time^2$ + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}*SWD + γ_{05}* Teacher Qualifications + γ_{06}*Positive Learning Environment + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Type + γ_{12}*SES + γ_{13}*Minority + γ_{14}*LEP + γ_{15}*SWD + γ_{16}* Teacher Qualifications + γ_{17}*Positive Learning Environment + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Type + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}* Teacher Qualifications + γ_{27}*Positive Learning Environment

Mixed-Effects Model: Student Absences = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* SWD + γ_{05}*Teacher Qualifications + γ_{06}* Positive Learning Environment + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}*SWD *Time + γ_{15}* Teacher Qualifications*Time + γ_{16}* Positive Learning Environment*Time + γ_{20}*$Time^2$ + γ_{21}*School Level*$Time^2$ + γ_{22}*SES*$Time^2$ + γ_{23}*Minority*$Time^2$ + γ_{24}* SWD*$Time^2$ + γ_{25}* Teacher Qualifications*$Time^2$ + γ_{26}* Positive Learning Environment*$Time^2$ + $u_0 + u_1$ + r

Table 44.

Model 5a: Absences Predicted by Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		9.9297	0.2366	2259	41.97	<.0001	**
Time		0.5105	0.4363	2203	1.17	0.2422	
Time2		-0.1434	0.2061	2086	-0.7	0.4865	
School Level	Elementary	-3.452	0.2837	2086	-12.17	<.0001	**
School Level	High	3.9992	0.3116	2086	12.83	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		1.0116	0.1253	2086	8.07	<.0001	**
Minority		0.5305	0.138	2086	3.84	0.0001	**
LEP		-0.1373	0.1163	2086	-1.18	0.2379	
Students with Disabilities		0.9648	0.09183	2086	10.51	<.0001	**
Positive Learning Environment		-1.1039	0.1035	2086	-10.66	<.0001	**
Positive Teacher Qualifications		0.08278	0.07872	2086	1.05	0.2931	
Time*School Level	Elementary	1.5174	0.5355	2086	2.83	0.0046	**
Time*School Level	High	-0.6382	0.5278	2086	-1.21	0.2267	
Time*School Level	Middle	0	.	.	.	.	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time*Free Reduced Lunch		0.506	0.2499	2086	2.02	0.043	*
Time*Minority		-0.08575	0.2482	2086	-0.35	0.7298	
Time*LEP		-0.4033	0.2049	2086	-1.97	0.0492	*
Time*Students with Disabilities		-0.05828	0.1732	2086	-0.34	0.7365	
Time*Positive Learning Environment		0.142	0.2296	2086	0.62	0.5365	
Time*Positive Teacher Qualifications		-0.4028	0.1641	2086	-2.46	0.0142	*
Time2*School Level	Elementary	-0.6285	0.2548	2086	-2.47	0.0137	*
Time2*School Level	High	0.6511	0.2502	2086	2.6	0.0093	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.07063	0.1197	2086	-0.59	0.5553	
Time2*Minority		-0.1168	0.1175	2086	-0.99	0.3202	
Time2*LEP		0.1246	0.09677	2086	1.29	0.1981	
Time2*Students with Disabilities		0.1098	0.08186	2086	1.34	0.1801	
Time2*Positive Learning Environment		-0.0519	0.1112	2086	-0.47	0.6407	
Time2*Positive Teacher Qualifications		0.1795	0.07802	2086	2.3	0.0215	*

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	9.9418	0.5279	18.83	<.0001	**
$\tau_{(1,0)}$	2.0392	0.2204	9.25	<.0001	**
$\tau_{(1,1)}$	0.9566	0.1821	5.25	<.0001	**
Residual	7.3519	0.2252	32.64	<.0001	**

Note: * $p < .05$; ** $p < .01$

When the data were filtered to include only elementary and middle schools and gifted was also added to the equation, parameter estimates for the intercept, elementary relative to middle school, free or reduced lunch status, students with disabilities, gifted, and positive learning environment were significant, while time, time^2, minority, LEP, and positive teacher qualifications were not significant. Significant interactions with time included elementary relative to middle school, free or reduced lunch status, minority, and LEP. Significant interactions with time^2 only included elementary relative to middle school (see Table 45). This model demonstrated better fit than the previous model by all model fit indices (see Table 53). It explained 2% more of the between school variance and 1% more of the within school variance than the previous model for a total 63% of all the variance.

Model 5b: School Learning Environment with Demographics by School Level (Elementary and Middle Schools with Gifted)

Level 1: Student Absences = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Type + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Type + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment

Mixed-Effects Model: Student Absences = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + $u_0 + u_1$ + r

Table 45.

Model 5b: Absences Predicted by Demographics and Student Learning Environment by School Level for Elementary and Middle School with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		10.018	0.1995	1825	50.22	<.0001	**
Time		0.3751	0.4472	1704	0.84	0.4017	
Time2		-0.03742	0.211	1531	-0.18	0.8592	
School Level	Elementary	-3.686	0.2455	1531	-15.01	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		1.1083	0.1156	1531	9.59	<.0001	**
Minority		0.2226	0.1266	1531	1.76	0.079	
LEP		-0.1688	0.09751	1531	-1.73	0.0836	
Students with Disabilities		0.8061	0.07999	1531	10.08	<.0001	**
Gifted		-0.3716	0.08643	1531	-4.3	<.0001	**
Positive Learning Environment		-0.9781	0.1051	1531	-9.31	<.0001	**
Positive Teacher Qualifications		-0.02594	0.07138	1531	-0.36	0.7163	
Time*School Level	Elementary	1.8769	0.5614	1531	3.34	0.0008	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.7751	0.2713	1531	2.86	0.0043	**
Time*Minority		-0.5854	0.2722	1531	-2.15	0.0317	*
Time*LEP		-0.4407	0.2112	1531	-2.09	0.0371	*
Time*Students with Disabilities		0.03888	0.1789	1531	0.22	0.8279	
time*Gifted		0.03961	0.189	1531	0.21	0.834	
Time*Positive Learning Environment		-0.1871	0.2685	1531	-0.7	0.486	
Time*Positive Teacher Qualifications		-0.3163	0.168	1531	-1.88	0.06	
Time2*School Level	Elementary	-0.8227	0.2671	1531	-3.08	0.0021	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.168	0.1302	1531	-1.29	0.197	
Time2*Minority		0.1397	0.1288	1531	1.08	0.2784	
Time2*LEP		0.1279	0.1	1531	1.28	0.2014	
Time2*Students with Disabilities		0.09683	0.08471	1531	1.14	0.2532	
time2*Gifted		0.02173	0.08874	1531	0.24	0.8066	
Time2*Positive Learning Environment		0.1471	0.1301	1531	1.13	0.2584	
Time2*Positive Teacher Qualifications		0.1462	0.08045	1531	1.82	0.0693	
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		3.9099	0.367		10.65	<.0001	**
$\tau_{(1,0)}$		2.5557	0.1869		13.68	<.0001	**
$\tau_{(1,1)}$		1.0726	0.1834		5.85	<.0001	**
Residual		6.187	0.2182		28.35	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added technology integration variables with the demographics, learning environment, and school level variables. These variables included student access to various types of software, teachers regularly using various types of software, frequency that students use various types of software, and technology support. This model was estimated twice, first without gifted population but all school levels (see model 6a) and then with elementary and middle school levels and gifted population (see model 6b). When the model was estimated with all school levels without gifted, the significant technology parameter estimates were frequency that students use content software at the intercept and the interactions between time and time^2 with teachers who regularly use technology for administrative purposes and technical support – human (see Table 46). Other significant parameter estimates included the intercept, elementary and high school relative to middle school, free or reduced lunch status, minority, students with disabilities, and positive learning environment, while LEP and positive teacher qualifications were not significant. Significant interactions with time included elementary relative to middle school, free or reduced lunch status, LEP, and positive teacher qualifications. Significant interactions with time^2 included elementary and high relative to middle school and positive teacher qualifications. All model fit indices indicated that this model had better fit (see Table 52). No additional variance was explained with this model. Two technology integration indicators were retained in the final model for all school levels without gifted, percent of teachers who use technology for administrative purposes and technology support - human.

Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Level 1: Student Absences = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Access Content SW + γ_{09}*Access Office SW + γ_{010}*Access Ad Prod SW + γ_{011}*Teachers Use Deliver Instruction + γ_{012}*Teachers use Admin + γ_{013}*Frequency Students Use Content + γ_{014}*Frequency Students Use Tool + γ_{015}*Technical Support Human + γ_{016}*Technical Support Hardware + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}* Teacher Qualifications + γ_{17}* Positive Learning Environment + γ_{18}*Access Content SW + γ_{19}*Access Office SW + γ_{110}*Access Ad Prod SW + γ_{111}*Teachers Use Deliver Instruction + γ_{112}*Teachers use Admin + γ_{113}*Frequency Students Use Content + γ_{114}*Frequency Students Use Tool + γ_{115}*Technical Support Human + γ_{116}*Technical Support Hardware + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}* Teacher Qualifications + γ_{27}* Positive Learning Environment + γ_{28}*Access Content SW + γ_{29}*Access Office SW + γ_{210}*Access Ad Prod SW + γ_{211}*Teachers Use Deliver Instruction + γ_{212}*Teachers use Admin + γ_{213}*Frequency Students Use Content + γ_{214}*Frequency Students Use Tool + γ_{215}*Technical Support Human + γ_{216}*Technical Support Hardware

Mixed-Effects Model: Student Absences = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Access Content SW + γ_{09}*Access Office SW + γ_{010}*Access Ad Prod SW + γ_{011}*Teachers Use Deliver Instruction + γ_{012}*Teachers use Admin + γ_{013}*Frequency Students Use Content + γ_{014}*Frequency Students Use Tool + γ_{015}*Technical Support Human + γ_{016}*Technical Support Hardware + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Teacher Qualifications*Time + γ_{17}* Positive Learning Environment*Time + γ_{18}*Access Content SW*Time + γ_{19}*Access Office SW*Time + γ_{110}*Access Ad Prod SW*Time + γ_{111}*Teachers Use Deliver Instruction*Time + γ_{112}*Teachers use Admin*Time + γ_{113}*Frequency Students Use Content*Time + γ_{114}*Frequency Students Use Tool*Time + γ_{115}*Technical Support Human*Time + γ_{116}*Technical Support Hardware*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Teacher Qualifications*Time^2 + γ_{27}* Positive Learning Environment*Time^2 + γ_{28}*Access Content SW*Time^2 + γ_{29}*Access Office SW*Time^2 + γ_{210}*Access Ad Prod SW*Time^2 + γ_{211}*Teachers Use Deliver Instruction*Time^2 + γ_{212}*Teachers use Admin*Time^2 + γ_{213}*Frequency Students Use Content*Time^2 + γ_{214}*Frequency Students Use Tool*Time^2 + γ_{215}*Technical Support Human*Time^2 + γ_{216}*Technical Support Hardware*Time^2 + $u_0 + u_1$ + r

Table 46.

Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		10.0858	0.2408	2259	41.89	<.0001	**
Time		0.2367	0.4587	2203	0.52	0.6059	
Time2		-0.00366	0.2179	2059	-0.02	0.9866	
School Level	Elementary	-3.6634	0.2905	2059	-12.61	<.0001	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
School Level	High	4.0514	0.3135	2059	12.92	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		0.956	0.1276	2059	7.49	<.0001	**
Minority		0.5077	0.1386	2059	3.66	0.0003	**
LEP		-0.1384	0.1168	2059	-1.19	0.2361	
Students with Disabilities		0.9716	0.09176	2059	10.59	<.0001	**
Positive Learning Environment		-1.0714	0.1036	2059	-10.34	<.0001	**
Positive Teacher Qualifications		0.07752	0.0787	2059	0.98	0.3247	
Access Content Software		0.0834	0.0794	2059	1.05	0.2937	
Access Office Software		-0.0249	0.07898	2059	-0.32	0.7525	
Access Advanced Production Software		-0.02961	0.0804	2059	-0.37	0.7127	
Teachers Use to Deliver Instruction		-0.1421	0.08797	2059	-1.62	0.1064	
Teachers Use for Administrative Purposes		-0.1513	0.0909	2059	-1.66	0.0962	
Frequency that Students Use Content Software		0.143	0.07278	2059	1.96	0.0496	*
Frequency Students Use Tool-Based Software		0.0432	0.07857	2059	0.55	0.5825	
Technical Support Human		-0.048	0.07203	2059	-0.67	0.5053	
Technical Support Hardware		-0.08185	0.06965	2059	-1.18	0.2401	
Time*School Level	Elementary	1.9079	0.5698	2059	3.35	0.0008	**
Time*School Level	High	-0.6158	0.5347	2059	-1.15	0.2496	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.5228	0.2548	2059	2.05	0.0403	*
Time*Minority		-0.00161	0.2509	2059	-0.01	0.9949	
Time*LEP		-0.4421	0.2057	2059	-2.15	0.0317	*
Time*Students with Disabilities		-0.05408	0.1734	2059	-0.31	0.7551	
Time*Positive Learning Environment		0.03395	0.2319	2059	0.15	0.8836	
Time*Positive Teacher Qualifications		-0.4122	0.1656	2059	-2.49	0.0129	*
Time*Access Content Software		0.08198	0.1906	2059	0.43	0.6671	
Time*Access Office Software		0.01079	0.19	2059	0.06	0.9547	
Time*Access Advanced Production Software		0.1234	0.1903	2059	0.65	0.5167	
Time*Teachers Use to Deliver Instruction		-0.00222	0.2112	2059	-0.01	0.9916	
Time*Teachers Use for Administrative Purposes		0.4922	0.2165	2059	2.27	0.0231	*
Time*Frequency that Students Use Content Software		-0.09701	0.1844	2059	-0.53	0.5989	
Time*Frequency Students Use Tool-Based Software		-0.1651	0.1929	2059	-0.86	0.3921	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time*Technical Support Human		0.3383	0.1661	2059	2.04	0.0419	*
Time*Technical Support Hardware		0.1014	0.1687	2059	0.6	0.5478	
Time2*School Level	Elementary	-0.8298	0.2732	2059	-3.04	0.0024	**
Time2*School Level	High	0.6136	0.2543	2059	2.41	0.0159	*
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.06898	0.1226	2059	-0.56	0.5738	
Time2*Minority		-0.1537	0.1189	2059	-1.29	0.1963	
Time2*LEP		0.1511	0.0973	2059	1.55	0.1207	
Time2*Students with Disabilities		0.1053	0.08208	2059	1.28	0.1999	
Time2*Positive Learning Environment		-0.00892	0.1124	2059	-0.08	0.9368	
Time2*Positive Teacher Qualifications		0.1856	0.07924	2059	2.34	0.0193	*
Time2*Access Content Software		-0.1053	0.09173	2059	-1.15	0.2511	
Time2*Access Office Software		-0.02278	0.0915	2059	-0.25	0.8034	
Time2*Access Advanced Production Software		-0.0043	0.09154	2059	-0.05	0.9625	
Time2*Teachers Use to Deliver Instruction		0.01714	0.1024	2059	0.17	0.8671	
Time2*Teachers Use for Administrative Purposes		-0.2106	0.1039	2059	-2.03	0.0428	*
Time2*Frequency that Students Use Content Software		0.04685	0.08961	2059	0.52	0.6012	
Time2*Frequency Students Use Tool-Based Software		0.05756	0.09445	2059	0.61	0.5423	
Time2*Technical Support Human		-0.2003	0.07971	2059	-2.51	0.0121	*
Time2*Technical Support Hardware		-0.1527	0.08118	2059	-1.88	0.0601	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	9.9757	0.5294	18.84	<.0001	**
$\tau_{(1,0)}$	2.0476	0.2189	9.35	<.0001	**
$\tau_{(1,1)}$	0.8108	0.1786	4.54	<.0001	**
Residual	7.3218	0.2248	32.57	<.0001	**

Note: * $p < .05$; ** $p < .01$

Similar results were found with the elementary and middle school data with gifted. There were no significant technology parameter estimates at the intercept, and only the interaction of time with the percent of teachers who use technology for administrative purposes was significant (see

Table 47). Other significant parameter estimates included the intercept, time, time^2, elementary relative to middle school, free or reduced lunch status, students with disabilities, gifted, and positive learning environment, while minority, LEP, and positive teacher qualifications were not significant. Significant interactions with time included elementary relative to middle school, free and reduced lunch status, LEP, and positive learning environment. The only significant interaction with time^2 was elementary relative to middle school. Three of the fit indices indicated that this model had better fit (see Table 53), even though adding the technology integration indicators to the model did not explain any additional variance. Teachers who use technology for administrative purposes was the only technology integration indicator retained in the final model for the data with elementary and middle schools and gifted.

Model 6b: Technology Integration with Demographics and Student Learning Environment by School Level (Elementary and Middle Schools with Gifted)
Level 1: Student Absences = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Access Content SW + γ_{010}*Access Office SW + γ_{011}*Access Ad Prod SW + γ_{012}*Teachers Use Deliver Instruction + γ_{013}*Teachers use Admin + γ_{014}*Frequency Students Use Content + γ_{015}*Frequency Students Use Tool + γ_{016}*Technical Support Human + γ_{017}*Technical Support Hardware + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + γ_{19}*Access Content SW + γ_{110}*Access Office SW + γ_{111}*Access Ad Prod SW + γ_{112}*Teachers Use Deliver Instruction + γ_{113}*Teachers use Admin + γ_{114}*Frequency Students Use Content + γ_{115}*Frequency Students Use Tool + γ_{116}*Technical Support Human + γ_{117}*Technical Support Hardware + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment + γ_{29}*Access Content SW + γ_{210}*Access Office SW + γ_{211}*Access Ad Prod SW + γ_{212}*Teachers Use Deliver Instruction + γ_{213}*Teachers use Admin + γ_{214}*Frequency Students Use Content + γ_{215}*Frequency Students Use Tool + γ_{216}*Technical Support Human + γ_{217}*Technical Support Hardware

Mixed-Effects Model: Student Absences = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Access Content SW + γ_{010}*Access Office SW + γ_{011}*Access Ad Prod SW + γ_{012}*Teachers Use Deliver Instruction + γ_{013}*Teachers use Admin + γ_{014}*Frequency Students Use Content + γ_{015}*Frequency Students Use Tool + γ_{016}*Technical Support Human + γ_{017}*Technical Support Hardware + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{19}*Access Content SW*Time + γ_{110}*Access Office SW*Time + γ_{111}*Access Ad Prod SW*Time + γ_{112}*Teachers Use Deliver Instruction*Time + γ_{113}*Teachers use Admin*Time + γ_{114}*Frequency Students Use Content*Time + γ_{115}*Frequency Students Use Tool*Time + γ_{116}*Technical Support Human*Time + γ_{117}*Technical Support Hardware*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + γ_{29}*Access Content SW*Time^2 + γ_{210}*Access Office SW*Time^2 + γ_{211}*Access Ad Prod SW*Time^2 + γ_{212}*Teachers Use Deliver Instruction*Time^2 + γ_{213}*Teachers use Admin*Time^2 + γ_{214}*Frequency Students Use Content*Time^2 + γ_{215}*Frequency Students Use Tool*Time^2 + γ_{216}*Technical Support Human*Time^2 + γ_{217}*Technical Support Hardware*Time^2 + $u_0 + u_1$ + r

Table 47.

Model 6b: Technology Integration with Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		10.1578	0.2041	1825	49.76	<.0001	**
Time		0.1526	0.4716	1704	0.32	0.7463	
Time2		0.05106	0.2239	1504	0.23	0.8197	
School Level	Elementary	-3.8731	0.2524	1504	-15.35	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		1.0593	0.1181	1504	8.97	<.0001	**
Minority		0.1874	0.1275	1504	1.47	0.1418	
LEP		-0.1655	0.09803	1504	-1.69	0.0915	
Students with Disabilities		0.804	0.08001	1504	10.05	<.0001	**
Gifted		-0.3717	0.08711	1504	-4.27	<.0001	**
Positive Learning Environment		-0.9479	0.1052	1504	-9.02	<.0001	**
Positive Teacher Qualifications		-0.0299	0.07133	1504	-0.42	0.6752	
Access Content Software		0.05763	0.07475	1504	0.77	0.4409	
Access Office Software		-0.0016	0.07158	1504	-0.02	0.9821	
Access Advanced Production Software		-0.00514	0.07468	1504	-0.07	0.9452	
Teachers Use to Deliver Instruction		-0.1332	0.08247	1504	-1.61	0.1065	
Teachers Use for Administrative Purposes		-0.1593	0.08651	1504	-1.84	0.0658	
Frequency that Students Use Content Software		0.1016	0.06888	1504	1.47	0.1405	
Frequency Students Use Tool-Based Software		0.0086	0.07264	1504	0.12	0.9058	
Technical Support Human		-0.04038	0.06755	1504	-0.6	0.5501	
Technical Support Hardware		-0.02848	0.06417	1504	-0.44	0.6572	
Time*School Level	Elementary	2.1855	0.5967	1504	3.66	0.0003	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.8276	0.2779	1504	2.98	0.0029	**
Time*Minority		-0.5322	0.2758	1504	-1.93	0.0539	
Time*LEP		-0.4703	0.2127	1504	-2.21	0.0272	*
Time*Students with Disabilities		0.03309	0.18	1504	0.18	0.8542	
Time*Gifted		0.09982	0.1918	1504	0.52	0.6029	
Time*Positive Learning Environment		-0.2978	0.2718	1504	-1.1	0.2735	
Time*Positive Teacher Qualifications		-0.3361	0.1703	1504	-1.97	0.0486	*
Time*Access Content Software		0.09871	0.1942	1504	0.51	0.6113	
Time*Access Office Software		-0.1085	0.1889	1504	-0.57	0.566	
Time*Access Advanced		-0.05071	0.1913	1504	-0.27	0.791	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Production Software							
Time*Teachers Use to Deliver Instruction		-0.06853	0.2172	1504	-0.32	0.7524	
Time*Teachers Use for Administrative Purposes		0.5253	0.226	1504	2.32	0.0202	*
Time*Frequency that Students Use Content Software		0.06608	0.1931	1504	0.34	0.7323	
Time*Frequency Students Use Tool-Based Software		0.03403	0.196	1504	0.17	0.8622	
Time*Technical Support Human		0.1805	0.1733	1504	1.04	0.2977	
Time*Technical Support Hardware		-0.0968	0.1702	1504	-0.57	0.5696	
Time2*School Level	Elementary	-0.9501	0.2862	1504	-3.32	0.0009	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.1702	0.134	1504	-1.27	0.2041	
Time2*Minority		0.1187	0.1309	1504	0.91	0.3649	
Time2*LEP		0.1464	0.101	1504	1.45	0.1474	
Time2*Students with Disabilities		0.09916	0.08548	1504	1.16	0.2462	
Time2*Gifted		-0.0053	0.09034	1504	-0.06	0.9532	
Time2*Positive Learning Environment		0.181	0.1318	1504	1.37	0.1698	
Time2*Positive Teacher Qualifications		0.1539	0.08213	1504	1.87	0.0611	
Time2*Access Content Software		-0.09308	0.09481	1504	-0.98	0.3264	
Time2*Access Office Software		0.03233	0.09217	1504	0.35	0.7258	
Time2*Access Advanced Production Software		0.08214	0.09286	1504	0.88	0.3766	
Time2*Teachers Use to Deliver Instruction		0.04502	0.1069	1504	0.42	0.6738	
Time2*Teachers Use for Administrative Purposes		-0.1971	0.1096	1504	-1.8	0.0723	
Time2*Frequency that Students Use Content Software		-0.05648	0.09527	1504	-0.59	0.5534	
Time2*Frequency Students Use Tool-Based Software		-0.01862	0.09759	1504	-0.19	0.8488	
Time2*Technical Support Human		-0.1182	0.0838	1504	-1.41	0.1587	
Time2*Technical Support Hardware		-0.05149	0.08301	1504	-0.62	0.5352	
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		3.887	0.3689		10.54	<.0001	**
$\tau_{(1,0)}$		2.5845	0.1854		13.94	<.0001	**
$\tau_{(1,1)}$		0.8673	0.1805		4.8	<.0001	**
Residual		6.2248	0.2207		28.21	<.0001	**

Note: * $p < .05$; ** $p < .01$

The last models estimated in order to answer the first hypothesis included all school levels, demographic, student learning environment, and significant technology integration variables. These models were different because the model fit to the data for all schools levels without gifted included two technology integration variables - percent of teachers who regularly use technology for administrative purposes and the level of technology support - human (see model 8a); while the model fitted to the data with elementary and middle school levels and gifted included only one technology integration variable – the percent of teachers who regularly use technology for administrative purposes (see model 8b). For the model with all schools levels and no gifted, the same parameter estimates and interactions identified in the previous models as significant were significant again (see Table 48). Although, there was no difference in the percentage of variance explained in this model than there was in the Demographic Model with Student Learning Environment by school level or the Technology Integration with Demographic and Student Learning Environment Model by school level, the BIC index indicated better model fit (see Table 52). The level-1 residuals for the final model for predicting student absences using all school levels without gifted ranged between -19.04 and 22.48 with a standard deviation of 2.22. Although there were outliers, skewness was 0.47 and kurtosis was 13.23, which would indicate that most of the residuals were centered at the mean. Distribution of the empirical bayes intercepts ranged between -12.50 and 15.13 with standard deviation of 2.86. Skewness was 0.84, and kurtosis was 2.81, which indicated that most of the intercept residuals at level-2 were centered at the mean. Distribution of the empirical bayes slopes ranged between -2.77 and 4.77 with standard deviation of 0.75. Skewness was 1.31, and kurtosis was 4.44, which indicated that most of the slope residuals at level-2 were not normally distributed. Because the residuals for student absences outcome were not normally distributed, the results of the analysis may be biased.

Final Model 7a: Significant Technology Integration Indicators with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Level 1: Student Absences = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Teachers use Admin + γ_{09}*Technical Support Hardware + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}* Teacher Qualifications + γ_{17}* Positive Learning Environment + γ_{18}* Teachers use Admin + γ_{19}* Technical Support Hardware + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}* Teacher Qualifications + γ_{27}* Positive Learning Environment + γ_{28}*Teachers use Admin + γ_{29}* Technical Support Hardware

Mixed-Effects Model: Student Absences = γ_{00} + γ_{01}*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Teachers use Admin + γ_{09}*Technical Support Hardware + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD*Time + γ_{16}*Teacher Qualifications*Time + γ_{17}* Positive Learning Environment*Time + γ_{18}* Teachers use Admin*Time + γ_{19}* Technical Support Hardware*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Teacher Qualifications*Time^2 + γ_{27}* Positive Learning Environment*Time^2 + γ_{28}*Teachers use Admin*Time^2 + γ_{29}* Technical Support Hardware*Time^2 + u_0 + u_1 + r

Table 48.

Final Model 7a: Significant Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		9.9922	0.2377	2259	42.03	<.0001	**
Time		0.2026	0.4427	2203	0.46	0.6473	
Time2		0.01098	0.2093	2080	0.05	0.9582	
School Level	Elementary	-3.5418	0.2857	2080	-12.4	<.0001	**
School Level	High	3.9887	0.3115	2080	12.8	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		0.9618	0.1267	2080	7.59	<.0001	**
Minority		0.514	0.1381	2080	3.72	0.0002	**
LEP		-0.1247	0.1167	2080	-1.07	0.2853	
Students with Disabilities		0.9744	0.09174	2080	10.62	<.0001	**
Positive Learning Environment		-1.0886	0.1036	2080	-10.51	<.0001	**
Positive Teacher Qualifications		0.07804	0.07884	2080	0.99	0.3224	
Teachers Use for Administrative Purposes		-0.1873	0.07461	2080	-2.51	0.0121	*
Technical Support Human		-0.03634	0.07108	2080	-0.51	0.6092	
Time*School Level	Elementary	1.9454	0.5456	2080	3.57	0.0004	**
Time*School Level	High	-0.6503	0.5268	2080	-1.23	0.2172	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.5353	0.2511	2080	2.13	0.0331	*
Time*Minority		0.002798	0.2491	2080	0.01	0.991	
Time*LEP		-0.4589	0.2054	2080	-2.23	0.0256	*
Time*Students with Disabilities		-0.03988	0.1728	2080	-0.23	0.8176	
Time*Positive Learning Environment		0.05275	0.2302	2080	0.23	0.8188	
Time*Positive Teacher Qualifications		-0.4224	0.1644	2080	-2.57	0.0102	*
Time*Teachers Use for Administrative Purposes		0.5167	0.1749	2080	2.95	0.0032	**
Time*Technical Support Human		0.3417	0.1636	2080	2.09	0.0369	*

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time2*School Level	Elementary	-0.8454	0.2598	2080	-3.25	0.0012	**
Time2*School Level	High	0.6583	0.2497	2080	2.64	0.0085	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.07835	0.1203	2080	-0.65	0.5151	
Time2*Minority		-0.1574	0.1179	2080	-1.34	0.182	
Time2*LEP		0.1596	0.09701	2080	1.65	0.1	
Time2*Students with Disabilities		0.09823	0.08169	2080	1.2	0.2293	
Time2*Positive Learning Environment		-0.01234	0.1114	2080	-0.11	0.9118	
Time2*Positive Teacher Qualifications		0.1989	0.07828	2080	2.54	0.0111	*
Time2*Teachers Use for Administrative Purposes		-0.2375	0.08382	2080	-2.83	0.0046	**
Time2*Technical Support Human		-0.2152	0.07864	2080	-2.74	0.0063	**

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	9.9732	0.5278	18.9	<.0001	**
$\tau_{(1,0)}$	2.0306	0.2198	9.24	<.0001	**
$\tau_{(1,1)}$	0.9645	0.1811	5.33	<.0001	**
Residual	7.3005	0.2238	32.62	<.0001	**

Note: * $p < .05$; ** $p < .01$

For the model with elementary and middle school levels and gifted, the same significant parameter estimate, percent of teachers who regularly use technology for administrative purposes, was identified as in the previous model (see Table 49). Interactions between time and time^2 with percent of teachers who regularly use technology for administrative purposes were significant. Although there was no difference in the percentage of variance explained in this model than was in the Demographic Model with Student Learning Environment by school level or the Technology Integration with Demographic and Student Learning Environment Model by school level, the BIC index all indicated better model fit (see Table 52). The level-1 residuals for the final model for predicting student absences using elementary and middle schools with gifted ranged between -16.49 and 22.23 with a standard deviation of 2.12. There were outliers. Skewness was 0.75 and kurtosis was 13.71, which would indicate that the residuals were not normally distributed and most were centered at the mean. Distribution of the empirical bayes intercepts ranged between -5.88 and 12.94 with standard deviation of 1.87. Skewness was 1.68, and kurtosis was 5.88, which indicated that the intercept residuals at level-2 were not distributed normally. Distribution of the empirical bayes slopes ranged between -3.17 and 6.57 with standard deviation of 1.03. Skewness was 1.24, and kurtosis was 3.93, which indicated that most of the slope residuals at level-2 were not normally distributed. Because the residuals for student absences outcome were not normally distributed, the results of the analysis may be biased.

Final Model 7b: Technology Integration with Demographics and Student Learning Environment by School Level (Elementary and Middle Schools with Gifted)

Level 1: Student Absences = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Teachers use Admin + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + γ_{19}* Teachers use Admin + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment + γ_{29}*Teachers use Admin

Mixed-Effects Model: Student Absences = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Teachers use Admin + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{19}*Teachers use Admin*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + γ_{29}*Teachers use Admin*Time^2 + $u_0 + u_1$ + r

Table 49.

Final Model 7b: Significant Technology Integration with Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		10.0879	0.2007	1825	50.27	<.0001	**
Time		0.1225	0.4547	1704	0.27	0.7877	
Time2		0.06814	0.2147	1528	0.32	0.751	
School Level	Elementary	-3.7797	0.2473	1528	-15.28	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		1.052	0.1167	1528	9.01	<.0001	**
Minority		0.2045	0.1268	1528	1.61	0.1069	
LEP		-0.1649	0.09745	1528	-1.69	0.0908	
Students with Disabilities		0.8098	0.07991	1528	10.13	<.0001	**
Gifted		-0.3837	0.08644	1528	-4.44	<.0001	**
Positive Learning Environment		-0.9598	0.1051	1528	-9.13	<.0001	**
Positive Teacher Qualifications		-0.03555	0.07137	1528	-0.5	0.6185	
Teachers Use for		-0.2047	0.06924	1528	-2.96	0.0032	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Administrative Purposes							
Time*School Level	Elementary	2.2127	0.5723	1528	3.87	0.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.8636	0.272	1528	3.18	0.0015	**
Time*Minority		-0.5038	0.273	1528	-1.85	0.0652	
Time*LEP		-0.452	0.2109	1528	-2.14	0.0322	*
Time*Students with Disabilities		0.05196	0.1786	1528	0.29	0.7712	
Time*Gifted		0.07717	0.1892	1528	0.41	0.6834	
Time*Positive Learning Environment		-0.268	0.2694	1528	-0.99	0.32	
Time*Positive Teacher Qualifications		-0.3045	0.1678	1528	-1.81	0.0698	
Time*Teachers Use for Administrative Purposes		0.5563	0.1774	1528	3.14	0.0017	**
Time2*School Level	Elementary	-0.9621	0.2724	1528	-3.53	0.0004	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.2061	0.1306	1528	-1.58	0.1146	
Time2*Minority		0.1078	0.1292	1528	0.83	0.4045	
Time2*LEP		0.1335	0.09985	1528	1.34	0.1813	
Time2*Students with Disabilities		0.0913	0.08461	1528	1.08	0.2807	
Time2*Gifted		0.005296	0.08883	1528	0.06	0.9525	
Time2*Positive Learning Environment		0.1788	0.1304	1528	1.37	0.1707	
Time2*Positive Teacher Qualifications		0.1419	0.08034	1528	1.77	0.0776	
Time2*Teachers Use for Administrative Purposes		-0.2272	0.08581	1528	-2.65	0.0082	**

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	3.9259	0.3666	10.71	<.0001	**
$\tau_{(1,0)}$	2.5493	0.1864	13.68	<.0001	**
$\tau_{(1,1)}$	1.0783	0.1828	5.9	<.0001	**
Residual	6.1579	0.2172	28.34	<.0001	**

Note: * $p < .05$; ** $p < .01$

The last step was to add in USDOE funded Magnet Schools and USDOE Technology Magnet Schools as variables in the model. Results of this model indicated that having U.S. technology magnet school status was significant at the intercept; however, the interactions with time and time^2 with having U.S. technology magnet school status were not significant in both datasets (see Table 50 and Table 51).

The parameter estimates for having U.S. magnet school status at the intercept as well as the interaction with time with having U.S. magnet school status were significant predictors of percent of students absent more than 21 days in the dataset that included all school levels without gifted (see Table 50), while only the interactions with time and $time^2$ with having U.S. magnet school status were significant predictors of percent of students absent more than 21 days in the dataset that included elementary and middle school with gifted (see Table 51). U.S. technology magnet schools were predicted to start the study with 3.24 lower percent of students absent more than 21 days with the all school level without gifted dataset and 2.54 lower percent of students absent more than 21 days in the elementary and middle school with gifted dataset. On the other hand, U.S. magnet schools had the reverse relationship. U.S. magnet schools were predicted to start the study with 1.93 percent higher of students absent more than 21 days with the all school level without gifted dataset and 0.66 percent higher of students absent more than 21 days in the elementary and middle school with gifted dataset.

Table 50.

Model 8a: Magnet Schools with Significant Technology Integration Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		8.6371	1.1461	2257	7.54	<.0001	**
Time		1.1814	1.9339	2201	0.61	0.5413	
Time2		-0.3936	0.9141	2078	-0.43	0.6668	
School Level	Elementary	-3.5135	0.2856	2078	-12.3	<.0001	**
School Level	High	4.0148	0.3108	2078	12.92	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		0.952	0.1266	2078	7.52	<.0001	**
Minority		0.498	0.1386	2078	3.59	0.0003	**
LEP		-0.1168	0.1167	2078	-1	0.3172	
Students with Disabilities		0.9847	0.09173	2078	10.73	<.0001	**
Positive Learning Environment		-1.0835	0.1036	2078	-10.46	<.0001	**
Positive Teacher Qualifications		0.07696	0.07878	2078	0.98	0.3287	
Teachers Use for Administrative Purposes		-0.1817	0.07471	2078	-2.43	0.0151	*
Technical Support Human		-0.03495	0.07107	2078	-0.49	0.6229	
Not a Technology Magnet School - US		3.2352	1.3168	2078	2.46	0.0141	*
Technology Magnet School - US		0	.	.	.	.	
Not a US Magnet School		-1.927	0.7027	2078	-2.74	0.0062	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
US Magnet School		0	.	.	.	.	
Time*School Level	Elementary	2.0352	0.5456	2078	3.73	0.0002	**
Time*School Level	High	-0.6263	0.5261	2078	-1.19	0.234	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.4938	0.2512	2078	1.97	0.0494	*
Time*Minority		-0.07251	0.25	2078	-0.29	0.7718	
Time*LEP		-0.4107	0.2058	2078	-2	0.0461	*
Time*Students with Disabilities		-0.03385	0.1729	2078	-0.2	0.8448	
Time*Positive Learning Environment		0.03441	0.23	2078	0.15	0.8811	
Time*Positive Teacher Qualifications		-0.4172	0.1641	2078	-2.54	0.0111	*
Time*Teachers Use for Administrative Purposes		0.49	0.1751	2078	2.8	0.0052	**
Time*Technical Support Human		0.3471	0.1637	2078	2.12	0.0341	*
Time*Not a Technology Magnet School - US		2.5563	2.2082	2078	1.16	0.2471	
Time*Technology Magnet School - US		0	.	.	.	.	
Time*Not a US Magnet School		-3.6699	1.179	2078	-3.11	0.0019	**
Time*US Magnet School		0	.	.	.	.	
Time2*School Level	Elementary	-0.8759	0.2598	2078	-3.37	0.0008	**
Time2*School Level	High	0.653	0.2495	2078	2.62	0.0089	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.06408	0.1204	2078	-0.53	0.5947	
Time2*Minority		-0.1317	0.1183	2078	-1.11	0.2658	
Time2*LEP		0.1419	0.09719	2078	1.46	0.1445	
Time2*Students with Disabilities		0.09691	0.08175	2078	1.19	0.236	
Time2*Positive Learning Environment		-0.00351	0.1113	2078	-0.03	0.9749	
Time2*Positive Teacher Qualifications		0.1957	0.07818	2078	2.5	0.0124	*
Time2*Teachers Use for Administrative Purposes		-0.228	0.08394	2078	-2.72	0.0067	**
Time2*Technical Support Human		-0.2173	0.0787	2078	-2.76	0.0058	**
Time2*Not a Technology Magnet School - US		-0.609	1.0451	2078	-0.58	0.5602	
Time2*Technology Magnet School - US		0	.	.	.	.	
Time2*Not a US Magnet School		1.0575	0.5595	2078	1.89	0.0589	
Time2*US Magnet School		0	.	.	.	.	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	9.8976	0.5249	18.86	<.0001	**
$\tau_{(1,0)}$	1.9702	0.2188	9.01	<.0001	**
$\tau_{(1,1)}$	0.9356	0.1801	5.2	<.0001	**
Residual	7.2828	0.2232	32.62	<.0001	**

Note: * $p < .05$; ** $p < .01$

Table 51.

Model 8b: Magnet Schools with Significant Technology Integration Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		8.2082	1.0128	1823	8.1	<.0001	**
Time		0.5601	2.1257	1702	0.26	0.7922	
Time2		0.06375	1.0177	1526	0.06	0.9501	
School Level	Elementary	-3.7833	0.2471	1526	-15.31	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		1.0535	0.1166	1526	9.03	<.0001	**
Minority		0.2131	0.1271	1526	1.68	0.0938	
LEP		-0.1695	0.09752	1526	-1.74	0.0824	
Students with Disabilities		0.8196	0.07993	1526	10.25	<.0001	**
Gifted		-0.3833	0.08628	1526	-4.44	<.0001	**
Positive Learning Environment		-0.949	0.105	1526	-9.04	<.0001	**
Positive Teacher Qualifications		-0.04138	0.07128	1526	-0.58	0.5616	
Teachers Use for Administrative Purposes		-0.1931	0.06926	1526	-2.79	0.0054	**
Not a Technology Magnet School - US		2.5372	1.1544	1526	2.2	0.0281	*
Technology Magnet School - US		0	.	.	.	.	
Not a US Magnet School		-0.6561	0.5993	1526	-1.09	0.2738	
US Magnet School		0	.	.	.	.	
Time*School Level	Elementary	2.2867	0.5714	1526	4	<.0001	**
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.8053	0.2723	1526	2.96	0.0031	**
Time*Minority		-0.5818	0.2733	1526	-2.13	0.0334	*
Time*LEP		-0.3943	0.2111	1526	-1.87	0.0619	
Time*Students with Disabilities		0.05492	0.1785	1526	0.31	0.7583	
Time*Gifted		0.06121	0.1888	1526	0.32	0.7459	
Time*Positive Learning Environment		-0.2902	0.2689	1526	-1.08	0.2807	
Time*Positive Teacher Qualifications		-0.2931	0.1675	1526	-1.75	0.0804	
Time*Teachers Use for		0.5285	0.1777	1526	2.97	0.003	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Administrative Purposes							
Time*Not a Technology Magnet School - US		3.6062	2.3931	1526	1.51	0.132	
Time*Technology Magnet School - US		0	.	.	.	.	
Time*Not a US Magnet School		-4.1758	1.2171	1526	-3.43	0.0006	**
Time*US Magnet School		0	.	.	.	.	
Time2*School Level	Elementary	-0.9889	0.272	1526	-3.64	0.0003	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.1877	0.1308	1526	-1.44	0.1514	
Time2*Minority		0.1312	0.1294	1526	1.01	0.3106	
Time2*LEP		0.1137	0.09997	1526	1.14	0.2554	
Time2*Students with Disabilities		0.08898	0.08456	1526	1.05	0.2928	
Time2*Gifted		0.009079	0.08873	1526	0.1	0.9185	
Time2*Positive Learning Environment		0.1934	0.1302	1526	1.49	0.1377	
Time2*Positive Teacher Qualifications		0.1367	0.08021	1526	1.7	0.0886	
Time2*Teachers Use for Administrative Purposes		-0.2203	0.08595	1526	-2.56	0.0105	*
Time2*Not a Technology Magnet School - US		-1.0704	1.1448	1526	-0.94	0.3499	
Time2*Technology Magnet School - US		0	.	.	.	.	
Time2*Not a US Magnet School		1.1144	0.5782	1526	1.93	0.0541	
Time2*US Magnet School		0	.	.	.	.	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	3.9043	0.365	10.7	<.0001	**
$\tau_{(1,0)}$	2.5135	0.1851	13.58	<.0001	**
$\tau_{(1,1)}$	1.0275	0.1808	5.68	<.0001	**
Residual	6.1369	0.2165	28.35	<.0001	**

Note: * $p < .05$; ** $p < .01$

Table 52.

Model Fit Indices for Models Predicting FCAT Student Absences Scores for All School Levels (without Gifted)

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 1: Absences Predicted by Average Absences of All Schools in Florida	40464.6	40470.6	40470.6	40487.8
Model 2a: Time as a Predictor of Absences	40065.4	40077.4	40077.4	40111.9

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Quadratic Model 2b: Time^2 as a Predictor of Absences	40022.8	40036.8	40036.8	40077
Model 3: Time, Time^2, and School Level as Predictors of Absences	39266	39292	39292	39366.7
Model 4a: Absences predicted by Time, School Level, and Demographics Variables	36544.7	36594.7	36594.9	36737.8
Model 5a: Demographics and Student Learning Environment by School Level	36389.7	36451.7	36452	36629.2
Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level	36304.4	36420.4	36421.5	36752.4
Final Model 7a: Significant Technology Integration with Demographics and Student Learning Environment by School Level	36366	36440	36440.4	36651.8
Model 8a: Magnet Schools with Significant Technology Integration Demographics and Student Learning Environment by School Level (All School Levels without Gifted)	36323.1	36409.1	36409.7	36655.3

Table 53.

Model Fit Indices for Models Predicting FCAT Student Absences Scores for Elementary and Middle School Levels (with Gifted)

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 1: Absences Predicted by Average Absences of All Elementary and Middle Schools in Florida	33095.3	33101.3	33101.3	33118
Model 4b: Absences predicted by Time, School Level, and Demographics Variables No High School includes gifted	26929.5	26979.5	26979.7	27117.2
Model 5b: Demographics and Teacher Qualifications by School Level	26804.9	26866.9	26867.3	27037.7
Model 6b: Technology Integration with Demographics and Teacher Qualifications by School Level	26739.3	26855.3	26856.7	27174.9
Final Model 7b: Significant Technology Integration with Demographics and Student Learning Environment by School Level	26792.4	26860.4	26860.9	27047.8
Model 8b: Magnet Schools with Significant Technology Integration Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted	26752	26832	26832.6	27052.4

The result of the analysis for all the models indicated that Hypothesis 1 for Research Question 2 was partially correct. When the sample included schools at all three school levels, there was a significant relationship at the intercept between the percent of teachers who regularly use technology for administrative purposes (-0.1873) and percent of students absent more than 21 days at the intercept when all other school level, demographic, and school learning environment factors were controlled. Also, there were significant interactions between time (0.5167) and time^2 (-0.2375) with the percent of teachers who regularly use technology for administrative purposes for predicting the percent of students absent more than 21 days and significant interactions between time (0.3417) and time^2 (-0.2152) with technology support - human for predicting the percent of students absent more than 21 days. The interactions of time and time^2 with the percent of teachers who regularly use technology for administrative purposes resulted in a curvilinear trend.

After controlling so that all other variables were held at the mean, the trend for each school level could be examined separately, by comparing schools with different levels that teachers use technology for administrative purposes. Figure 27 illustrates the relationship between the percent of teachers who regularly use technology for administrative purposes and the percent of students absent more than 21 days for high schools. Percent of teachers who regularly use technology for administrative purposes was compared at one and two standard deviations below the mean, the mean, and one and two standard deviations above the mean. This allowed the extreme cases of schools that had the highest percent of teachers who regularly use technology for administrative purposes, +2 standard deviations above the mean, and schools that had the lowest percent of teachers regularly use technology for administrative purposes, -2 standard deviations below the mean to be compared. High schools that had the highest percentage of teachers who regularly use technology for administrative purposes started the study in 2003-04 with 13.61% of students absent more than 21 days and schools that had the lowest percent of teachers who regularly use technology for administrative purposes had started with 14.36% of students absent more than 21 days. This difference of 0.75% was significant because there were so many schools in the sample; however, the practical importance was modest. The interaction between the percent of teachers who regularly use technology for administrative purposes and time and time^2 with percent of students absent more than 21 days was significant, so the slopes of the trends were curvilinear. In 2004-05, schools at one and two standard deviations below the mean of percent of teachers who use technology for administrative purposes experienced a decrease in the percent of students absent more than 21 days, while high schools that had two standard deviations above the mean of percent of teachers who use technology for administrative purposes experienced the greatest increase in the percentage of students absent more than 21 days (0.78%). By 2005-06, all high schools gained in their percent of students absent for more than 21 days, and high schools with the lowest percent of teachers who regularly use technology for administrative purposes had the highest increase in percent of students absent more than 21 days (see Figure 27).

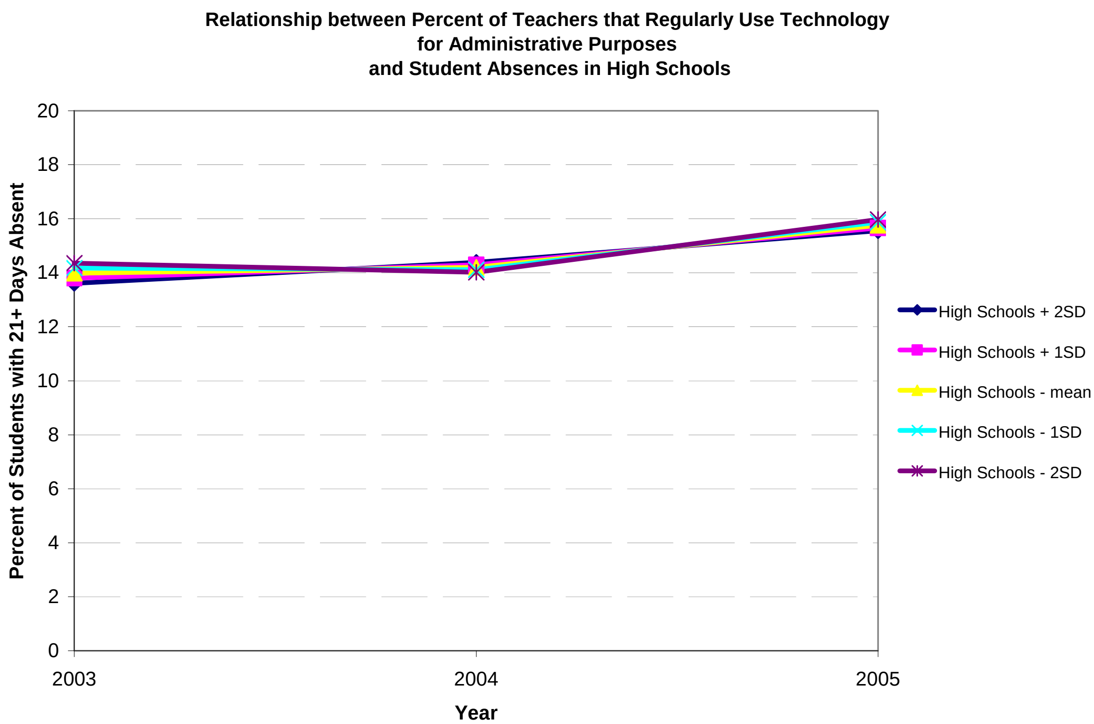

Figure 27. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Student Absences in High Schools.

Middle schools had a similar beginning pattern to high school, that is after controlling for all other factors, schools that were two standard deviations above the mean in the percent of teachers who regularly use technology for administrative purposes had the lowest percent of students absent more than 21 days in 2003-04 (9.62%), while those with two standard deviations below the mean had the highest levels (10.37%). Although this difference of 0.75% was significant due to the large sample size, the practical importance is modest. Because the interactions between time and time^2 and the percent of teachers who regularly use technology for administrative purposes with percent of students absent more than 21 days were significant, the trends were curvilinear. Between 2003-04 and 2004-05 middle schools at one and two standard deviations below the mean in percent of teachers using technology for administrative purposes experienced decreases in the percent of students absent more than 21 days (0.07% and 0.35%, respectively), while schools that were two standard deviations above the mean experienced the greatest increases in percent of students absent more than 21 days (0.77%). These trends reversed in 2005-06, with middle schools with the highest percentage of teachers who regularly use technology for administrative purposes having a decline in the percentage of students with more than 21 days absent (0.16%) and schools at two standard deviations below the mean of percentage of teachers who regularly use technology for administrative purposes having the greatest increases (0.63%) (see Figure 28).

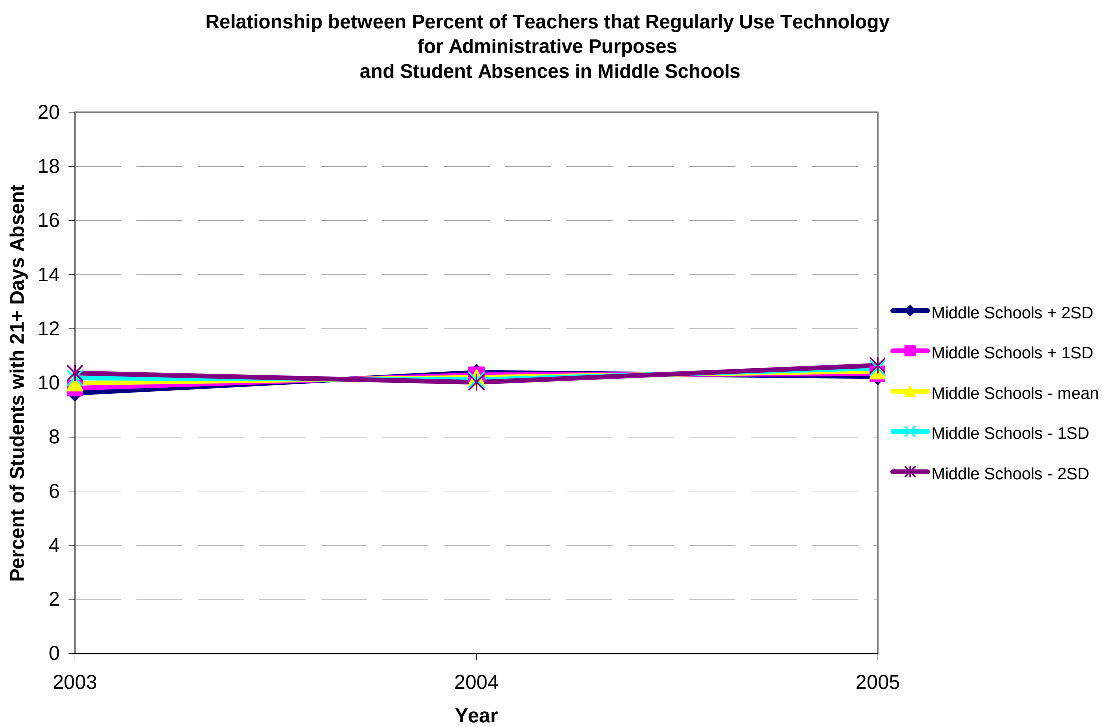

Figure 28. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Student Absences in Middle Schools.

The trends for elementary schools were similar to those of high and middle schools. Schools with the highest percent of teachers who regularly use technology for administrative purposes began the study with the lowest percent of students absent more than 21 days (6.08%), while schools with the lowest percent of teachers who regularly use technology for administrative purposes began the study with the highest percent of students absent more than 21 days (6.83%). Although this difference of 0.75% was statistically significant, it had modest practical importance. Between 2003-04 and 2004-05, elementary schools experienced an increase in percent of students absent more than 21 days with elementary schools that had the greatest percentage of teachers who regularly use technology for administrative purposes associated with the greatest increase in the percent of students absent more than 21 days (0.87%). At the end of the study in 2005-06, the trends changed. Elementary schools at two standard deviations below the mean in percentage of teachers who regularly use technology for administrative purposes experienced increases in the percentage of students who were absent more than 21 days (0.04%), while schools at two standard deviations above the mean in percentage of teachers who regularly use technology for administrative purposes experienced the greatest decreases (0.75%) (see Figure 29).

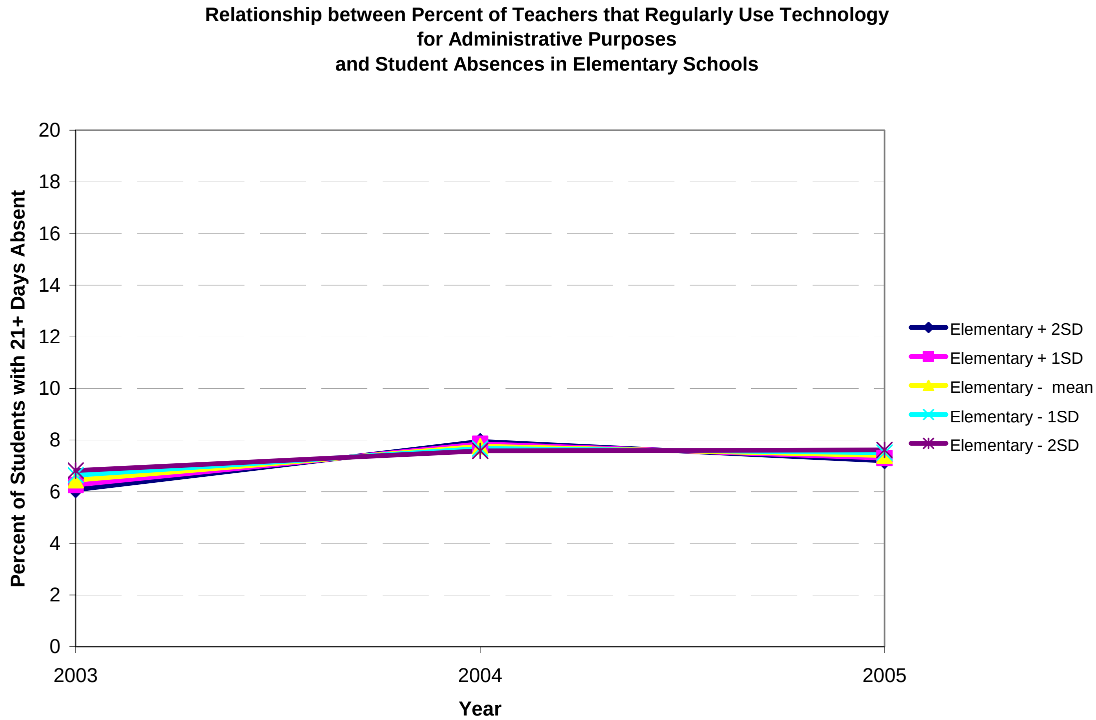

Figure 29. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Student Absences in Elementary Schools.

When the sample was restricted to just elementary and middle schools and percent of gifted students was included in the equation, there was a main effect with gifted but no interactions of percent of gifted students in the school with time or $time^2$. Thus, when all other factors were held equal, schools with highest percentages of gifted students began the study with the lowest percent of students absent more than 21 days and this trend did not change over time (see Figure 30). However, there were differences by school level. Between 2003-04 and 2005-06, first, the trend for all elementary schools with gifted students was an increase in percent of students absent more than 21 days, which then leveled out, while the trend for middle schools with gifted students was a decrease in the percent of students absent more than 21 days and then an increase. Both elementary and middle schools ended the study in 2005-06 at approximately the same percent.

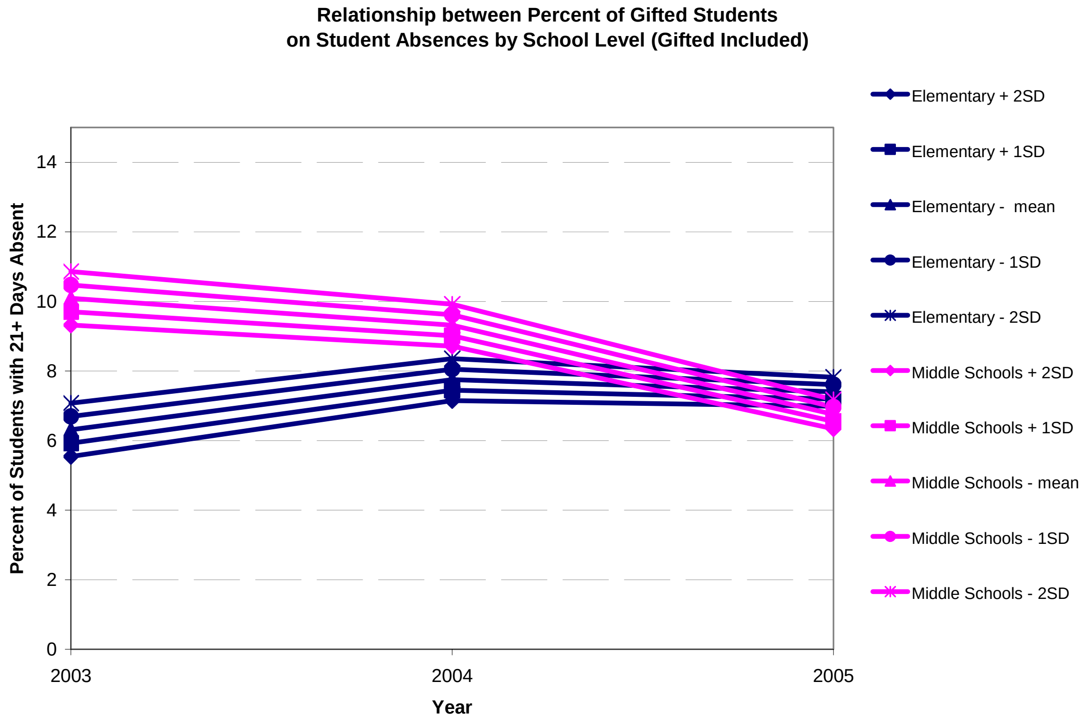

Figure 30. Relationship between Percent of Gifted Students on Student Absences by School Level (Gifted Included)

When examining the parameter estimates of the technology integration indicators within these data, there was a significant relationship between the intercept of the percent of teachers who regularly use technology for administrative purposes and percent of students absent more than 21 days. Interactions between time and time^2 and the percent of teachers who regularly use technology for administrative purposes were significant predictors of percent of students absent more than 21 days. In order to visualize the significant relationships between the percent that teachers who regularly use technology for administrative purposes and percent of students absent more than 21 days, separate charts were created after controlling for all other factors.

Each school level was examined separately. One and two standard deviations above the mean, the mean, and one and two standard deviations below the mean of percentages of teachers who regularly use technology for administrative purposes were compared after controlling for all other factors. In 2003-04, middle schools with the highest percentages of teachers who regularly use technology for administrative purposes started with the lowest percent of students absent more than 21 days (9.68%), while middle schools with the lowest percentages of teachers who regularly use technology for administrative purposes started with the highest percent of students absent more than 21 days (10.50%) (see Figure 31). The level of percent of students absent more than 21 days decreased in middle schools at one and two standard deviations below the mean in percentages of teachers who regularly use technology for administrative purposes in 2004-05 (0.14% and 0.47%, respectively); however the middle schools that were at two standard deviations above the mean in percentage of teachers who regularly used technology for administrative purposes had the most increase in percent of students absent more than 21 days (0.85%). In 2005-06, all middle schools experienced increases in their percent of students absent more than 21 days, with middle schools with the highest percentages of teachers who regularly used technology for administrative purposes experiencing the least increase in percent of students absent more than 21 days (0.07%). At the end of the study in 2005-06, the differences in the percentage of students absent more than 21 days related to the different levels in percentage of teachers who regularly used technology for administrative purposes was 0.01%. Although the curvilinear trends were significant because there were so many schools in the sample, the difference had modest practical importance.

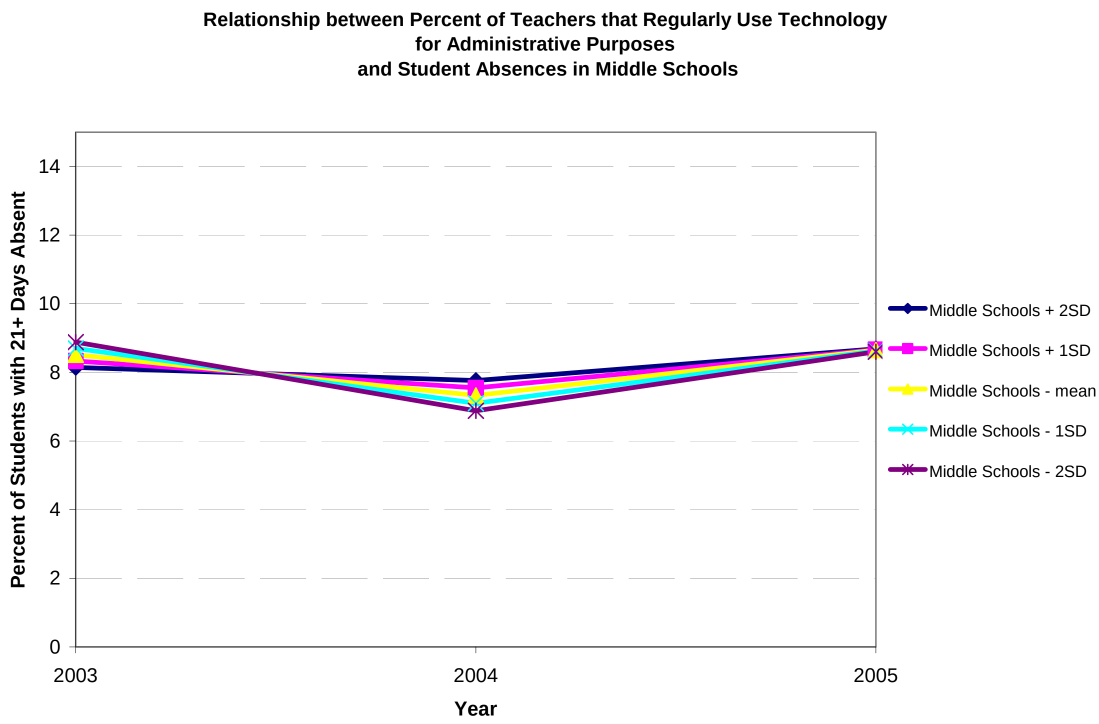

Figure 31. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Student Absences in Middle Schools (Gifted Included).

The trends for elementary schools followed a very similar pattern to that of middle schools (see Figure 32). In 2003-04, elementary schools with two standard deviations above the mean of percentage of teachers who regularly use technology for administrative purposes had the lowest percentage of students absent more than 21 days (5.90%), while elementary schools with two standard deviations below the mean of percentage of teachers who regularly use technology for administrative purposes had the highest percentage of students absent more than 21 days (6.72%). Although this difference was significant, the difference of 0.82% is very modest. In 2004-05 the percent of students absent more than 21 days increased in all elementary schools. However, elementary schools with the least or two standard deviations below the mean for percentage of teachers who regularly use technology for administrative purposes increased the least (0.78%), while elementary schools with the highest percentage of teachers who regularly use technology for administrative purposes increased the most (2.10%). The trend for elementary schools with all levels of percentage of teachers who regularly use technology for administrative purposes reversed again in 2005-06. Elementary schools at two standard deviations above the mean of percentage of teachers who regularly use technology for administrative purposes had the greatest decreases (0.60%) in percent of students absent more than 21 days, while elementary schools with two standard deviations below the mean of percentage of teachers who regularly use technology for administrative purposes experienced the smallest decreases (0.10%) in average school percent of students absent more than 21 days (see Figure 32).

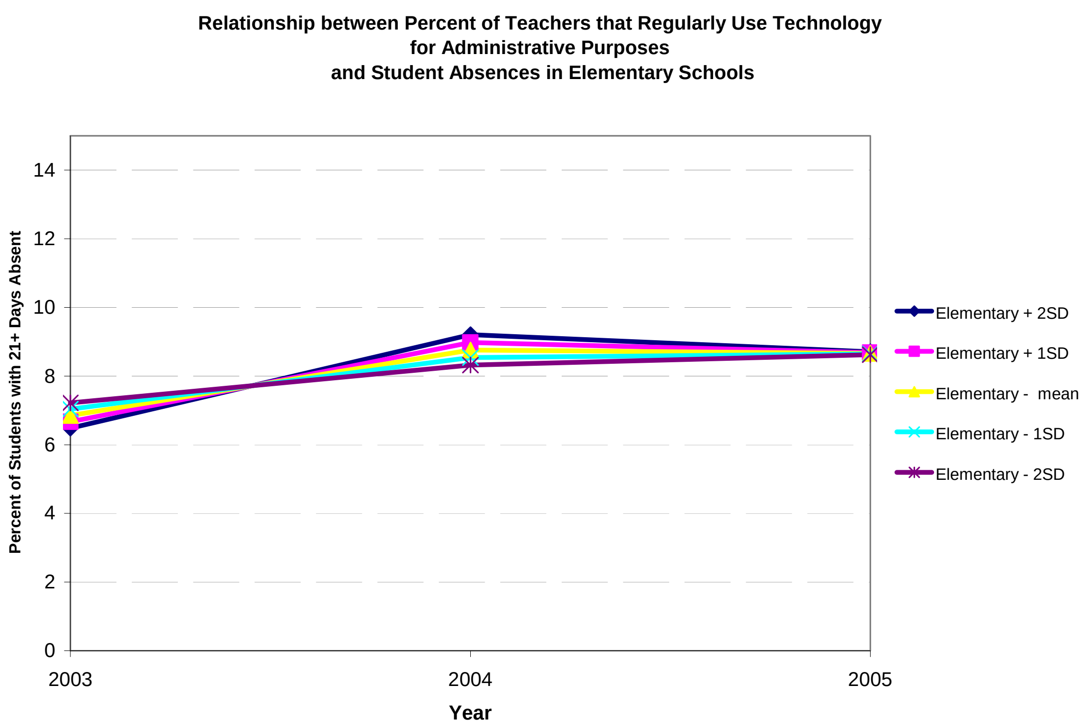

Figure 32. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Absences in Elementary Schools (Gifted Included).

The significant relationship between the interaction of time[2] and the level of technology support – human and the percent of students absent more than 21 days for all school levels without gifted are depicted for each level of school separately. Charts were made for each level of school to visualize the relationship between the level of technology support – human and percent of students absent more than 21 days at one and two standard deviations above the mean, the mean, and one and two standard deviations below the mean. Although the intercept for level of technology support – human were not significant, interactions between time and time^2 and level of technology support – human with percent of students absent more than 21 days were significant. This resulted in curvilinear trends at each grade level.

The trends for high school level at one and two standard deviations above the mean, the mean, and one and two standard deviations below the mean of level of technology support – human were examined (see Figure 33). When controlling for all other variables, high schools that began the study at two standard deviations above the mean have lower percentage of students absent more than 21 days (13.91%) than high schools at two standard deviations below the mean (14.05%). In the 2004-05 school year high schools at two standard deviations below the mean of level of technology support – human experienced a decline in the percent of students absent more than 21 days (0.03%), while schools with two standard deviations above the mean of level of technology support – human experienced the greatest increase in the percent of students absent more than 21 days (0.47%). At the end of the study in 2005-06, all high schools experienced an increase in percent of students absent more than 21 days, with schools at two standard deviations above the mean in level of technology support – human having the least gain in percent of students absent more than 21 days (0.95%), and schools with two standard deviations below the mean having the greatest gains in percent of students absent more than 21 days (2.17%). The intercept for level of technology support – human was not significant. The significant interactions between time and time^2 and level of technology support – human resulted in changes in the relationship between level technology support – human and the percent of students absent more than 21 days. More time is needed to examine the directions of these trends.

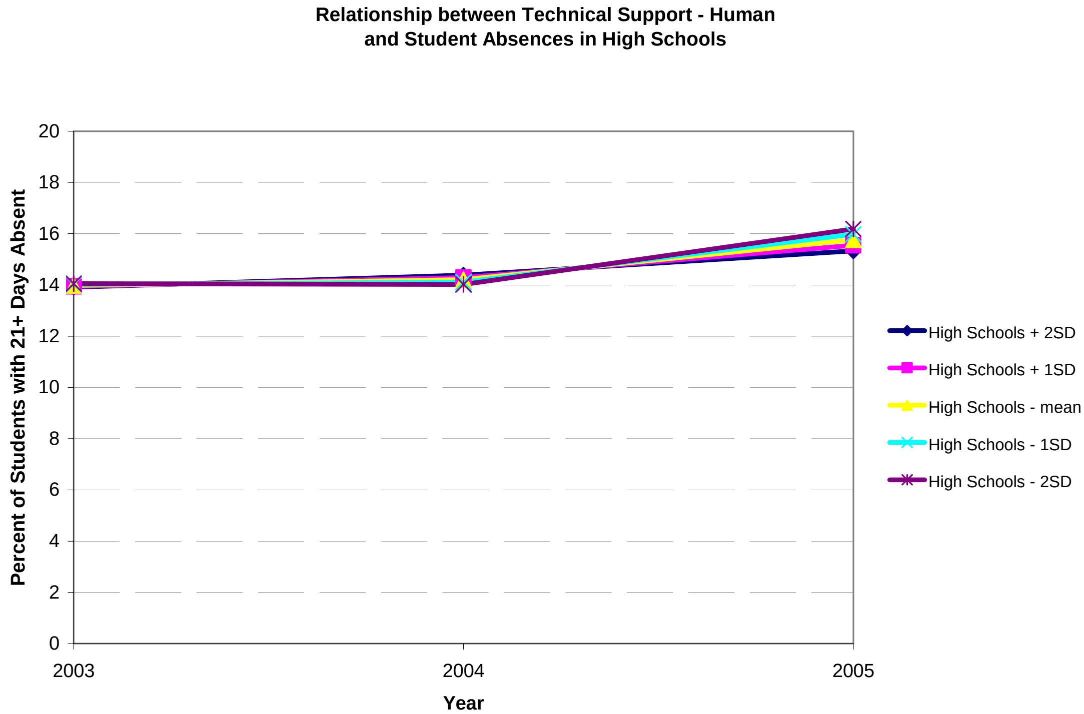

Figure 33. Relationship between Technology Support – Human and Student Absences in High Schools.

When controlling for all other variables, middle schools at two standard deviations above the mean a for level of technical support - human started the study in 2003-04 with 9.92% of students absent more than 21 days, while schools at two standard deviations below the mean started the study with 10.06% (see Figure 34). As with high schools, in 2004-05 middle schools at two standard deviations below the mean of level of technical support - human experienced decreases (0.03%) in the percent of students absent more than 21 days, while middle schools at two standard deviations above the mean a for level of technical support – human experienced the greatest increase (0.47%). At the end of the study in 2005-06, middle schools at two standard deviations below the mean experienced the greatest increases (0.84%) in the percent of students absent more than 21 days, while middle schools at two standard deviations above the mean for level of technical support – human experienced the greatest decrease (0.37%).

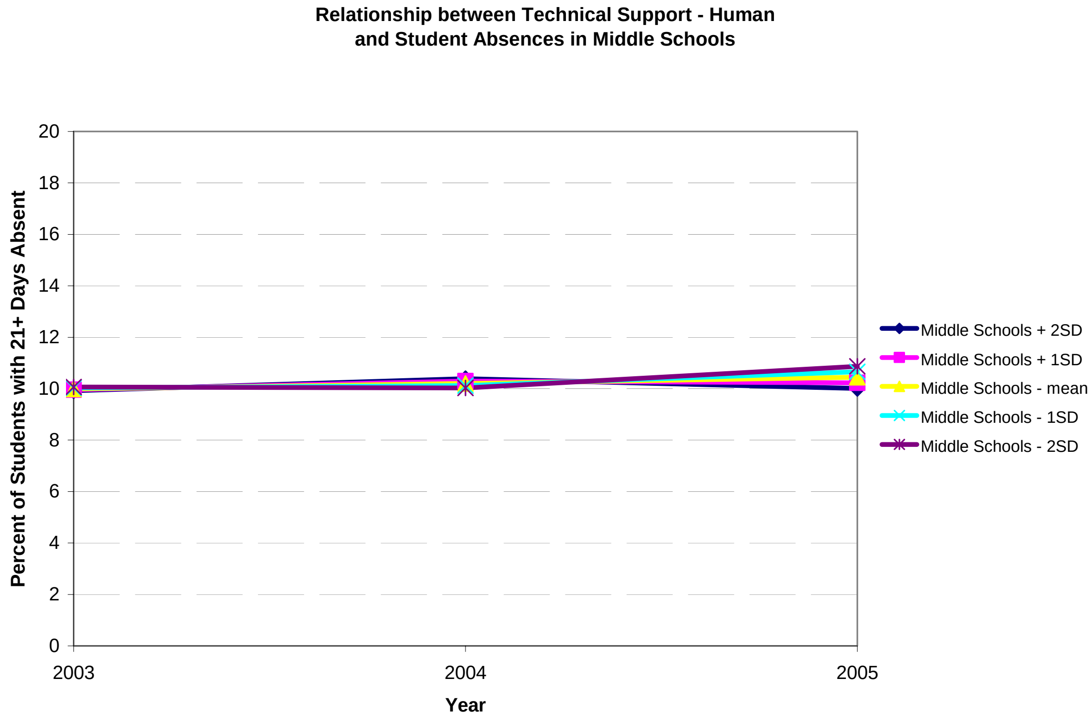

Figure 34. Relationship between Technology Support – Human and Student Absences in Middle Schools.

After controlling for all other variables, elementary schools with two standard deviations above the mean for level of technology support - human began with 6.38% of students absent more than 21 days in 2003-04, while elementary schools with two standard deviations below the mean began with 6.52% of students absent more than 21 days (see Figure 35). All elementary schools experienced increases in percent of students absent more than 21 days in the 2004-05 school year, with elementary schools with two standard deviations above the mean of level of technology support – human having the greatest increase (1.56%) and elementary schools with two standard deviations below the mean with the least increase (1.06%). By the end of the study in 2005-06, the trends for elementary schools were different based on their level of technology support – human. Elementary schools at the two standard deviations above the mean experienced the greatest decrease in the percent of students absent more than 21 days (0.96%), while elementary schools at two standard deviations below the mean in level of technology support – human experienced the greatest increase in the percent of students absent more than 21 days (0.25%). More time is needed to examine this relationship and the directions of trend.

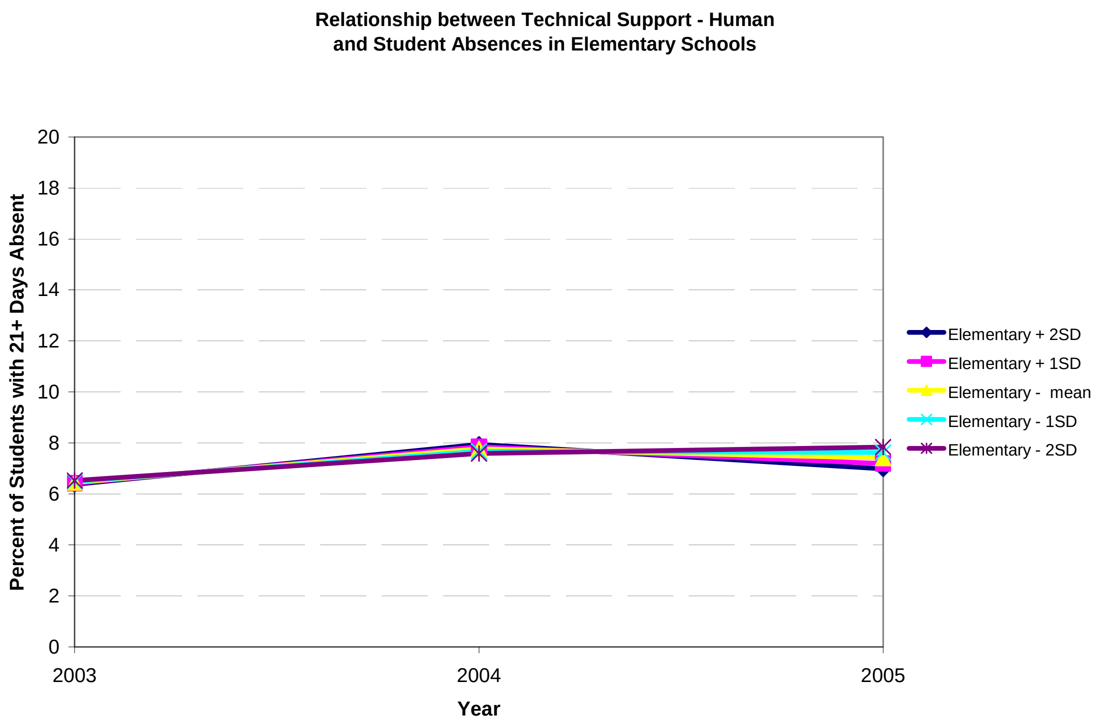

Figure 35. Relationship between Technology Support – Human and Absences in Elementary Schools.

Hypothesis 2

The second analysis conducted to answer the second research question used the student misconduct outcome data to test the following hypothesis:

> H_2: After controlling for school level (elementary, middle, and high), school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality, mean school student misconduct composite variable will have a negative relationship with indicators of technology integration.

The first step was to build the unconditional model. The unconditional model predicted the schools' student misconduct composite from the average of student misconduct composite for all schools. There were no other predictors. The average student misconduct for all schools was 19.99 points (t (2311) = 45.84, p <.0001).

Model 1: Unconditional Model
Level 1: Student Misconduct = $\beta_0 + r$
Level 2: $\beta_0 = \gamma_{00} + u_0$
Mixed-Effects Model: Student Misconduct = $\gamma_{00} + u_0 + r$

The intraclass correlation coefficient (ICC) was computed to determine the proportion of variance in the student misconduct variable that is accounted for by the schools. The ICC was .86, which is high and supports using multi-level modeling for the analysis. The model fit statistics from this model were used as the baseline for model comparisons.

The next step added time to the predictor equation (see Model 2a). The variance components from this analysis showed how much of the variance in the model was accounted for by time. The variance in the slopes between schools was significant. Therefore, time was set as a random effect, and the model was estimated. Both the intercept (t (2311) = 43.89, p <.0001) and time (t (2311) = -9.63, p <.0001) were significant parameters. Although time added additional explained variance between schools, time accounted for 36% of the variance within schools.

Model 2a: Unconditional Growth Model
Level 1: Student Misconduct = $\beta_0 + \beta_1$*Time + r
Level 2: $\beta_0 = \gamma_{00} + u_0$
$\beta_1 = \gamma_{10} + u_1$

Mixed-Effects Model: Student Misconduct = $\gamma_{00} + \gamma_{10}$*Time + $u_0 + u_1$*Time + r

To determine if the equation was not linear but curvilinear, time^2 was added to the equation so the variance could be compared. Results indicated that time^2 was significant (t (2311) = 3.19, p = 0.0014), but it did not increase the variance explained over the Growth Model (see Model 2b). Time and time^2 were retained in the quadratic growth model equation.

Model 2b: Quadratic Growth Model
Level 1: Student Misconduct = $\beta_0 + \beta_1$*Time + β_2* Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + u_0$
$\beta_1 = \gamma_{10} + u_1$
$\beta_2 = \gamma_{20}$
Mixed-Effects Model: Student Misconduct = $\gamma_{00} + \gamma_{10}$*Time + γ_{20}* Time^2 + $u_0 + u_1$ + r

Next, school level was added to the Quadratic Growth Model to predict misconduct (See Model 3). The significance of the parameter estimates determined if school level was significantly related to the student misconduct and if there was an interaction with time. This model adjusted the mean school student misconduct and the slope of student misconduct growth for school level. The parameter estimates of elementary school relative to middle school and time at the intercept were significant, while time^2 was not significant at the intercept. Neither the interactions between time nor time^2 with elementary or high school relative to middle school were significant. All model fit indices indicated improved fit with this model (see

Table 65). This model accounted for 36% of the between school variance but no additional within school variance from the Quadratic Growth Model.

Model 3: School Level as Predictor

Level 1: Student Misconduct = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Type + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Type

Mixed-Effects Model: Student Misconduct = $\gamma_{00} + \gamma_{01}$*School Type + γ_{10}*Time + γ_{11}*School Type*Time + γ_{20}*Time^2 + γ_{21}*School Type*Time^2 + $u_0 + u_1$ + r

Table 54.

Model 3: Time, Time Squared, and School Type as Predictors of Misconduct

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		43.5557	0.8274	2309	52.64	<.0001	**
Time		-3.0542	0.8239	2309	-3.71	0.0002	**
Time^2		0.1687	0.3816	2309	0.44	0.6585	
School Level	Elementary	-33.3814	0.9412	2309	-35.47	<.0001	**
School Level	High	-0.9679	1.2488	2309	-0.78	0.4384	
School Level	Middle	0	.	.	.	.	
Time*School Level	Elementary	1.0952	0.9372	2309	1.17	0.2427	
Time*School Level	High	-0.452	1.2435	2309	-0.36	0.7162	
Time*School Level	Middle	0	.	.	.	.	
Time^2*School Level	Elementary	0.558	0.434	2309	1.29	0.1987	
Time^2*School Level	High	0.00046	0.5759	2309	0	0.9994	
Time^2*School Level	Middle	0	.	.	.	.	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	262.07	8.8328	29.67	<.0001	**
$\tau_{(1,0)}$	-35.6545	2.7148	-13.13	<.0001	**
$\tau_{(1,1)}$	21.3539	1.4158	15.08	<.0001	**
Residual	43.289	1.2732	34	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added student demographic variables to the School Level Model. This model was estimated twice. The first time, the model was run with high school as a school level and all of the demographic variables except gifted, because gifted is not a designation at the high school level (see Model 4a). The second time, the data were filtered to exclude high school as a school level and kept the gifted variable with middle and elementary schools (see Model 4b). The model fit statistics of the demographic model with all three school levels was compared with the School Level as Predictor Model to determine if there was a better fit (see Table 65). The significance of the parameter estimates determined which of the demographic variables remained in the predictor equation (see Table 55). The variance estimates showed the amount of the total variance that was accounted for by each model. When all of the demographics variables except gifted were added to the model (see Model 4a), the intercept was significant and the average middle school started with FCAT misconduct score of 43.86 (t (2259) = 57.82, p <.0001). The parameter estimates for time, elementary school relative to middle school, free or reduced lunch status, minority, LEP, and students with disabilities were significant, while the parameter estimate for $time^2$, and high school relative to middle school were not significant. There were no interactions with time or $time^2$ with any of the demographic variables or school level. All model fit indices indicated better fit with the addition of these demographics variables. Adding the demographics variables with school level explained 54% of the between school variance and 36% of the within school variance for a total of 51% of all variance explained.

Model 4a: Demographics by School Level (including High School and no Gifted)

Level 1: Student Misconduct = $\beta_0 + \beta_1$*Time + β_2*$Time^2$ + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Type + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Type + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD

Mixed-Effects Model: Student Misconduct = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}*SWD + γ_{05}*LEP + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}*SWD*Time + γ_{15}*LEP*Time + γ_{20}*$Time^2$ + γ_{21}*School Level*$Time^2$ + γ_{22}*SES*$Time^2$ + γ_{23}*Minority*$Time^2$ + γ_{24}*SWD*$Time^2$ + γ_{25}*LEP*$Time^2$ + $u_0 + u_1$ + r

Table 55.

Model 4a: Misconduct predicted by Time, School Type, and Demographics Variables (No Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		43.8553	0.7584	2259	57.82	<.0001	**
Time		-3.4066	0.8683	2203	-3.92	<.0001	**
Time2		0.1807	0.3991	2092	0.45	0.6508	
School Level	Elementary	-34.0721	0.8717	2092	-39.09	<.0001	**
School Level	High	2.2263	1.1424	2092	1.95	0.0514	
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		2.6192	0.4238	2092	6.18	<.0001	**
Minority		6.3022	0.4837	2092	13.03	<.0001	**
LEP		-2.9498	0.4213	2092	-7	<.0001	**
Students with Disabilities		2.8979	0.3263	2092	8.88	<.0001	**
Time*School Level	Elementary	1.4968	1.0041	2092	1.49	0.1362	
Time*School Level	High	-0.9885	1.3128	2092	-0.75	0.4516	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.0205	0.5952	2092	0.03	0.9725	
Time*Minority		-0.9399	0.6133	2092	-1.53	0.1255	
Time*LEP		0.2539	0.5101	2092	0.5	0.6187	
Time*Students with Disabilities		-0.00911	0.4336	2092	-0.02	0.9832	
Time2*School Level	Elementary	0.4451	0.462	2092	0.96	0.3354	
Time2*School Level	High	0.1533	0.604	2092	0.25	0.7996	
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		0.2171	0.2744	2092	0.79	0.4289	
Time2*Minority		0.1091	0.2809	2092	0.39	0.6978	
Time2*LEP		-0.2954	0.2321	2092	-1.27	0.2033	
Time2*Students with Disabilities		-0.2511	0.1983	2092	-1.27	0.2056	
Covariance Parameter		Estimate	*SE*		*z*	*p*	
$\tau_{(0,0)}$		193.62	7.1121		27.22	<.0001	**
$\tau_{(1,0)}$		-33.592	2.609		-12.88	<.0001	**
$\tau_{(1,1)}$		22.3308	1.5287		14.61	<.0001	**
Residual		43.6012	1.3449		32.42	<.0001	**

Note: * $p < .05$; ** $p < .01$

The results from the analysis in Model 4b indicated that the intercept, time, school level, free or reduced lunch status, minority, LEP, students with disabilities, and gifted were all significant, while time^2 was not significant (see Table 56). Interactions between time and elementary school level, free or reduced lunch status, LEP, students with disabilities, and gifted were significant. Interactions between time and elementary relative to middle school and gifted were significant. Interactions between time^2 and gifted were also significant. Because the parameter for gifted was significant in this model, an unconditional model using the same population with high schools filtered out, predicting FCAT misconduct with average FCAT misconduct was estimated in order to compare the fit of this model. All model fit statistics indicated better model fit (see Table 66). When examining the variance of misconduct in elementary and middle schools, adding demographics variables to the equation explained 56% of the between school variance and 42% more of the within school variance. Two sets of analyses were conducted on the rest of the models in order to examine the relationship of gifted with technology integration as one of the predictors of school achievement.

Model 4b: Demographics by School Level (Elementary and Middle School only)

Level 1: Student Misconduct = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Type + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Type + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted

Mixed-Effects Model: Student Misconduct = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}*SWD + γ_{05}*LEP + γ_{06}*Gifted + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP*Time + γ_{15}* SWD*Time + γ_{16}*Gifted*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + u_0 + u_1 + r

Table 56.

Model 4b: Misconduct predicted by Time, School Level, and Demographics Variables for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		43.7317	0.6991	1825	62.56	<.0001	**
Time		-3.9217	0.8124	1704	-4.83	<.0001	**
Time2		0.4931	0.3723	1537	1.32	0.1855	
School Level	Elementary	-34.0648	0.8109	1537	-42.01	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		1.8571	0.4521	1537	4.11	<.0001	**
Minority		6.3869	0.5108	1537	12.5	<.0001	**
LEP		-3.2139	0.4094	1537	-7.85	<.0001	**
Students with Disabilities		1.8151	0.3301	1537	5.5	<.0001	**
Gifted		-2.1716	0.357	1537	-6.08	<.0001	**
Time*School Level	Elementary	2.1908	0.9516	1537	2.3	0.0215	*
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		0.3796	0.6517	1537	0.58	0.5604	
Time*Minority		-0.5206	0.6686	1537	-0.78	0.4363	
Time*LEP		0.05544	0.5164	1537	0.11	0.9145	
Time*Students with Disabilities		0.473	0.4457	1537	1.06	0.2888	
Time*Gifted		1.182	0.4631	1537	2.55	0.0108	*
Time2*School Level	Elementary	0.08988	0.4365	1537	0.21	0.8369	
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		0.2056	0.2992	1537	0.69	0.4921	
Time2*Minority		-0.1458	0.3047	1537	-0.48	0.6323	
Time2*LEP		-0.2263	0.2346	1537	-0.96	0.3348	
Time2*Students with Disabilities		-0.4301	0.2031	1537	-2.12	0.0344	*
Time2*Gifted		-0.5064	0.2108	1537	-2.4	0.0164	*

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	157.77	6.5899	23.94	<.0001	**
$\tau_{(1,0)}$	-26.7708	2.5116	-10.66	<.0001	**
$\tau_{(1,1)}$	21.4441	1.5534	13.81	<.0001	**
Residual	35.0381	1.2616	27.77	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added the variable that measures the school learning environment factors to the Demographics Model by School Level Model. These included teacher qualifications and positive learning environment. This model was estimated twice, first without gifted population but all school levels (see model 5a) and then with elementary and middle school levels and gifted population (see model 5b). When school learning environment factors were added with the demographic and school level variables for all school levels, the parameter estimates for the intercept, elementary relative to middle school, free or reduced lunch status, minority, LEP, students with disabilities, positive learning environment, and teacher qualifications were significant, while time, time^2, and high school relative to middle school, were not significant (see Table 57). There were significant interactions between time and time^2 with positive learning environment and time and positive teacher qualifications. Time^2 also had a significant interaction with students with disabilities. Adding the student learning environment variables explained an additional 3% of the between school variance and explained an additional 1% of the within school variance for a total of 55% of all of the variance explained. All of the model fit indices indicated that this model fit of the data better (see Table 65).

Model 5a: School Learning Environment with Demographics by School Level (all school levels without gifted and LEP)
Level 1: Student Misconduct = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}*SWD + γ_{05}* Teacher Qualifications + γ_{06}*Positive Learning Environment + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Type + γ_{12}*SES + γ_{13}*Minority + γ_{14}*LEP + γ_{15}*SWD + γ_{16}* Teacher Qualifications + γ_{17}*Positive Learning Environment + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Type + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}* Teacher Qualifications + γ_{27}*Positive Learning Environment

Mixed-Effects Model: Student Misconduct = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* SWD + γ_{05}*Teacher Qualifications + γ_{06}* Positive Learning Environment + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}*SWD *Time + γ_{15}* Teacher Qualifications*Time + γ_{16}* Positive Learning Environment*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* SWD*Time^2 + γ_{25}* Teacher Qualifications*Time^2 + γ_{26}* Positive Learning Environment*Time^2 + $u_0 + u_1$ + r

Table 57.

Model 5a: Misconduct Predicted by Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		41.3088	0.7627	2259	54.16	<.0001	**
Time		-1.5258	0.9167	2203	-1.66	0.0962	
Time2		-0.3489	0.4139	2086	-0.84	0.3993	
School Level	Elementary	-30.7665	0.8873	2086	-34.67	<.0001	**
School Level	High	-0.8125	1.1547	2086	-0.7	0.4817	
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		1.146	0.4414	2086	2.6	0.0095	**
Minority		5.7406	0.4748	2086	12.09	<.0001	**
LEP		-2.6873	0.4092	2086	-6.57	<.0001	**
Students with Disabilities		1.9912	0.3273	2086	6.08	<.0001	**
Positive Learning Environment		-3.2218	0.2834	2086	-11.37	<.0001	**
Positive Teacher Qualifications		-1.32	0.2679	2086	-4.93	<.0001	**
Time*School Level	Elementary	-1.3693	1.0813	2086	-1.27	0.2055	
Time*School Level	High	1.2139	1.4189	2086	0.86	0.3923	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		1.176	0.6614	2086	1.78	0.0756	
Time*Minority		-0.8265	0.6158	2086	-1.34	0.1797	
Time*LEP		0.2369	0.5097	2086	0.46	0.6422	
Time*Students with Disabilities		0.5555	0.4451	2086	1.25	0.2122	
Time*Positive Learning Environment		1.7178	0.4827	2086	3.56	0.0004	**
Time*Positive Teacher Qualifications		0.8713	0.414	2086	2.1	0.0354	*
Time2*School Level	Elementary	1.5555	0.4893	2086	3.18	0.0015	**
Time2*School Level	High	-0.9091	0.6494	2086	-1.4	0.1617	
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.4285	0.3065	2086	-1.4	0.1623	
Time2*Minority		0.1947	0.2816	2086	0.69	0.4895	
Time2*LEP		-0.2305	0.2324	2086	-0.99	0.3213	
Time2*Students with Disabilities		-0.4876	0.203	2086	-2.4	0.0164	*
Time2*Positive Learning Environment		-0.9132	0.2282	2086	-4	<.0001	**
Time2*Positive Teacher Qualifications		-0.3864	0.1909	2086	-2.02	0.0431	*

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	177.51	6.6148	26.83	<.0001	**
$\tau_{(1,0)}$	-31.7691	2.5039	-12.69	<.0001	**
$\tau_{(1,1)}$	22.1247	1.5067	14.68	<.0001	**
Residual	42.7769	1.3183	32.45	<.0001	**

Note: * $p < .05$; ** $p < .01$

When the data were filtered to include only elementary and middle schools and gifted was also added to the equation, parameter estimates for the intercept, elementary school relative to middle school, minority, LEP, students with disabilities, gifted, positive learning environment, and teacher qualifications were significant, while time, time^2, and free or reduced lunch status were not significant. Significant interactions with time included elementary relative to middle school, minority, teacher qualifications, and positive learning environment. Significant interactions with time included free or reduced lunch status, students with disabilities, and positive learning environment. Significant interactions with time^2 included elementary relative to middle school, students with disabilities, positive learning environment, and positive teacher qualifications (see Table 58). This model demonstrated better fit than the previous model by all model fit indices (see Table 66). It explained 3% more of the between school variance and 1% more of the within school variance than the previous model for a total 57% of all the variance.

Model 5b: School Learning Environment with Demographics by School Level (Elementary and Middle Schools with Gifted)
Level 1: Student Misconduct = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + u_0
$\beta_1 = \gamma_{10} + \gamma_{11}$*School Type + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + u_1
$\beta_2 = \gamma_{20} + \gamma_{21}$*School Type + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment

Mixed-Effects Model: Student Misconduct = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + $u_0 + u_1$ + r

Table 58.

Model 5b: Misconduct Predicted by Demographics and Student Learning Environment by School Level for Elementary and Middle School with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		40.7779	0.7324	1825	55.67	<.0001	**
Time		-1.1294	0.9086	1704	-1.24	0.2141	
Time2		-0.3959	0.4024	1531	-0.98	0.3253	
School Level	Elementary	-30.1026	0.8711	1531	-34.56	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		0.2592	0.4753	1531	0.55	0.5856	
Minority		5.9955	0.5015	1531	11.95	<.0001	**
LEP		-2.8548	0.3992	1531	-7.15	<.0001	**
Students with Disabilities		1.0893	0.3302	1531	3.3	0.001	**
Gifted		-1.3382	0.3565	1531	-3.75	0.0002	**
Positive Learning Environment		-3.724	0.3672	1531	-10.14	<.0001	**
Positive Teacher Qualifications		-0.8584	0.2759	1531	-3.11	0.0019	**
Time*School Level	Elementary	-1.9468	1.1016	1531	-1.77	0.0774	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		1.9779	0.73	1531	2.71	0.0068	**
Time*Minority		-0.2972	0.6707	1531	-0.44	0.6578	
Time*LEP		-0.1308	0.5193	1531	-0.25	0.8012	
Time*Students with Disabilities		1.1092	0.4582	1531	2.42	0.0156	*
time*Gifted		0.4707	0.4769	1531	0.99	0.3238	
Time*Positive Learning Environment		3.2289	0.6188	1531	5.22	<.0001	**
Time*Positive Teacher Qualifications		0.8082	0.4268	1531	1.89	0.0584	
Time2*School Level	Elementary	1.6594	0.4877	1531	3.4	0.0007	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.562	0.3367	1531	-1.67	0.0953	
Time2*Minority		-0.1224	0.306	1531	-0.4	0.6893	
Time2*LEP		-0.1174	0.2369	1531	-0.5	0.6203	
Time2*Students with Disabilities		-0.6881	0.2084	1531	-3.3	0.001	**
time2*Gifted		-0.2352	0.2163	1531	-1.09	0.2771	
Time2*Positive Learning Environment		-1.4441	0.2797	1531	-5.16	<.0001	**
Time2*Positive Teacher Qualifications		-0.3868	0.1967	1531	-1.97	0.0495	*

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	145.88	6.1939	23.55	<.0001	**
$\tau_{(1,0)}$	-24.2363	2.4064	-10.07	<.0001	**
$\tau_{(1,1)}$	20.6174	1.5194	13.57	<.0001	**
Residual	34.6398	1.2487	27.74	<.0001	**

Note: * $p < .05$; ** $p < .01$

The next model added technology integration variables with the demographics, learning environment, and school level variables. These included student access to various types of software, teachers regularly using various types of software, frequency that students use various types of software, and technology support. This model was estimated twice, first without gifted population but all school levels (see model 6a) and then with elementary and middle school levels and gifted population (see model 6b). When the model was estimated with all school levels without gifted, the significant technology parameter estimates at the intercept were teachers who use technology to deliver instruction and teachers who use technology for administrative purposes. Teachers who use technology for administrative purposes also had a significant interaction with time (see Table 59). Other significant parameter estimates included the intercept, elementary school relative to middle school, free or reduced lunch status, minority, LEP, students with disabilities, positive learning environment, and positive teacher qualifications, while time, time^2, and high school relative to middle school were not significant. Significant interactions with time included positive learning environment and positive teacher qualifications. Significant interactions with time^2 included elementary relative to middle school, students with disabilities, and positive learning environment. Only one model fit index indicated that this model had better fit (see Table 65). No additional variance was explained with this model. Two technology integration indicators were retained in the final model for all school levels without gifted, percent of teachers who use technology for administrative purposes and percent of teachers who use technology to deliver instruction.

Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Level 1: Student Misconduct = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Access Content SW + γ_{09}*Access Office SW + γ_{010}*Access Ad Prod SW + γ_{011}*Teachers Use Deliver Instruction + γ_{012}*Teachers use Admin + γ_{013}*Frequency Students Use Content + γ_{014}*Frequency Students Use Tool + γ_{015}*Technical Support Human + γ_{016}*Technical Support Hardware + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}* Teacher Qualifications + γ_{17}* Positive Learning Environment + γ_{18}*Access Content SW + γ_{19}*Access Office SW + γ_{110}*Access Ad Prod SW + γ_{111}*Teachers Use Deliver Instruction + γ_{112}*Teachers use Admin + γ_{113}*Frequency Students Use Content + γ_{114}*Frequency Students Use Tool + γ_{115}*Technical Support Human + γ_{116}*Technical Support Hardware + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}* Teacher Qualifications + γ_{27}* Positive Learning Environment + γ_{28}*Access Content SW + γ_{29}*Access Office SW + γ_{210}*Access Ad Prod SW + γ_{211}*Teachers Use Deliver Instruction + γ_{212}*Teachers use Admin + γ_{213}*Frequency Students Use Content + γ_{214}*Frequency Students Use Tool + γ_{215}*Technical Support Human + γ_{216}*Technical Support Hardware

Mixed-Effects Model: Student Misconduct = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Access Content SW + γ_{09}*Access Office SW + γ_{010}*Access Ad Prod SW + γ_{011}*Teachers Use Deliver Instruction + γ_{012}*Teachers use Admin + γ_{013}*Frequency Students Use Content + γ_{014}*Frequency Students Use Tool + γ_{015}*Technical Support Human + γ_{016}*Technical Support Hardware + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Teacher Qualifications*Time + γ_{17}* Positive Learning Environment*Time + γ_{18}*Access Content SW*Time + γ_{19}*Access Office SW*Time + γ_{110}*Access Ad Prod SW*Time + γ_{111}*Teachers Use Deliver Instruction*Time + γ_{112}*Teachers use Admin*Time + γ_{113}*Frequency Students Use Content*Time + γ_{114}*Frequency Students Use Tool*Time + γ_{115}*Technical Support Human*Time + γ_{116}*Technical Support Hardware*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Teacher Qualifications*Time^2 + γ_{27}* Positive Learning Environment*Time^2 + γ_{28}*Access Content SW*Time^2 + γ_{29}*Access Office SW*Time^2 + γ_{210}*Access Ad Prod SW*Time^2 + γ_{211}*Teachers Use Deliver Instruction*Time^2 + γ_{212}*Teachers use Admin*Time^2 + γ_{213}*Frequency Students Use Content*Time^2 + γ_{214}*Frequency Students Use Tool*Time^2 + γ_{215}*Technical Support Human*Time^2 + γ_{216}*Technical Support Hardware*Time^2 + $u_0 + u_1 + r$

Table 59.

Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		41.5078	0.7731	2259	53.69	<.0001	**
Time		-1.0874	0.9687	2203	-1.12	0.2617	
Time2		-0.6157	0.4411	2059	-1.4	0.1629	
School Level	Elementary	-31.0568	0.9057	2059	-34.29	<.0001	**
School Level	High	-0.5642	1.1584	2059	-0.49	0.6263	
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		1.1219	0.4492	2059	2.5	0.0126	*
Minority		5.7044	0.4763	2059	11.98	<.0001	**
LEP		-2.6893	0.4101	2059	-6.56	<.0001	**
Students with Disabilities		1.9047	0.3273	2059	5.82	<.0001	**
Positive Learning Environment		-3.1849	0.2846	2059	-11.19	<.0001	**
Positive Teacher Qualifications		-1.2999	0.2685	2059	-4.84	<.0001	**
Access Content Software		-0.1843	0.2616	2059	-0.7	0.4812	
Access Office Software		-0.3068	0.2604	2059	-1.18	0.2388	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Access Advanced Production Software		-0.2019	0.266	2059	-0.76	0.4478	
Teachers Use to Deliver Instruction		-0.6685	0.2891	2059	-2.31	0.0209	*
Teachers Use for Administrative Purposes		0.598	0.2993	2059	2	0.0458	*
Frequency that Students Use Content Software		0.09566	0.2387	2059	0.4	0.6887	
Frequency Students Use Tool-Based Software		-0.4775	0.2571	2059	-1.86	0.0634	
Technical Support Human		-0.08317	0.2404	2059	-0.35	0.7294	
Technical Support Hardware		0.1623	0.2285	2059	0.71	0.4777	
Time*School Level	Elementary	-1.9974	1.1636	2059	-1.72	0.0862	
Time*School Level	High	1.3634	1.4442	2059	0.94	0.3452	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		1.2867	0.6779	2059	1.9	0.0578	
Time*Minority		-1.2016	0.6255	2059	-1.92	0.0549	
Time*LEP		0.3761	0.5128	2059	0.73	0.4634	
Time*Students with Disabilities		0.5712	0.4463	2059	1.28	0.2007	
Time*Positive Learning Environment		1.745	0.485	2059	3.6	0.0003	**
Time*Positive Teacher Qualifications		0.8852	0.4188	2059	2.11	0.0346	*
Time*Access Content Software		0.6167	0.5054	2059	1.22	0.2226	
Time*Access Office Software		-0.297	0.5025	2059	-0.59	0.5546	
Time*Access Advanced Production Software		0.09899	0.4977	2059	0.2	0.8424	
Time*Teachers Use to Deliver Instruction		0.7804	0.5634	2059	1.38	0.1662	
Time*Teachers Use for Administrative Purposes		-1.3835	0.5736	2059	-2.41	0.016	*
Time*Frequency that Students Use Content Software		-0.4055	0.4878	2059	-0.83	0.4059	
Time*Frequency Students Use Tool-Based Software		0.1039	0.518	2059	0.2	0.8411	
Time*Technical Support Human		-0.5208	0.4334	2059	-1.2	0.2296	
Time*Technical Support Hardware		-0.05939	0.4501	2059	-0.13	0.895	
Time2*School Level	Elementary	1.956	0.5346	2059	3.66	0.0003	**
Time2*School Level	High	-1.1071	0.6622	2059	-1.67	0.0947	
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.5262	0.3152	2059	-1.67	0.0952	
Time2*Minority		0.3995	0.2863	2059	1.4	0.1631	
Time2*LEP		-0.3015	0.234	2059	-1.29	0.1977	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time2*Students with Disabilities		-0.4887	0.2038	2059	-2.4	0.0166	*
Time2*Positive Learning Environment		-0.9631	0.2295	2059	-4.2	<.0001	**
Time2*Positive Teacher Qualifications		-0.3779	0.1945	2059	-1.94	0.0522	
Time2*Access Content Software		-0.2741	0.2336	2059	-1.17	0.2407	
Time2*Access Office Software		0.241	0.2324	2059	1.04	0.2998	
Time2*Access Advanced Production Software		-0.2303	0.2303	2059	-1	0.3174	
Time2*Teachers Use to Deliver Instruction		-0.2895	0.2621	2059	-1.1	0.2695	
Time2*Teachers Use for Administrative Purposes		0.5121	0.2641	2059	1.94	0.0526	
Time2*Frequency that Students Use Content Software		0.1973	0.2284	2059	0.86	0.3879	
Time2*Frequency Students Use Tool-Based Software		0.1043	0.2433	2059	0.43	0.6681	
Time2*Technical Support Human		0.3064	0.2003	2059	1.53	0.1262	
Time2*Technical Support Hardware		0.02631	0.2081	2059	0.13	0.8994	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	176.24	6.5874	26.75	<.0001	**
$\tau_{(1,0)}$	-31.9049	2.4956	-12.78	<.0001	**
$\tau_{(1,1)}$	21.9224	1.5021	14.59	<.0001	**
Residual	42.5992	1.3169	32.35	<.0001	**

Note: * $p < .05$; ** $p < .01$

Similar results were found with the elementary and middle school data with gifted. There were no significant technology parameter estimates at the intercept. Interactions of time and time^2 were significant with only the percent of teachers who use technology for administrative purposes (see Table 60). Other significant parameter estimates included the intercept, elementary relative to middle school, minority, LEP, students with disabilities, gifted, positive learning environment, and positive teacher qualifications, while time, time^2, and free or reduced lunch status were not significant. Significant interactions with time and time^2 included elementary relative to middle school, students with disabilities, and positive learning environment. Two of the fit indices indicated that this model had better fit (see Table 66), even though adding the technology integration indicators to the model did not explain any additional variance. Teachers use technology for administrative purposes was the only technology integration indicator retained in the final model for the data with elementary and middle schools and gifted.

Model 6b: Technology Integration with Demographics and Student Learning Environment by School Level (Elementary and Middle Schools with Gifted)
Level 1: Student Misconduct = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Access Content SW + γ_{010}*Access Office SW + γ_{011}*Access Ad Prod SW + γ_{012}*Teachers Use Deliver Instruction + γ_{013}*Teachers use Admin + γ_{014}*Frequency Students Use Content + γ_{015}*Frequency Students Use Tool + γ_{016}*Technical Support Human + γ_{017}*Technical Support Hardware + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + γ_{19}*Access Content SW + γ_{110}*Access Office SW + γ_{111}*Access Ad Prod SW + γ_{112}*Teachers Use Deliver Instruction + γ_{113}*Teachers use Admin + γ_{114}*Frequency Students Use Content + γ_{115}*Frequency Students Use Tool + γ_{116}*Technical Support Human + γ_{117}*Technical Support Hardware + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment + γ_{29}*Access Content SW + γ_{210}*Access Office SW + γ_{211}*Access Ad Prod SW + γ_{212}*Teachers Use Deliver Instruction + γ_{213}*Teachers use Admin + γ_{214}*Frequency Students Use Content + γ_{215}*Frequency Students Use Tool + γ_{216}*Technical Support Human + γ_{217}*Technical Support Hardware

Mixed-Effects Model: Student Misconduct = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Access Content SW + γ_{010}*Access Office SW + γ_{011}*Access Ad Prod SW + γ_{012}*Teachers Use Deliver Instruction + γ_{013}*Teachers use Admin + γ_{014}*Frequency Students Use Content + γ_{015}*Frequency Students Use Tool + γ_{016}*Technical Support Human + γ_{017}*Technical Support Hardware + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{19}*Access Content SW*Time + γ_{110}*Access Office SW*Time + γ_{111}*Access Ad Prod SW*Time + γ_{112}*Teachers Use Deliver Instruction*Time + γ_{113}*Teachers use Admin*Time + γ_{114}*Frequency Students Use Content*Time + γ_{115}*Frequency Students Use Tool*Time + γ_{116}*Technical Support Human*Time + γ_{117}*Technical Support Hardware*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + γ_{29}*Access Content SW*Time^2 + γ_{210}*Access Office SW*Time^2 + γ_{211}*Access Ad Prod SW*Time^2 + γ_{212}*Teachers Use Deliver Instruction*Time^2 + γ_{213}*Teachers use Admin*Time^2 + γ_{214}*Frequency Students Use Content*Time^2 + γ_{215}*Frequency Students Use Tool*Time^2 + γ_{216}*Technical Support Human*Time^2 + γ_{217}*Technical Support Hardware*Time^2 + $u_0 + u_1$ + r

Table 60.

Model 6b: Technology Integration with Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		40.9119	0.7467	1825	54.79	<.0001	**
Time		-0.5019	0.966	1704	-0.52	0.6034	
Time2		-0.7451	0.4322	1504	-1.72	0.0849	
School Level	Elementary	-30.3046	0.8936	1504	-33.91	<.0001	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		0.1894	0.4828	1504	0.39	0.6949	
Minority		5.8885	0.5038	1504	11.69	<.0001	**
LEP		-2.8378	0.4002	1504	-7.09	<.0001	**
Students with Disabilities		1.0123	0.3301	1504	3.07	0.0022	**
Gifted		-1.2689	0.3582	1504	-3.54	0.0004	**
Positive Learning Environment		-3.744	0.3695	1504	-10.13	<.0001	**
Positive Teacher Qualifications		-0.8579	0.2759	1504	-3.11	0.0019	**
Access Content Software		-0.02455	0.2726	1504	-0.09	0.9283	
Access Office Software		-0.5042	0.2608	1504	-1.93	0.0534	
Access Advanced Production Software		-0.2166	0.2743	1504	-0.79	0.4298	
Teachers Use to Deliver Instruction		-0.4688	0.2998	1504	-1.56	0.1181	
Teachers Use for Administrative Purposes		0.4445	0.3157	1504	1.41	0.1594	
Frequency that Students Use Content Software		-0.02405	0.2496	1504	-0.1	0.9233	
Frequency Students Use Tool-Based Software		-0.4634	0.2624	1504	-1.77	0.0776	
Technical Support Human		0.1686	0.2509	1504	0.67	0.5019	
Technical Support Hardware		0.3047	0.2328	1504	1.31	0.1908	
Time*School Level	Elementary	-2.7863	1.1882	1504	-2.34	0.0192	*
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		2.0013	0.7483	1504	2.67	0.0076	**
Time*Minority		-0.6287	0.6795	1504	-0.93	0.355	
Time*LEP		0.01751	0.5206	1504	0.03	0.9732	
Time*Students with Disabilities		1.1344	0.4585	1504	2.47	0.0135	*
Time*Gifted		0.3969	0.483	1504	0.82	0.4114	
Time*Positive Learning Environment		3.3401	0.6213	1504	5.38	<.0001	**
Time*Positive Teacher Qualifications		0.7822	0.4303	1504	1.82	0.0693	
Time*Access Content Software		0.5017	0.5223	1504	0.96	0.3369	
Time*Access Office Software		0.3643	0.507	1504	0.72	0.4726	
Time*Access Advanced Production Software		0.296	0.5038	1504	0.59	0.5569	
Time*Teachers Use to Deliver Instruction		0.421	0.5866	1504	0.72	0.473	
Time*Teachers Use for Administrative Purposes		-1.7077	0.6079	1504	-2.81	0.005	**
Time*Frequency that Students Use Content Software		-0.07635	0.5173	1504	-0.15	0.8827	
Time*Frequency Students		-0.1351	0.5323	1504	-0.25	0.7996	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Use Tool-Based Software							
Time*Technical Support Human		-0.5604	0.4531	1504	-1.24	0.2164	
Time*Technical Support Hardware		-0.03409	0.4586	1504	-0.07	0.9407	
Time2*School Level	Elementary	2.135	0.5358	1504	3.98	<.0001	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.592	0.3463	1504	-1.71	0.0876	
Time2*Minority		0.08395	0.3102	1504	0.27	0.7867	
Time2*LEP		-0.2018	0.2376	1504	-0.85	0.396	
Time2*Students with Disabilities		-0.6962	0.2089	1504	-3.33	0.0009	**
Time2*Gifted		-0.2185	0.2191	1504	-1	0.3187	
Time2*Positive Learning Environment		-1.5289	0.2814	1504	-5.43	<.0001	**
Time2*Positive Teacher Qualifications		-0.3421	0.2	1504	-1.71	0.0874	
Time2*Access Content Software		-0.1763	0.2416	1504	-0.73	0.4657	
Time2*Access Office Software		-0.07092	0.2348	1504	-0.3	0.7627	
Time2*Access Advanced Production Software		-0.3421	0.2327	1504	-1.47	0.1417	
Time2*Teachers Use to Deliver Instruction		-0.181	0.2736	1504	-0.66	0.5083	
Time2*Teachers Use for Administrative Purposes		0.7687	0.2791	1504	2.75	0.006	**
Time2*Frequency that students use content software		-0.01618	0.2433	1504	-0.07	0.947	
Time2*Frequency Students Use Tool-Based Software		0.2094	0.2513	1504	0.83	0.4047	
Time2*Technical Support Human		0.2312	0.2092	1504	1.11	0.2692	
Time2*Technical Support Hardware		0.03214	0.2126	1504	0.15	0.8799	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	145.11	6.1622	23.55	<.0001	**
$\tau_{(1,0)}$	-24.4972	2.3968	-10.22	<.0001	**
$\tau_{(1,1)}$	20.4403	1.5125	13.51	<.0001	**
Residual	34.3042	1.2416	27.63	<.0001	**

Note: * $p < .05$; ** $p < .01$

The last models estimated in order to answer the second hypothesis included all school levels, demographic, student learning environment, and significant technology integration variables. These models were different because the model fit to the data for all schools levels without gifted included two technology integration variables - percent of teachers who regularly use technology for administrative purposes and the percent of teachers who regularly use technology to deliver instruction (see model 7a); while the model fitted to the data with elementary and middle school levels and gifted included only one technology integration variable – the percent of teachers who regularly use technology for administrative purposes (see model 7b). For the model with all schools levels and no gifted, the same parameter estimates and interactions identified in the previous models as significant were significant again (see Table 61). Although, there was no difference in the percentage of variance explained in this model than was in the Demographic Model with Student Learning Environment by school level or the Technology Integration with Demographic and Student Learning Environment Model by school level, three of the model fit indices indicated better model fit (see Table 65). The level-1 residuals for the final model for predicting student misconduct using all school levels without gifted ranged between -38.39 and 55.67 with a standard deviation of 4.74. There were outliers, skewness was 0.83, and kurtosis was 13.89, which would indicate that the residuals were not normally distributed. Distribution of the empirical bayes intercepts ranged between -49.69 and 107.64 with standard deviation of 12.26. Skewness was 1.69, and kurtosis was 8.31, which indicated that the intercept residuals at level-2 were not normally distributed. Distribution of the empirical bayes slopes ranged between -31.19 and 18.15 with standard deviation of 3.31. Skewness was -1.91, and kurtosis was 13.02, which indicated that most of the slope residuals at level-2 were not normally distributed. Because the residuals for student conduct outcome were not normally distributed, the results of the analysis may be biased.

Final Model 7a: Significant Technology Integration Indicators with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Level 1: Student Misconduct = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Teachers use Admin + γ_{09}*Technical Support Hardware + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}* Teacher Qualifications + γ_{17}* Positive Learning Environment + γ_{18}* Teachers use Admin + γ_{19}* Technical Support Hardware + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}* Teacher Qualifications + γ_{27}* Positive Learning Environment + γ_{28}*Teachers use Admin + γ_{29}* Technical Support Hardware

Mixed-Effects Model: Student Misconduct = γ_{00} + γ_{01}*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}* Teacher Qualifications + γ_{07}* Positive Learning Environment + γ_{08}*Teachers use Admin + γ_{09}*Technical Support Hardware + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD*Time + γ_{16}*Teacher Qualifications*Time + γ_{17}* Positive Learning Environment*Time + γ_{18}* Teachers use Admin*Time + γ_{19}* Technical Support Hardware*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Teacher Qualifications*Time^2 + γ_{27}* Positive Learning Environment*Time^2 + γ_{28}*Teachers use Admin*Time^2 + γ_{29}* Technical Support Hardware*Time^2 + u_0 + u_1 + r

Table 61.

Final Model 7a: Significant Technology Integration with Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		41.4262	0.7646	2259	54.18	<.0001	**
Time		-1.3915	0.9284	2203	-1.5	0.1341	
Time2		-0.4009	0.4201	2080	-0.95	0.3401	
School Level	Elementary	-30.9249	0.8914	2080	-34.69	<.0001	**
School Level	High	-0.6513	1.1539	2080	-0.56	0.5725	
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		1.2054	0.4448	2080	2.71	0.0068	**
Minority		5.7442	0.4752	2080	12.09	<.0001	**
LEP		-2.7024	0.4084	2080	-6.62	<.0001	**
Students with Disabilities		1.9303	0.3272	2080	5.9	<.0001	**
Positive Learning Environment		-3.1923	0.2843	2080	-11.23	<.0001	**
Positive Teacher Qualifications		-1.2948	0.2679	2080	-4.83	<.0001	**
Teachers Use to Deliver Instruction		-0.828	0.2735	2080	-3.03	0.0025	**
Teachers Use for Administrative Purposes		0.4156	0.2829	2080	1.47	0.142	
Time*School Level	Elementary	-1.5555	1.1001	2080	-1.41	0.1575	
Time*School Level	High	0.964	1.423	2080	0.68	0.4982	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		1.1075	0.6656	2080	1.66	0.0963	
Time*Minority		-1.1147	0.6224	2080	-1.79	0.0735	
Time*LEP		0.3164	0.5105	2080	0.62	0.5355	
Time*Students with Disabilities		0.5528	0.4459	2080	1.24	0.2152	
Time*Positive Learning Environment		1.666	0.484	2080	3.44	0.0006	**
Time*Positive Teacher Qualifications		0.8877	0.4146	2080	2.14	0.0324	*
Time*Teachers Use to Deliver Instruction		0.8693	0.5255	2080	1.65	0.0982	
Time*Teachers Use for Administrative Purposes		-1.3314	0.5408	2080	-2.46	0.0139	*

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Time2*School Level	Elementary	1.6227	0.4995	2080	3.25	0.0012	**
Time2*School Level	High	-0.8353	0.6513	2080	-1.28	0.1998	
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.4171	0.3085	2080	-1.35	0.1764	
Time2*Minority		0.3299	0.2852	2080	1.16	0.2476	
Time2*LEP		-0.263	0.2329	2080	-1.13	0.2591	
Time2*Students with Disabilities		-0.4782	0.2034	2080	-2.35	0.0188	*
Time2*Positive Learning Environment		-0.8918	0.2286	2080	-3.9	<.0001	**
Time2*Positive Teacher Qualifications		-0.3973	0.1913	2080	-2.08	0.0379	*
Time2*Teachers Use to Deliver Instruction		-0.332	0.2443	2080	-1.36	0.1743	
Time2*Teachers Use for Administrative Purposes		0.5328	0.2502	2080	2.13	0.0333	*

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	176.45	6.5917	26.77	<.0001	**
$\tau_{(1,0)}$	-31.5923	2.4955	-12.66	<.0001	**
$\tau_{(1,1)}$	21.9185	1.5046	14.57	<.0001	**
Residual	42.8402	1.3212	32.43	<.0001	**

Note: * $p < .05$; ** $p < .01$

For the model with elementary and middle school levels and gifted, the same significant parameter estimate, percent of teachers who regularly use technology for administrative purposes, was identified as in the previous model (see Table 62). Interactions between time and time^2 with percent of teachers who regularly use technology for administrative purposes were significant. Although there was no difference in the percentage of variance explained in this model than was in the Demographic Model with Student Learning Environment by school level or the Technology Integration with Demographic and Student Learning Environment Model by school level, the AIC, AICC, and BIC indices all indicated better model fit (see Table 66). The level-1 residuals for the final model for predicting student misconduct using elementary and middle schools with gifted ranged between -37.91 and 55.27 with a standard deviation of 4.16. There were outliers. Skewness was 0.87 and kurtosis was 17.78, which would indicate that the residuals were not normally distributed. Distribution of the empirical bayes intercepts ranged between -41.84 and 86.87 with standard deviation of 11.02. Skewness was 1.78, and kurtosis was 8.67, which indicated that the intercept residuals at level-2 were not normally distributed. Distribution of the empirical bayes slopes ranged between -33.53 and 16.67 with standard deviation of 3.21. Skewness was -2.13, and kurtosis was 18.24, which indicated that the slope residuals at level-2 were not normally distributed. Because the residuals for student misconduct outcome were not normally distributed, the results of the analysis may be biased.

Final Model 7b: Technology Integration with Demographics and Student Learning Environment by School Level (Elementary and Middle Schools with Gifted)
Level 1: Student Misconduct = $\beta_0 + \beta_1$*Time + β_2*Time^2 + r
Level 2: $\beta_0 = \gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Teachers use Admin + u_0

$\beta_1 = \gamma_{10} + \gamma_{11}$*School Level + γ_{12}*SES + γ_{13}*Minority + γ_{14}* LEP + γ_{15}* SWD + γ_{16}*Gifted + γ_{17}* Teacher Qualifications + γ_{18}* Positive Learning Environment + γ_{19}* Teachers use Admin + u_1

$\beta_2 = \gamma_{20} + \gamma_{21}$*School Level + γ_{22}*SES + γ_{23}*Minority + γ_{24}* LEP + γ_{25}* SWD + γ_{26}*Gifted + γ_{27}* Teacher Qualifications + γ_{28}* Positive Learning Environment + γ_{29}*Teachers use Admin

Mixed-Effects Model: Student Misconduct = $\gamma_{00} + \gamma_{01}$*School Level + γ_{02}*SES + γ_{03}*Minority + γ_{04}* LEP + γ_{05}* SWD + γ_{06}*Gifted + γ_{07}* Teacher Qualifications + γ_{08}* Positive Learning Environment + γ_{09}*Teachers use Admin + γ_{10}*Time + γ_{11}*School Level*Time + γ_{12}*SES*Time + γ_{13}*Minority*Time + γ_{14}* LEP *Time + γ_{15}* SWD *Time + γ_{16}*Gifted*Time + γ_{17}* Teacher Qualifications*Time + γ_{18}* Positive Learning Environment*Time + γ_{19}*Teachers use Admin*Time + γ_{20}*Time^2 + γ_{21}*School Level*Time^2 + γ_{22}*SES*Time^2 + γ_{23}*Minority*Time^2 + γ_{24}* LEP*Time^2 + γ_{25}* SWD*Time^2 + γ_{26}*Gifted*Time^2 + γ_{27}* Teacher Qualifications*Time^2 + γ_{28}* Positive Learning Environment*Time^2 + γ_{29}*Teachers use Admin*Time^2 + $u_0 + u_1$ + r

Table 62.

Final Model 7b: Significant Technology Integration with Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		40.748	0.7365	1825	55.33	<.0001	**
Time		-0.6991	0.9234	1704	-0.76	0.4491	
Time2		-0.594	0.4088	1528	-1.45	0.1464	
School Level	Elementary	-30.0672	0.8776	1528	-34.26	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		0.2898	0.4779	1528	0.61	0.5443	
Minority		5.9326	0.502	1528	11.82	<.0001	**
LEP		-2.8511	0.3987	1528	-7.15	<.0001	**
Students with Disabilities		1.0678	0.33	1528	3.24	0.0012	**
Gifted		-1.2998	0.3566	1528	-3.65	0.0003	**
Positive Learning Environment		-3.7888	0.3689	1528	-10.27	<.0001	**
Positive Teacher Qualifications		-0.8545	0.2759	1528	-3.1	0.002	**
Teachers Use for		-0.07352	0.2539	1528	-0.29	0.7722	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Administrative Purposes							
Time*School Level	Elementary	-2.5202	1.1235	1528	-2.24	0.025	*
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		1.8076	0.7328	1528	2.47	0.0137	*
Time*Minority		-0.5006	0.6744	1528	-0.74	0.458	
Time*LEP		-0.05263	0.5192	1528	-0.1	0.9193	
Time*Students with Disabilities		1.0508	0.458	1528	2.29	0.0219	*
Time*Gifted		0.3391	0.4781	1528	0.71	0.4783	
Time*Positive Learning Environment		3.3045	0.6199	1528	5.33	<.0001	**
Time*Positive Teacher Qualifications		0.8379	0.4268	1528	1.96	0.0498	*
Time*Teachers Use for Administrative Purposes		-1.1022	0.4716	1528	-2.34	0.0196	*
Time2*School Level	Elementary	1.9232	0.4974	1528	3.87	0.0001	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.4843	0.338	1528	-1.43	0.1521	
Time2*Minority		-0.01672	0.3078	1528	-0.05	0.9567	
Time2*LEP		-0.1572	0.2368	1528	-0.66	0.507	
Time2*Students with Disabilities		-0.6556	0.2084	1528	-3.15	0.0017	**
Time2*Gifted		-0.1762	0.2168	1528	-0.81	0.4164	
Time2*Positive Learning Environment		-1.47	0.2797	1528	-5.25	<.0001	**
Time2*Positive Teacher Qualifications		-0.4056	0.1967	1528	-2.06	0.0394	*
Time2*Teachers Use for Administrative Purposes		0.5246	0.2167	1528	2.42	0.0156	*

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	145.38	6.1696	23.56	<.0001	**
$\tau_{(1,0)}$	-24.2891	2.4025	-10.11	<.0001	**
$\tau_{(1,1)}$	20.7305	1.5226	13.61	<.0001	**
Residual	34.5163	1.2447	27.73	<.0001	**

Note: * $p < .05$; ** $p < .01$

The last step was to add in USDOE funded Magnet Schools and USDOE Technology Magnet Schools as variables in the model. Results of the models for both sets of data, all school levels without gifted and elementary and middle schools with gifted, indicated that having USDOE funded Magnet Schools status or U.S. technology magnet school status was not significantly related to student misconduct.

Table 63.

Model 8a: Magnet Schools with Significant Technology Integration Demographics and Student Learning Environment by School Level (All School Levels without Gifted)

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		45.4078	4.0277	2257	11.27	<.0001	**
Time		-11.0247	4.8535	2201	-2.27	0.0232	*
Time2		3.2192	2.2135	2078	1.45	0.146	
School Level	Elementary	-30.9619	0.8909	2078	-34.75	<.0001	**
School Level	High	-0.7423	1.1529	2078	-0.64	0.5197	
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		1.2207	0.4443	2078	2.75	0.0061	**
Minority		5.7775	0.4771	2078	12.11	<.0001	**
LEP		-2.7278	0.4086	2078	-6.68	<.0001	**
Students with Disabilities		1.8823	0.3274	2078	5.75	<.0001	**
Positive Learning Environment		-3.2248	0.2841	2078	-11.35	<.0001	**
Positive Teacher Qualifications		-1.293	0.2675	2078	-4.83	<.0001	**
Teachers Use for Administrative Purposes		-0.8418	0.2734	2078	-3.08	0.0021	**
Technical Support Human		0.413	0.2827	2078	1.46	0.1441	
Not a Technology Magnet School - US		-8.4497	4.6607	2078	-1.81	0.07	
Technology Magnet School - US		0	.	.	.	.	
Not a US Magnet School		4.5509	2.4956	2078	1.82	0.0684	
US Magnet School		0	.	.	.	.	
Time*School Level	Elementary	-1.5888	1.0993	2078	-1.45	0.1485	
Time*School Level	High	0.9782	1.4233	2078	0.69	0.492	
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		1.1353	0.6653	2078	1.71	0.0881	
Time*Minority		-1.0224	0.6245	2078	-1.64	0.1018	
Time*LEP		0.2697	0.5111	2078	0.53	0.5977	
Time*Students with Disabilities		0.6017	0.4467	2078	1.35	0.1782	
Time*Positive Learning Environment		1.6511	0.4851	2078	3.4	0.0007	**
Time*Positive Teacher Qualifications		0.8878	0.4142	2078	2.14	0.0322	*
Time*Teachers Use for Administrative Purposes		0.9135	0.5255	2078	1.74	0.0823	
Time*Technical Support Human		-1.2903	0.5409	2078	-2.39	0.0172	*
Time*Not a Technology Magnet School - US		9.0991	5.5901	2078	1.63	0.1037	
Time*Technology Magnet School - US		0	.	.	.	.	
Time*Not a US Magnet		0.6297	2.9788	2078	0.21	0.8326	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
School							
Time*US Magnet School		0	.	.	.	.	
Time2*School Level	Elementary	1.6428	0.4992	2078	3.29	0.001	**
Time2*School Level	High	-0.8056	0.6518	2078	-1.24	0.2166	
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.4318	0.3084	2078	-1.4	0.1616	
Time2*Minority		0.2771	0.2861	2078	0.97	0.3329	
Time2*LEP		-0.2352	0.2332	2078	-1.01	0.3132	
Time2*Students with Disabilities		-0.4867	0.2038	2078	-2.39	0.017	*
Time2*Positive Learning Environment		-0.8632	0.2295	2078	-3.76	0.0002	**
Time2*Positive Teacher Qualifications		-0.3997	0.1911	2078	-2.09	0.0366	*
Time2*Teachers Use for Administrative Purposes		-0.352	0.2444	2078	-1.44	0.1499	
Time2*Technical Support Human		0.511	0.2502	2078	2.04	0.0413	*
Time2*Not a Technology Magnet School - US		-2.0751	2.5546	2078	-0.81	0.4167	
Time2*Technology Magnet School - US		0	.	.	.	.	
Time2*Not a US Magnet School		-1.6128	1.3705	2078	-1.18	0.2394	
Time2*US Magnet School		0	.	.	.	.	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	175.88	6.5727	26.76	<.0001	**
$\tau_{(1,0)}$	-31.3306	2.4864	-12.6	<.0001	**
$\tau_{(1,1)}$	21.8162	1.4997	14.55	<.0001	**
Residual	42.7692	1.3186	32.43	<.0001	**

Note: * $p < .05$; ** $p < .01$

Table 64.

Model 8b: Magnet Schools with Significant Technology Integration Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Intercept		44.2523	4.1917	1823	10.56	<.0001	**
Time		-0.2663	5.2147	1702	-0.05	0.9593	
Time2		-1.962	2.4094	1526	-0.81	0.4156	
School Level	Elementary	-30.0632	0.8773	1526	-34.27	<.0001	**
School Level	Middle	0	.	.	.	.	
Free Reduced Lunch		0.2925	0.4776	1526	0.61	0.5403	
Minority		5.9523	0.5037	1526	11.82	<.0001	**
LEP		-2.8631	0.3992	1526	-7.17	<.0001	**

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
Students with Disabilities		1.0379	0.3304	1526	3.14	0.0017	**
Gifted		-1.2995	0.3561	1526	-3.65	0.0003	**
Positive Learning Environment		-3.7998	0.3687	1526	-10.31	<.0001	**
Positive Teacher Qualifications		-0.851	0.2755	1526	-3.09	0.002	**
Teachers Use for Administrative Purposes		-0.07138	0.2539	1526	-0.28	0.7786	
Not a Technology Magnet School - US		-5.8317	4.8241	1526	-1.21	0.2269	
Technology Magnet School - US		0	.	.	.	.	
Not a US Magnet School		2.3413	2.5132	1526	0.93	0.3517	
US Magnet School		0	.	.	.	.	
Time*School Level	Elementary	-2.4999	1.1226	1526	-2.23	0.0261	*
Time*School Level	Middle	0	.	.	.	.	
Time*Free Reduced Lunch		1.8066	0.7329	1526	2.46	0.0138	*
Time*Minority		-0.4694	0.676	1526	-0.69	0.4875	
Time*LEP		-0.06392	0.5197	1526	-0.12	0.9021	
Time*Students with Disabilities		1.0381	0.4585	1526	2.26	0.0237	*
Time*Gifted		0.3536	0.4778	1526	0.74	0.4594	
Time*Positive Learning Environment		3.2449	0.6204	1526	5.23	<.0001	**
Time*Positive Teacher Qualifications		0.8449	0.4263	1526	1.98	0.0477	*
Time*Teachers Use for Administrative Purposes		-1.0906	0.4728	1526	-2.31	0.0212	*
Time*Not a Technology Magnet School - US		-2.2918	5.9365	1526	-0.39	0.6995	
Time*Technology Magnet School - US		0	.	.	.	.	
Time*Not a US Magnet School		1.8868	3.0198	1526	0.62	0.5322	
Time*US Magnet School		0	.	.	.	.	
Time2*School Level	Elementary	1.907	0.497	1526	3.84	0.0001	**
Time2*School Level	Middle	0	.	.	.	.	
Time2*Free Reduced Lunch		-0.4846	0.3381	1526	-1.43	0.152	
Time2*Minority		-0.04735	0.3083	1526	-0.15	0.878	
Time2*LEP		-0.1441	0.237	1526	-0.61	0.5432	
Time2*Students with Disabilities		-0.6333	0.2086	1526	-3.04	0.0024	**
Time2*Gifted		-0.192	0.2167	1526	-0.89	0.3758	
Time2*Positive Learning Environment		-1.4064	0.2805	1526	-5.01	<.0001	**
Time2*Positive Teacher Qualifications		-0.411	0.1965	1526	-2.09	0.0366	*
Time2*Teachers Use for Administrative Purposes		0.5119	0.2173	1526	2.36	0.0186	*
Time2*Not a Technology Magnet School - US		3.9068	2.7387	1526	1.43	0.1539	
Time2*Technology Magnet		0	.	.	.	.	

Effect	School Level	Estimate	*SE*	*df*	*t*	*p*	
School - US							
Time2*Not a US Magnet School		-2.5746	1.3857	1526	-1.86	0.0634	
Time2*US Magnet School		0	.	.	.	.	

Covariance Parameter	Estimate	*SE*	*z*	*p*	
$\tau_{(0,0)}$	144.98	6.1517	23.57	<.0001	**
$\tau_{(1,0)}$	-24.0726	2.3924	-10.06	<.0001	**
$\tau_{(1,1)}$	20.5932	1.5153	13.59	<.0001	**
Residual	34.4372	1.2415	27.74	<.0001	**

Note: * $p < .05$; ** $p < .01$

Table 65.

Model Fit Indices for Models Predicting Student Misconduct Scores for All School Levels (without Gifted)

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 1: Misconduct Predicted by Average Misconduct of All Schools in Florida	55797.2	55803.2	55803.2	55820.4
Model 2a: Time as a Predictor of Misconduct	55271.3	55283.3	55283.3	55317.8
Quadratic Model 2b: Time^2 as a Predictor of Misconduct	55261.2	55275.2	55275.2	55315.4
Model 3: Time, Time^2, and School Level as Predictors of Misconduct	53722	53748	53748.1	53822.7
Model 4a: Misconduct predicted by Time, School Level, and Demographics Variables	50341.3	50391.3	50391.5	50534.4
Model 5a: Demographics and Student Learning Environment by School Level	50091.9	50153.9	50154.2	50331.4
Model 6a: Technology Integration with Demographics and Student Learning Environment by School Level	50038.4	50154.4	50155.4	50486.4
Final Model 7a: Significant Technology Integration with Demographics and Student Learning Environment by School Level	50072.6	50146.6	50147	50358.4
Model 8a: Magnet Schools with Significant Technology Integration Demographics and Student Learning Environment by School Level (All School Levels without Gifted)	50060.5	50146.5	50147.1	50392.6

Table 66.

Model Fit Indices for Models Predicting Student Misconduct Scores for Elementary and Middle School Levels (with Gifted)

Model	-2 Log Likelihood	AIC (smaller is better)	AICC (smaller is better)	BIC (smaller is better)
Model 1: Misconduct Predicted by Average Misconduct of All Elementary and Middle Schools in Florida	46610.5	46616.5	46616.5	46633.2
Model 4b: Misconduct predicted by Time, School Level, and Demographics Variables No High School includes gifted	38168.6	38218.6	38218.8	38356.3
Model 5b: Demographics and Teacher Qualifications by School Level	38005.9	38067.9	38068.3	38238.8
Model 6b: Technology Integration with Demographics and Teacher Qualifications by School Level	37951.5	38067.5	38068.9	38387.1
Final Model 7b: Significant Technology Integration with Demographics and Student Learning Environment by School Level	37995.1	38063.1	38063.6	38250.5
Model 8b: Magnet Schools with Significant Technology Integration Demographics and Student Learning Environment by School Level for Elementary and Middle Schools with Gifted	37982	38062	38062.7	38282.4

The result of the analysis for all the models indicated that Hypothesis 2 for Research Question 2 was partially correct. When the sample included schools at all three school levels and all other school level, demographic, and school learning environment factors were controlled, there was only a significant negative relationship between the percent of teachers who regularly use technology to deliver instruction and the level of student misconduct at the intercept. With the dataset with elementary and middle school with gifted, the percent of teachers who regularly use technology to deliver instruction was not significant. Also with both datasets, there were significant interactions between time and time^2 and the percent of teachers who regularly use technology for administrative purposes with school level student misconduct resulting in a curvilinear trend.

After controlling so that all other variables were held at the mean, the trend for each school level could be examined separately by comparing schools with different levels of the technology indicator. The relationship between the percent of teachers who regularly use technology to deliver instruction and the level of student misconduct was only significant at the intercept. Charts were made for each level of school to visualize the relationship between the percent of teachers who regularly use technology to deliver instruction and the level of student misconduct at one and two standard deviations above the mean, the mean, and one and two standard deviations below the mean were examined. When controlling for all other variables, high schools that began the study at two standard deviations above the mean had a student misconduct score (39.12) that was 3.31 points lower than high schools at two standard deviations below the mean (42.43). Because there were no interactions with time these trends were parallel (see Figure 36).

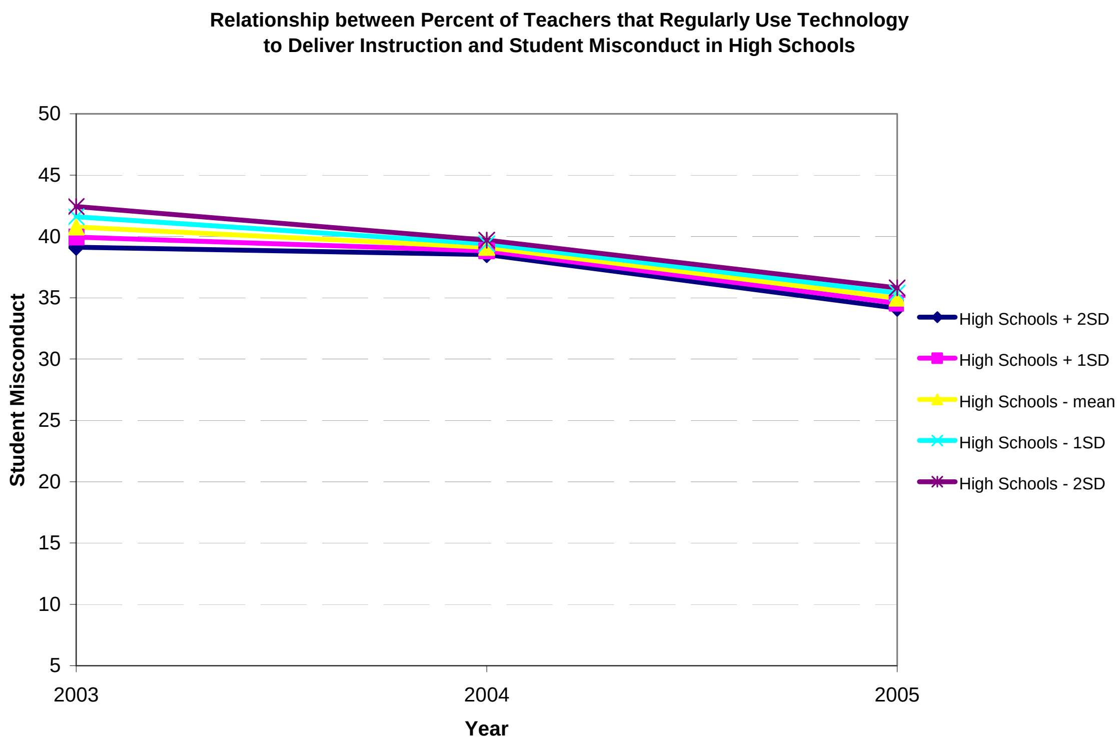

Figure 36. Relationship between Percent of Teachers Who Regularly Use Technology to Deliver Instruction and Student Misconduct in High Schools.

When controlling for all other variables, middle schools at two standard deviations above the mean a for percent of teachers who regularly use technology to deliver instruction started with student misconduct scores at 39.77, while schools at two standard deviations below the mean started with scores at 43.08 or 3.31 points lower in 2003-04 (See Figure 37). Because time was not significant, the trends remained parallel.

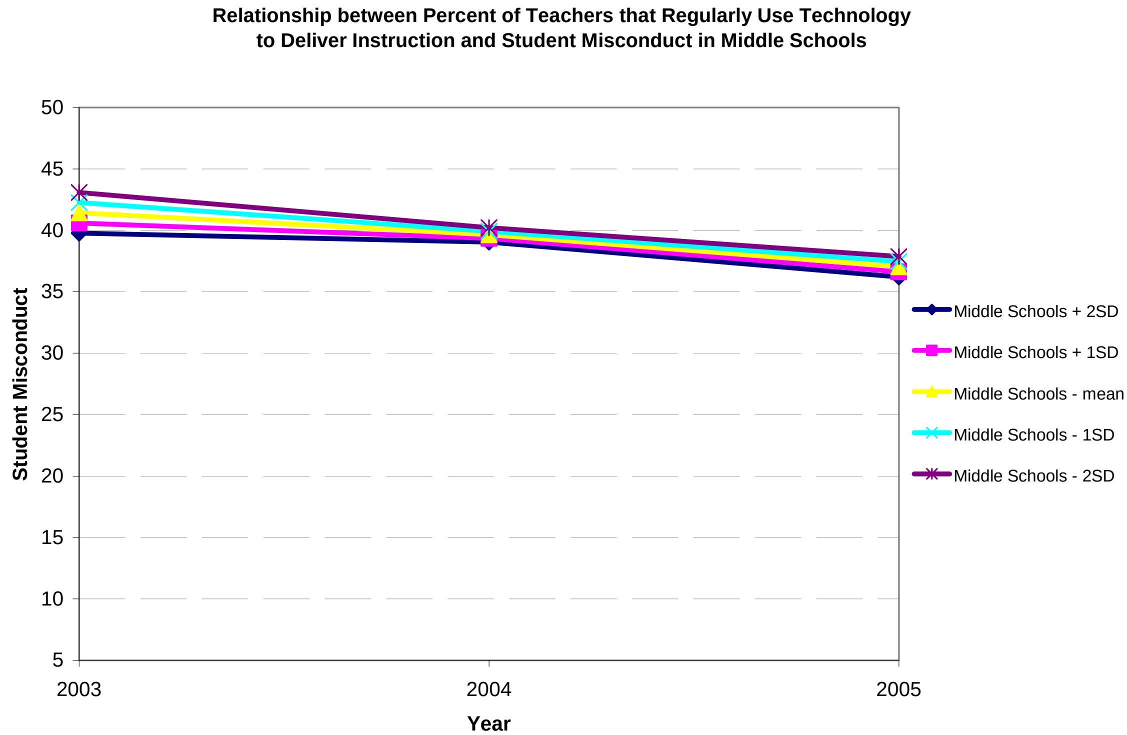

Figure 37. Relationship between Percent of Teachers Who Regularly Use Technology to Deliver Instruction and Student Misconduct in Middle Schools.

When controlling for all other variables, elementary schools at two standard deviations above the mean for percent of teachers who regularly use technology to deliver instruction started with student misconduct scores at 8.85, while schools at two standard deviations below the mean started with scores at 12.16 or 3.31 points lower in 2003-04 (See Figure 38). Because time was not significant, the trends remained parallel.

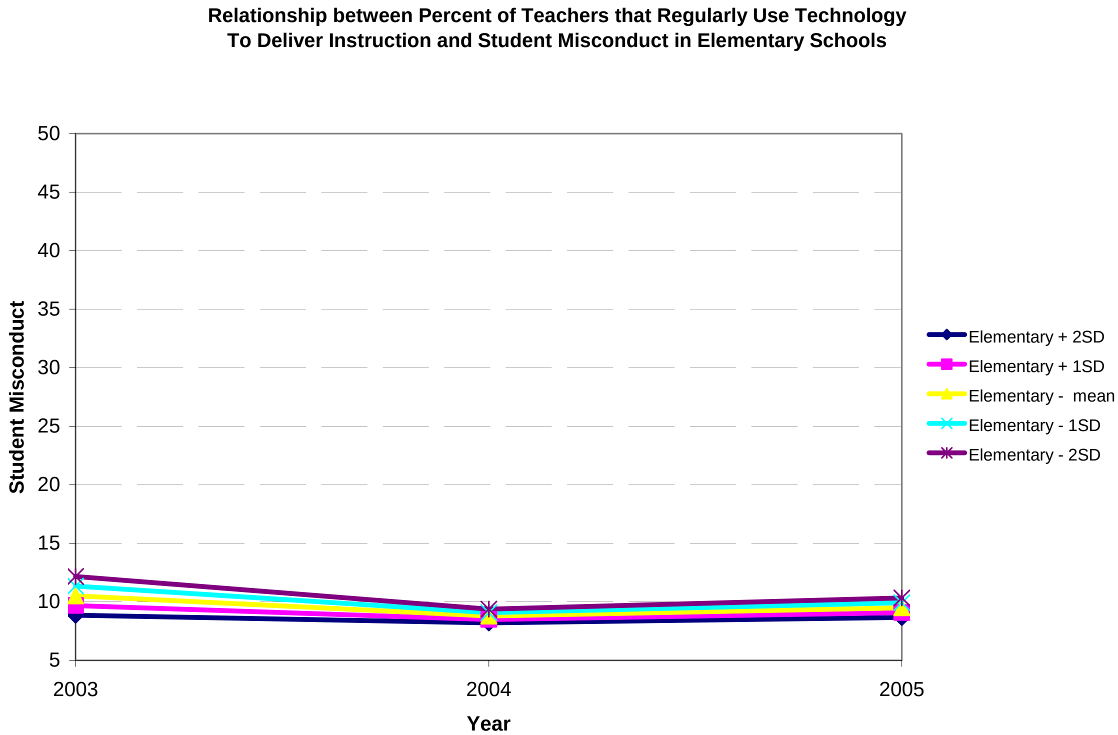

Figure 38. Relationship between Percent of Teachers Who Regularly Use Technology to Deliver Instruction in Elementary Schools.

Figure 39 illustrates the relationship between the average school percent of teachers who regularly use technology for administrative purposes and average school student misconduct score for high schools. Percent of teachers who regularly use technology for administrative purposes was compared at one and two standard deviations below the mean, the mean, and one and two standard deviations above the mean. This allowed the extreme cases of schools that had the highest percent of teachers who regularly use technology for administrative purposes, +2 standard deviations above the mean, and schools that had lowest percent of teachers who regularly use technology for administrative purposes, -2 standard deviations below the mean to be compared. Between 2003-04 and 2005-06, for all schools levels at all levels of teachers who regularly use technology for administrative purposes, the level of student misconduct decreased. Schools that had the highest percent of teachers who regularly use technology for administrative purposes started the study in 2003-04 with the highest student misconduct scores (41.61) and schools that had the lowest percent of teachers who regularly use technology for administrative purposes had started with the lowest student misconduct scores (39.94). The interactions between the percent of teachers who regularly use technology for administrative purposes and time and time^2 with student misconduct scores were significant, so the slopes of the trends were curvilinear. By 2005-06, high schools with the two standard deviations above the mean in percent of teachers who regularly use technology for administrative purposes had greatest decreases that resulted in the lowest levels of student misconduct (see Figure 39).

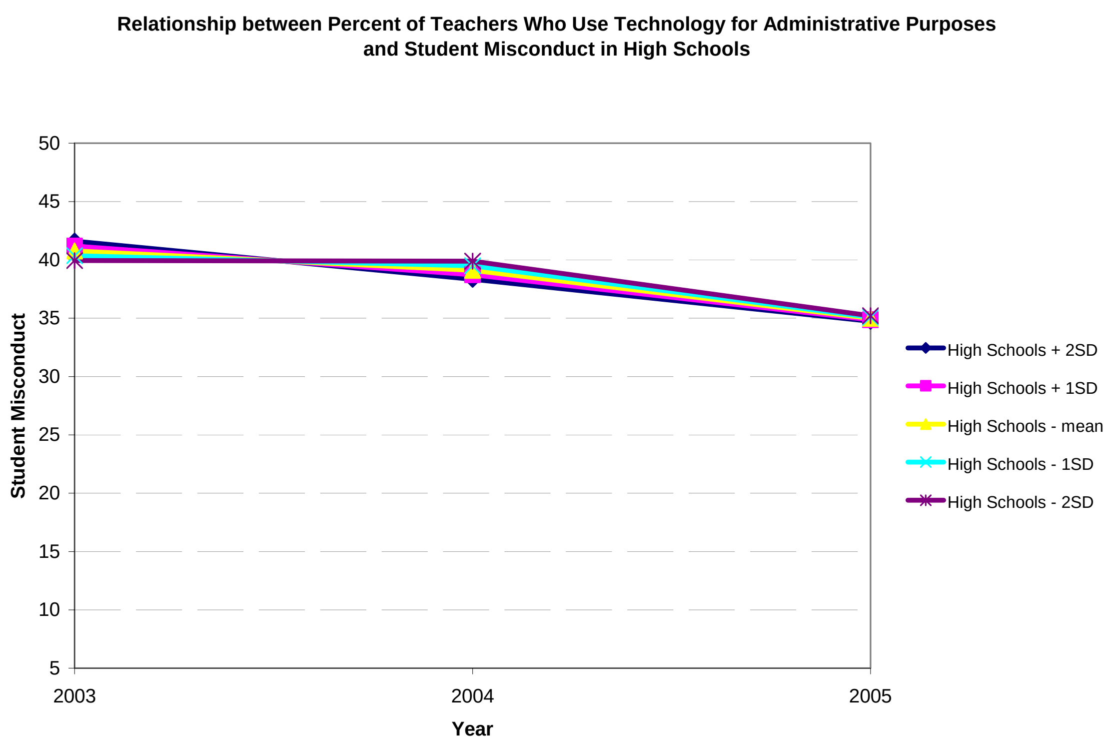

Figure 39. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Student Misconduct in High Schools.

Middle schools had a similar beginning pattern to high school, that is after controlling for all other factors, schools that were two standard deviations above the mean in the percent of teachers who regularly use technology for administrative purposes had the highest student misconduct scores in 2003-04 (42.26) while those with two standard deviations below the mean had the lowest levels (40.60). Schools at all levels of percent of teachers who regularly use technology for administrative purposes experienced decreases in the level of student misconduct over the course of the study. However, middle schools with two standard deviations above the mean of percent of teachers who regularly use technology for administrative purposes had the greatest decreases and ended the study with the lowest level of student misconduct (see Figure 40).

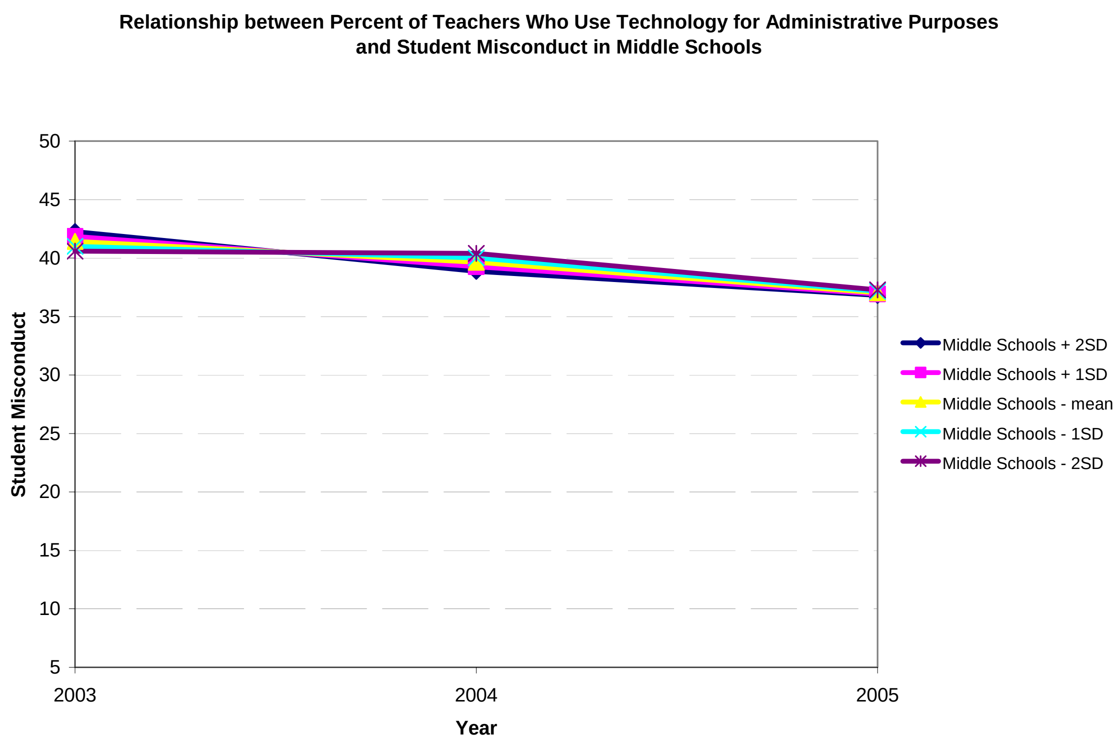

Figure 40. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Student Misconduct in Middle Schools.

Elementary schools experienced a similar pattern to middle schools. Schools at two standard deviations above the mean in percent of teachers who regularly use technology for administrative purposes began the study with the highest student misconduct score (11.33), while schools at two standard deviations below the mean in percent of teachers who regularly use technology for administrative purposes began the study with the lowest student misconduct score (9.67). Between 2003-04 and 2004-05 elementary schools at all levels of percent of teachers who regularly use technology for administrative purposes experienced decreases in level of student misconduct; however, schools at two standard deviations above the mean experienced the greatest decrease (3.32). Between 2004-05 and 2005-06 level of student misconduct increased. Although elementary schools at two standard deviations above the mean in level of percent of teachers who regularly use technology for administrative purposes experienced the greatest increase, the resulting level of student misconduct was still lower than at the beginning of the study (see Figure 41).

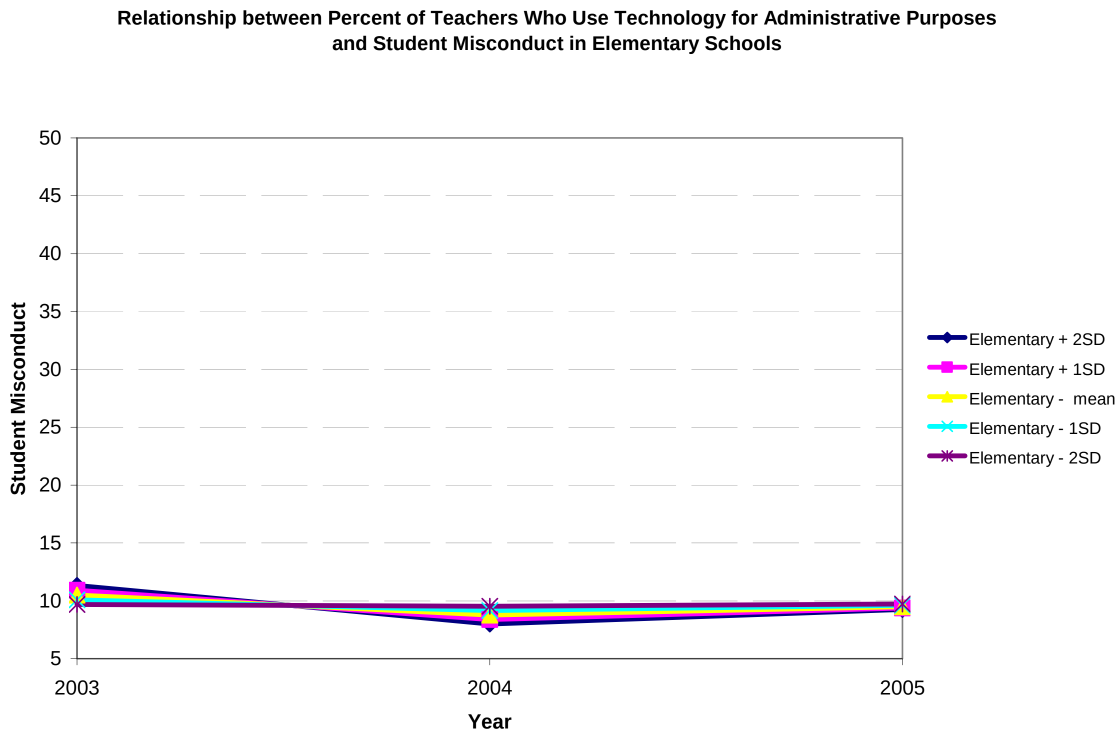

Figure 41. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Student Misconduct in Elementary Schools.

When the sample was restricted to just elementary and middle schools and percent of gifted students was included in the equation, there was a main effect with gifted but no interactions of percent of gifted students in the school with time or $time^2$ and level of student misconduct. Thus, when all other factors were held equal, schools at two standard deviations above the mean in percentages of gifted students began the study with the lowest student misconduct scores and this trend did not change over time (see Figure 42). However, overall elementary schools had lower levels of student misconduct than middle schools.

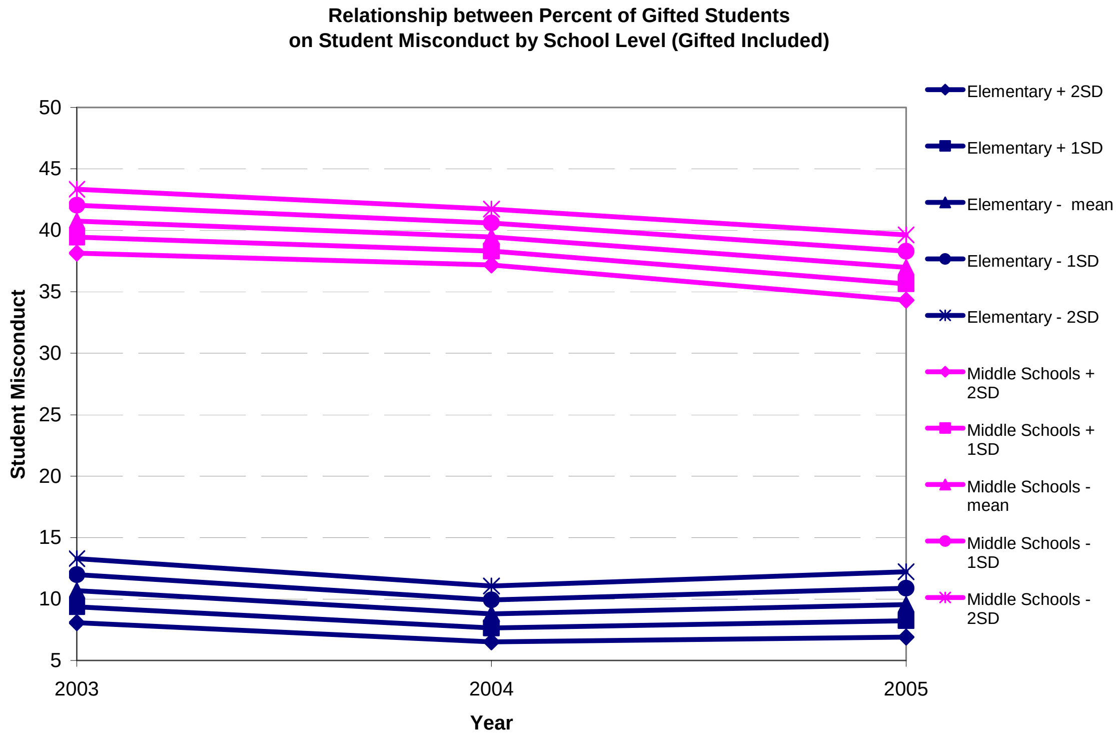

Figure 42. Relationship between Percent of Gifted Students and Level of Student Misconduct by School Level (Gifted Included).

When examining the parameter estimates of the technology integration indicators within the data for elementary and middle schools with gifted, there was no significant relationship between the intercept of the percent of teachers who regularly use technology for administrative purposes and student misconduct. However, there were significant interactions between time and time^2 with the percent of teachers who regularly use technology for administrative purposes. In order to visualize the significant relationships of the percent of teachers who regularly use technology for administrative purposes with student misconduct, after controlling for all other factors the trends are depicted in separate charts.

Each school level was examined separately. One and two standard deviations above the mean, the mean, and one and two standard deviations below the mean of levels of percentages of teachers who regularly use technology for administrative purposes were compared after controlling for all other factors. In 2003-04 when the study began, there was no significant difference between where middle schools with the highest percentages and the lowest percentages of teachers who regularly use technology for administrative purposes with the highest student misconduct scores (see Figure 43). The level of student misconduct decreased in all middle schools 2004-05; however the middle schools that were two standard deviations above the mean in percentage of teachers who regularly used technology for administrative purposes had the most decline student misconduct (2.45), while middle schools with two standard deviations below the mean in percentage of teachers who regularly used technology for administrative purposes had the least decline in student misconduct (0.14). In 2005-06, this rate of decline in the trend had reversed, with middle schools with the highest percentages of teachers who regularly used technology for administrative purposes experiencing the lowest decreases in student misconduct (1.54 vs. 3.42). Over the course of the study all student misconduct at all levels of percentages of teachers who regularly used technology for administrative purposes decreased.

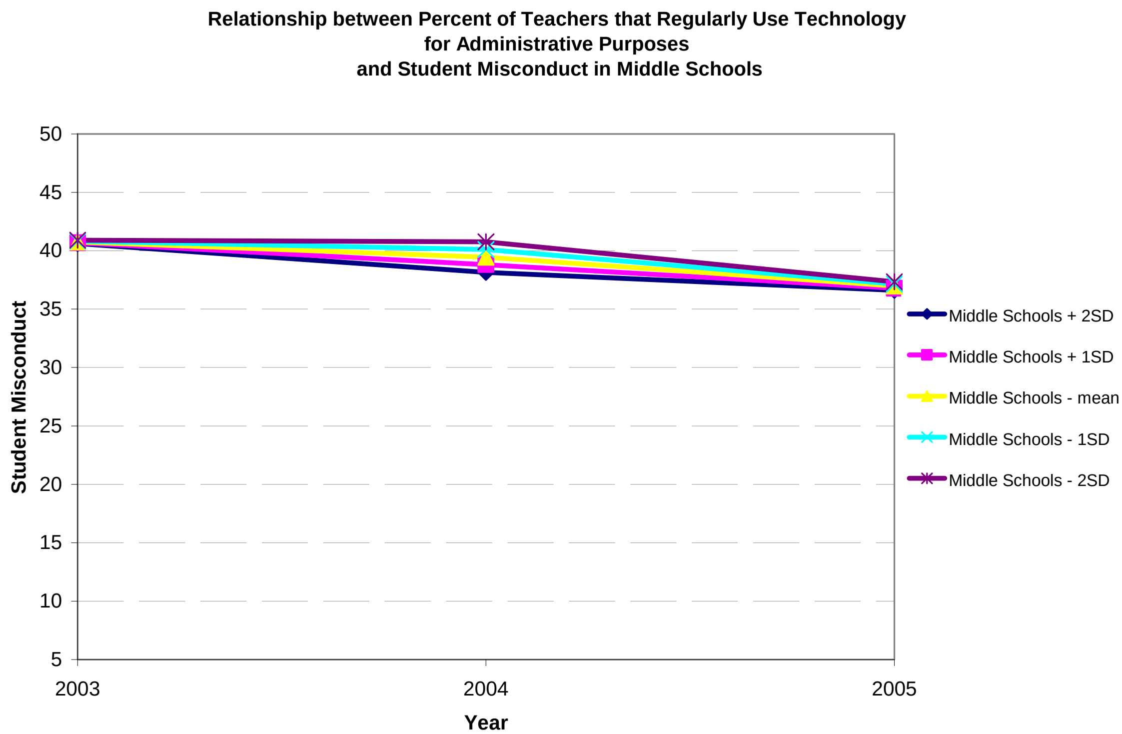

Figure 43. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Student Misconduct in Middle Schools (Gifted Included).

The trends for elementary schools followed a very similar pattern to that of middle schools (see Figure 44). In 2003-04 when the study began, there was no significant difference in level of student misconduct between elementary schools with two standard deviations above the mean and two standard deviations below the mean of percentage of teachers who regularly use technology for administrative purposes. In 2004-05 the average school student misconduct score declined in all elementary schools. However, elementary schools with the least or two standard deviations above the mean for percentage of teachers who regularly use technology for administrative purposes declined the most (3.05), while elementary schools with the least percentage of teachers who regularly use technology for administrative purposes declined the least (0.73). The trend for elementary schools at two standard deviations below the mean of percentage of teachers who regularly use technology for administrative purposes continued to decline at a slower rate in level of student misconduct (0.17) in 2005-06; however schools with all other levels of percentage of teachers who regularly use technology for administrative purposes reversed directions and experienced increases in the level of student misconduct. Schools with two standard deviations above the mean of percentage of teachers who regularly use technology for administrative purposes had the greatest increase in student misconduct (1.71).

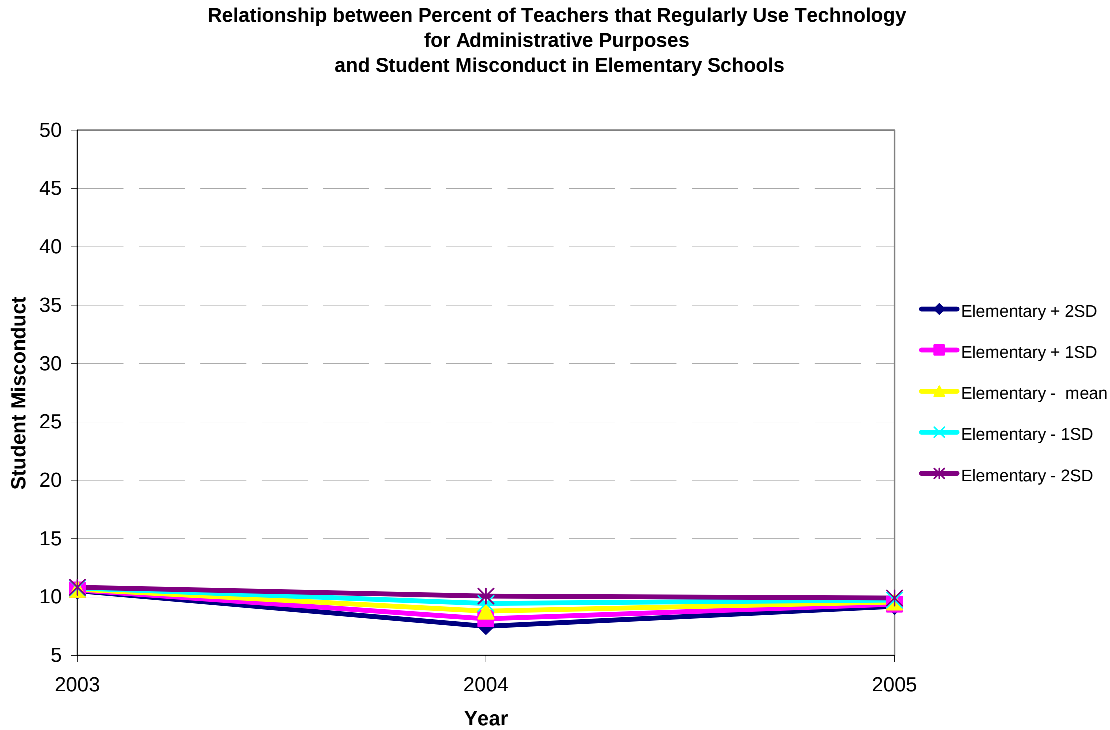

Figure 44. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Misconduct in Elementary Schools (Gifted Included).

Chapter 5: Discussion

This chapter reviews the general limitations of this study and the difficulties encountered during all phases. Results are interpreted and compared with those found in previous studies. Each research question is addressed separately and then common themes are discussed. Finally, recommendations for future research to further investigate these questions are proposed.

Limitations

It is important to review the limitations of this study before drawing conclusions. Most important to framing any recommendation from the results obtained is that this study was correlational; therefore, causality cannot be inferred. The study was conducted with data from public elementary, middle, and high schools in Florida over a four year period from 2003-04 to 2006-07. The results may be specific to this set of schools, and may not be generalized to public schools in other states or to other schools in Florida.

The data used were at the school level, not the student level. Percentages of groups of students within the school (e.g., free or reduced lunch, minority, LEP, students with disabilities, and gifted) were used in the analysis. Student level data were not available to the public due to FERPA laws and confidentiality. Because the data used were at the school level, inferences cannot be made at the student level. This study does not inform about the relationship between the integration of technology and specific groups of students; it only provides information about the relationship between technology integration and the outcome variables in schools with different percentages of these different groups of students.

Measurement issues are another major area of concern, which is common when using secondary data. In order to conduct this longitudinal study, items from different surveys were used. These surveys were created by the Florida Department of Education for purposes different from this study, so the locations and wordings of some items changed from year to year. The items chosen for this study may not have accurately measured the constructs that this study was designed to examine.

Availability and public release of data planned for use in this study was another issue that resulted in challenges. Some of the moderating predictor variables from the Florida Indicators Report were not available for the last year of the study (2006-07) so the values from the previous year were used to impute the missing data in order to examine the relationship between the fourth year of FCAT and technology integration data. When these indicators were used as outcome variables, the duration of the trends analyzed were shortened to three years. Percent of students with gifted status is only reported for elementary and middle schools. Therefore, the analysis was conducted in two stages. The first stage used all public schools at elementary, middle, and high levels without the gifted demographic variable, and the second stage used elementary and middle schools with the gifted demographic variable included. In addition, the Florida Department of Education reported that they were reanalyzing the third grade FCAT Reading scores for the 2005-06 school year due to irregularities. These scores were deleted from the database, and the FCAT Reading scores from the other grade levels were used to obtain the mean school FCAT reading score for 2005-06.

Additional measurement issues that occurred were specific to this study and may limit the validity of the findings. First, the location of computers for student use in either the classroom or computer lab has been found to impact the amount of time that they are used by students and students' achievement (Adelman et al., 2002; Becker, 2001; Mann, 1999; O'Dwyer et al., 2004, 2005; Smerdon et al., 2006). Obtaining an accurate count of computers located in different areas of schools was one of the first issues encountered during this study. This composite variable was going to be used to provide a measure for student access to computers, both in the regular classroom and in computer labs. The items, which asked for locations of desktop and laptop computers that were used to form this composite variable were interpreted by the people completing the survey so differently that, on close examination of the data, it appeared that over 100 schools used the same computers in counts for multiple locations and others may have done so also. This composite variable was not used in the analysis.

In the second issue, many of the variables that were used to measure the composite variable related to support for technology were missing. Analysis of the missing data revealed that the items that measured the level of instructional and technical support in 2003-04 and 2004-05, which also had the most missing data, did not have an option to indicate there was no support. It seemed reasonable to assume that items in the STAR survey that were unanswered were skipped because the answer was none or zero;

therefore, all missing responses for technology integration indicators were changed to zero in order to retain the items in the analysis.

In the third issue, several additional variables that were theorized to have relationships with student achievement were dropped from the study. During factor analysis, several variables did not have the variability required to have adequate loadings on factors (greater than .3) to include them in the study. As reported in previous studies (Anderson & Becker 2001; Fulton et al., 2004), the variable proportion of the technology budget spent on professional development was expected to be an important indicator for the level of support for technology integration; however, this variable did not load on the factor, so it was dropped from the study. Another variable expected to help measure the student learning environment, and have a relationship with student achievement, was class size or the ratio of students per instructional staff (Marzano, 2003; National Center for Education Statistics, 2005). This variable did not load on this factor, so it was not included in the analysis.

Achievement Outcomes - Research Question 1

> What is the relationship between indicators of technology integration and changes in mean student achievement when controlling for school level, school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality?

The analyses conducted to answer the first research question examined the relationship between technology integration variables and reading, math, and writing achievement, while controlling for moderating variables. The first research question was answered by conducting multi-level models with the FCAT achievement data for reading, mathematics, and writing. In general, reading achievement as measured by FCAT reading Norm Referenced Test scores, math achievement as measured by FCAT math Norm Referenced Test scores, and writing achievement as measured by FCAT Writing rubric scores for all public schools in Florida had significant variability in the intercept. Over time, the slopes for reading and math achievement were significantly curvilinear and S-shaped because time, $time^2$, and $time^3$ were significant. However, for writing achievement time was not significant, although $time^2$ and $time^3$ were significant.

First, the technology indicators that were not significantly related to mean school FCAT Reading, Math, and Writing achievement were examined. The first set of indicators measured student access to software. Student access to all types of software (i.e., software for delivery of content, office suite software, and advanced production software) was not significantly related to mean school FCAT Reading, Math, nor Writing scores. This finding counters the positive finding of Mann et al. (1999). Other researchers have found positive relationships between increased student access to hardware and software and the frequency that students use computers (e.g., Adelman et al. 2002; Bebell, 2005; Becker, 2001; Lowther et al., 2003; O'Dwyer et al., 2004, 2005; Shapley et al., 2006; Silvernail & Lane, 2004). The frequency that students use software may be positively related to improved achievement. However, the findings from this study suggest that there is not a direct relationship or path between access and school achievement.

Providing support is an essential condition for technology integration recommended by ISTE (ISTE NETS Project, 2007). Anderson and Becker (2001) and Fulton et al. (2004) also found technical support crucial to successful technology integration. However, two technology indicators that had no significant relationship with mean school FCAT Reading, Math, or Writing scores were both composite variables used to measure support when all school levels (without gifted) were examined. Neither human support from the technology integration specialist and the technical specialist nor the reliability of the hardware and Internet connections were significantly related to mean school reading, math, or writing achievement. This was an unexpected finding. Finding no relationship would suggest that technical support does not have a direct relationship or path with student achievement. Support for technology may be a mediating variable that is related to how often teachers use technology. Another unexpected finding from the dataset with middle and elementary schools with gifted was that one standard deviation increase in the level of dependability of the hardware and Internet was associated with a significant decrease of 0.28 point in the intercept of mean school FCAT Reading score. Although this had a modest effect, it beckons the researcher to investigate the negative association further. It also may be that the items used to measure support did not adequately measure this construct.

Another relationship that has been found to be positively related to the frequency that students use computers is the frequency that teachers use technology (Adelman et al. 2002; Becker, 2001; Becker et al., 1999; Knezek et al., 2003; O'Dwyer et al., 2004, 2005). The findings from this study indicated that the proportion of teachers who regularly use technology for delivery of instruction was not significantly related to mean school FCAT Reading, Math, nor Writing achievement. One explanation for this result is the method used to derive the composite variable did not adequately measure the frequency that teachers use technology to deliver instruction. The items in the survey that composed the factor included more advanced production software programs used for creating instruction such as video editors and web editing programs. Although teachers may not have used advanced production programs, they frequently may have used technology in less advanced ways to deliver instruction such as using technology to make presentations. Frequent use of technology in this mode only would not have been captured by the composite variable, because the composite was measured by the sum of time the teacher spent using technology in each instructional delivery method, and it was not measured by the total amount of time the teacher used technology in any method. Alternatively, these results suggest that the path between teacher use of technology for delivery of instruction and mean school achievement in Reading, Math, and Writing is not direct. Teacher use of technology for the delivery of instruction may be related to how often students use software, which may be related to achievement. Perhaps, the connection between teacher use and school mean achievement takes more time to be manifest.

Nevertheless, in this study when data at all levels of school without gifted were analyzed, the frequency that students used content delivery software was not significantly related to mean school FCAT Math achievement or mean school FCAT Reading achievement at the intercept. This finding counters previous research findings reported about reading and achievement by Borman (2003), Kulick (2003), and Mann (1999); and math achievement reported by Borman (2003), Kulick (2003), Mann (1999), Penuel et al. (2002), and Wenglinsky (1998, 2005). However, the findings coincide with newer research results for reading reported by Dynski et al. (2007), Russell et al. (2004), and Shapley et al. (2006) and research results for math reported by Dynski et al. (2007), O'Dwyer et al. (2005), and Shapley et al. (2006). These more recent research studies used multi-level modeling statistical techniques and found no significant relationship between frequency of student use of technology and reading or math achievement. Although these four studies examined relationships over a short period of time (less than one year) the current study analyzed data from four years using multi-level modeling and found similar results. It is possible that more than four years is needed to show significant relationships between increases in school level reading and math achievement and frequency that students use content software. The positive results reported by Mann

(1999) occurred after seven years, which would support that time may be needed for agents to adapt to change, as proposed by complexity theory.

Noteworthy, with the dataset that included all school levels without gifted, there were significant interactions between the frequency that students used content software and the slope of FCAT Reading with time, time^2, and time^3 (see Figure 45). This relationship was repeated with the dataset that included elementary and middle schools with gifted; there were significant interactions between the frequency that students used content software and FCAT Reading with time. These interactions demonstrate that the relationship of the frequency that students used content software with FCAT Reading achievement changed over time. Although all schools began the study at the same mean school FCAT Reading score, when measured in 2004, schools at all levels that were at two standard deviations above the mean in frequency that students used content software had mean FCAT Reading scores one point lower than schools at two standard deviations below the mean. This significant difference disappeared in later years.

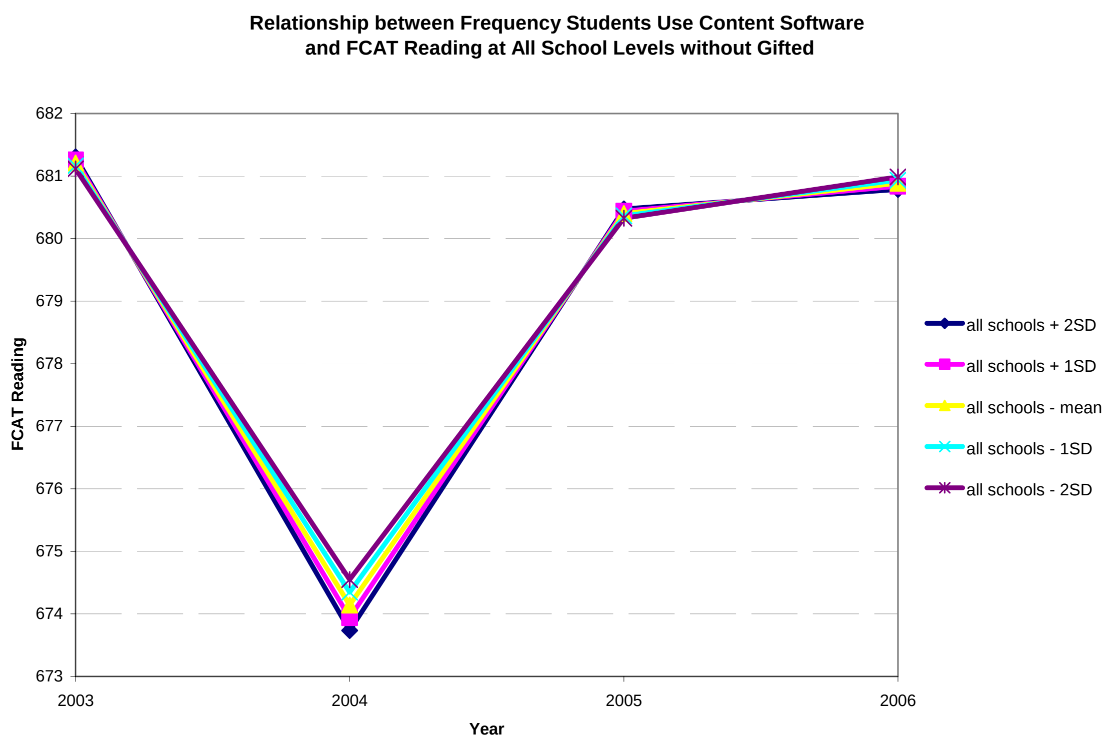

Figure 45. Relationship between Frequency that Students Use Content Software and FCAT Reading at All School Levels without Gifted

When the data with all school levels without gifted were examined, the only technology indicator that had a relationship with mean school FCAT Writing was the frequency that students use content software. However, this relationship was negative at the intercept, which was similar to FCAT Reading in 2004. That is, when all other factors were controlled, one standard deviation higher percentage of frequency that students used content software was associated with a decrease of 0.01 point in mean school FCAT Writing score in 2003-04. The interactions of time, $time^2$, and $time^3$ with the frequency that students use content software were not significant, so the trends were parallel over time. Although this relationship was significant, the practical importance was modest.

When the dataset with elementary and middle schools and gifted was analyzed, there were no significant relationships between FCAT Writing and any of the technology indicators. The ceiling effect of the test experienced by gifted students, who score at the top range of a test, may have resulted in this lack of significant relationships. Improvement can not be detected when students score at the highest range of the test and the follow-up test is given at the same level. Furthermore, in this study when data at all levels of school without gifted were analyzed, the frequency that students used office software or advanced production software was not significantly related to mean school FCAT Writing achievement. This finding counters previous research findings reported by Goldberg et al. (2003), Kulick (2003), Lowther et al. (2003), Mann (1999), O'Dwyer et al. (2005), and Penuel et al. (2002). This lack of significant results may be due to the decreased variability in this dataset. Writing in this study was measured by the writing rubric with scores that ranged between 0 and 6. The FCAT Writing test has been updated to include other types of measurement. The data from the new FCAT Writing assessment for future studies may have greater variability and ability to measure writing achievement. In addition, the lack of significant results found with this study may be due to how the computer was used. Although O'Dwyer et al. (2005) found a significant relationship between using a computer at school to edit papers; they also found a negative relationship when using the computer at school to create presentations. In the current study, using the computer for creating presentations was included in the category for tool-based use. Therefore, it is important for future studies to examine the specific use of technology, when examining the relationship of the integration of technology with student writing achievement.

On a positive note, when the data with all school levels without gifted were examined, the only technology indicator that had a positive relationship at the intercept with mean school FCAT reading was the frequency that students used tool-based software. This was an encouraging relationship to find, because it supports research findings reported by Kulik (2003), O'Dwyer et al. (2005), Pearson et al. (2005), and Wenglinsky (1998, 2005). In all of these studies, positive relationships were found between reading achievement and using word processors for writing. However, in this study, the effect size was modest. One standard deviation increase in frequency of student use of tool-based software was related to an increase of only 0.22 point in the mean school FCAT Reading scale score. In addition, when the data with elementary and middle schools with gifted were examined, the frequency that students used tool-based software was not significant.

Conversely, in the dataset with elementary and middle schools with gifted, the frequency that students used content software was significantly related to FCAT Reading achievement. One standard deviation increase in the frequency that students used content software was associated with an increase of 0.18 point in the mean school FCAT Reading score at the intercept, a modest effect size. This finding supports the research reported by Kulick (2003) and counters the no significant difference reported by Dynanski et al. (2007). These different significant results in frequency that students use content software and tool-based software may be associated with differences in school level. Other researchers have reported differences in how students use technology at the elementary and secondary levels (Barron et al., 2003; Hart et al., 2002; and Wenglinsky, 1998, 2005). Students at elementary levels may be using computers to learn how to read; therefore, they may be using content delivery software. Students at the secondary level may be focusing on reading to learn; therefore, they may be using technology as tools to extend and deepen their learning.

Also, these differences in how students use technology as a tool and for content delivery may be confounding the research results. If these software uses had been combined, significant changes in the frequency that students used all types of software may have been detected. As a result, no information would be available to relate how students used software with achievement. Thus, these conflicting results mean that the specific ways technology is used to support learning and deliver content are important components to examine. The statewide data used in this study provided broad categories of software in the items used to measure how often students use software. It did not include specific information about which programs students used to learn content or how technology was integrated into the curriculum. The best methods in which to collect this kind of information would be through surveys of teachers and direct observations. Therefore, future research is needed to look at how technology is integrated, along with frequency of student use, in order to clarify these findings.

In addition, how students are assessed may make a difference in measuring the relationship of technology use with achievement. Kim and Reeves (2007) suggest that the relationship between the tool and learning is dynamic, complex, and intertwined. They recommended that students use the technology tool while being assessed. During the time of this study, the FCAT Writing has not been administered on a computer in Florida schools. Moreover, a variety of assessment measures administered at multiple points in time are needed to measure methods of technology integration in instruction, ways that students use the technology, and achievement. Therefore, in the future, specific methods of integration of technology in each academic curriculum along with compatible and multiple forms of assessment need to be examined in order to determine which specific methods support achievement and which methods interfere with achievement.

The most interesting finding was the significant relationship between both school FCAT Reading and FCAT Math achievement and the percentage of teachers who regularly use technology for administrative purposes. With the dataset that included all levels of school without gifted, the percentage of teachers who regularly use technology for administrative purposes was significantly related to school FCAT Reading at the slope, but not at the intercept, which meant schools at different levels of percentage of teachers who regularly used technology for administrative purposes started with the same mean FCAT Reading scores (see Figure 46). However with FCAT Math achievement, this relationship was negative at the intercept (see Figure 47). That is, when all other factors were controlled, one standard deviation higher percentage of teachers who regularly use technology for administrative purposes was associated with a decrease of 0.23 points in mean school FCAT Math score in 2003-04.

Nevertheless, because time, time^2, and time^3 were significant with both FCAT Reading and Math, this relationship changed over time, so that by the end of the study, schools at two standard deviations above the mean in percentage of teachers who regularly use technology for administrative purposes were predicted to have mean FCAT Reading and FCAT Math scores two points higher than schools that were two standard deviations below the mean. With the dataset that included elementary and middle schools with gifted, there were similar significant interactions between the percentage of teachers who regularly use technology for administrative purposes and FCAT Reading at the intercept, time, and $time^2$ and with FCAT Math at the intercept, time, $time^2$, and $time^3$. By the end of the study schools with two standard deviations above the mean of percentage of teachers who regularly use technology for administrative purposes were predicted to have mean FCAT Reading scores one point higher and mean FCAT Math scores two points higher than schools with two standard deviations below the mean. Although these relationships were significant, the practical importance was modest. This suggests that the path between teacher use of technology for administrative purposes and mean school achievement in FCAT Reading and FCAT Math may be direct. In addition, this demonstrates that time may be an important variable when examining the relationship of technology integration indicators with achievement. The changes that occurred over time in the relationship between percent of teachers who regularly use technology for administrative purposes and student achievement suggests that more time may be needed before the relationship is fully developed or becomes established.

The administrative uses that were used to create this composite variable included administrative activities such as maintaining electronic grade books, analyzing student assessment information, and communicating with parents and students by e-mail. Perhaps, teachers were able to glean more quickly important information about their students' progress through maintaining electronic grade books and analyzing student assessment information with technology. As a result, they were able to share this valuable feedback with their students and parents. Afterward, students responded to the constructive feedback by improving their performance. As students improved their performance teachers may have decreased their use of technology for monitoring and communicating progress. Thus, the relationship between teachers' use of technology for administrative purposes and student achievement may be dynamic as both teachers and students adjust their strategies to match current conditions. Accordingly, it is important to examine specifically how technology is being used by both teachers and students during the dynamic process of instruction and learning.

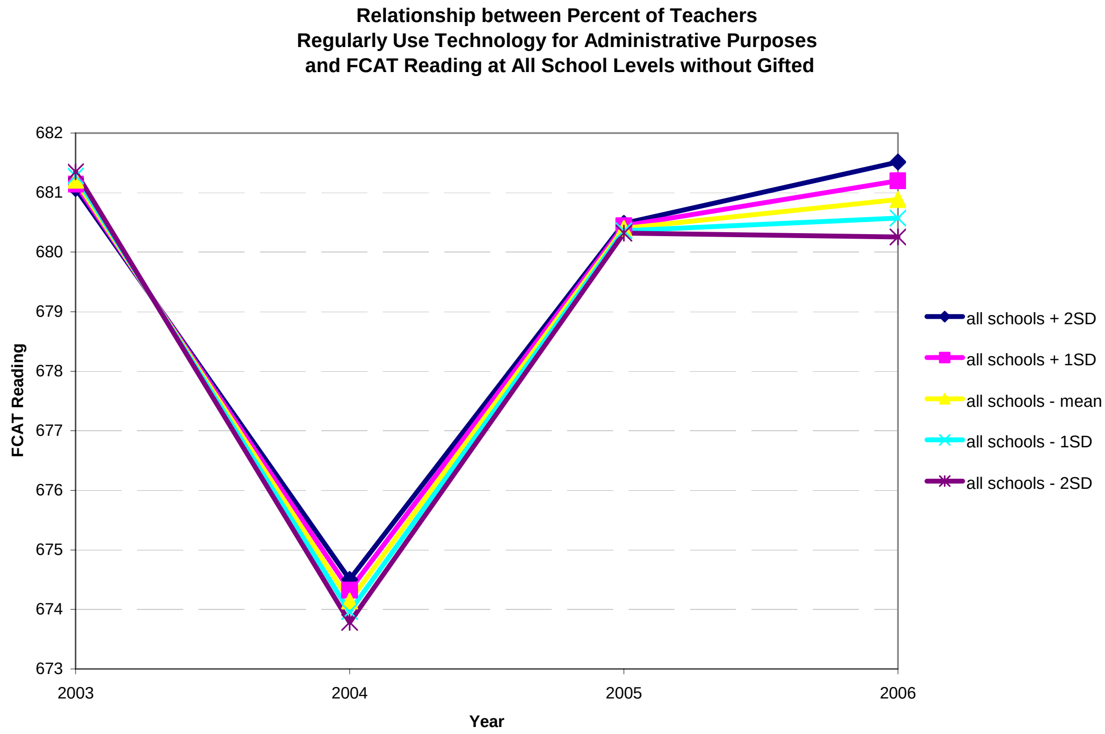

Figure 46. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and FCAT Reading at All School Levels without Gifted

The overall relationship during the course of the study for each of the significant technology indicator variables was an increase in mean school FCAT Reading scores, although the effect size of this increase was modest. Noteworthy, all of the figures that illustrate the relationship between each of these variables and mean school FCAT Reading score had similar decrease between 2003-04 and 2004-05. A major event occurred in this same time period. The Florida's A+ law provided consequences to schools for not meeting adequate yearly progress, and disaggregated results for each school's mean FCAT scores were made public for the first time. Schools that did not make adequate progress would have been in danger of losing funding and ultimately control of their school. In response to this event, teachers may have changed their methods of instruction and the way they integrated technology. All trends in all charts made a sharp upward turn in direction after 2004-05. After the first disaggregated results were published and educators could evaluate the results from the changes in their methods and adjust their instructional practices, school mean FCAT Reading scores increased between 2004-05 and 2006-07.

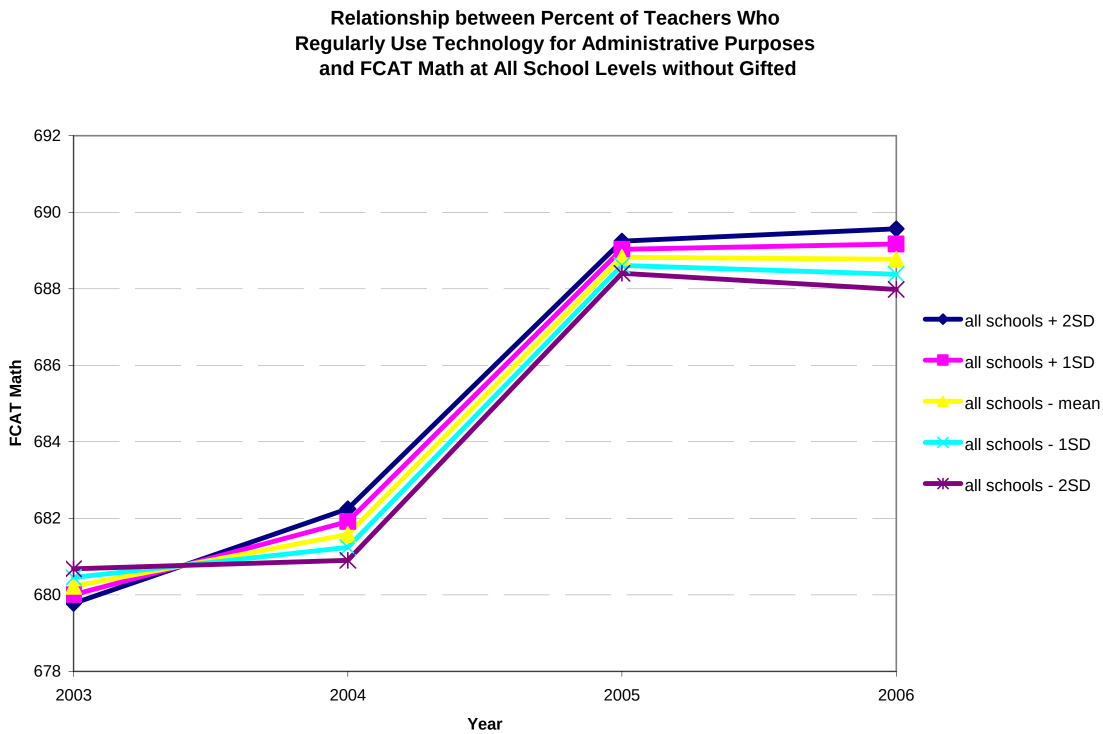

Figure 47. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and FCAT Math at All School Levels without Gifted

The trends for FCAT Math achievement may demonstrate similar responses to the consequences of Florida's A+ Law. Initially, the trend between 2003-04 and 2004-05 was shallow. However, the steep incline in the mean school FCAT Math scores between 2004-05 and 2005-06, similar to the trend for Reading FCAT scores, is prominent in most of the figures that illustrate the relationship between the technology integration variables and mean school FCAT Math score. The s-shape of the graphs depicting the shallower gains made from 2005-06 to 2006-07 may indicate that there is a ceiling to the amount that schools can increase their mean FCAT Math scores. More time will be needed to see if this is a ceiling or if the upward trend continues; as suggested by the research reported by Borman (2003), positive results of school reform may take five years or more to become established.

Interestingly, this study found a significant relationship between U.S. magnet schools and FCAT Writing achievement. Although being a U.S. magnet school had no significant relationship with the intercept, the interactions of U.S. magnet school with time and $time^2$ were significant. This resulted in two changes of direction over time with approximately 0.03 point difference between magnet and non-magnet schools. Schools designated as U.S. magnet schools began the study in 2003-04 with lower mean school FCAT Writing scores and then in 2004-05 U.S. magnet schools had higher mean school FCAT Writing scores. This trend reversed in 2005-06 and remained reversed in 2006-07 (see Figure 48). Although this is a significant trend over time, the difference is modest. The flatter pattern may be due to the specific focus of the U.S. magnet school on an interest area, so that less attention is devoted to the development of writing skills.

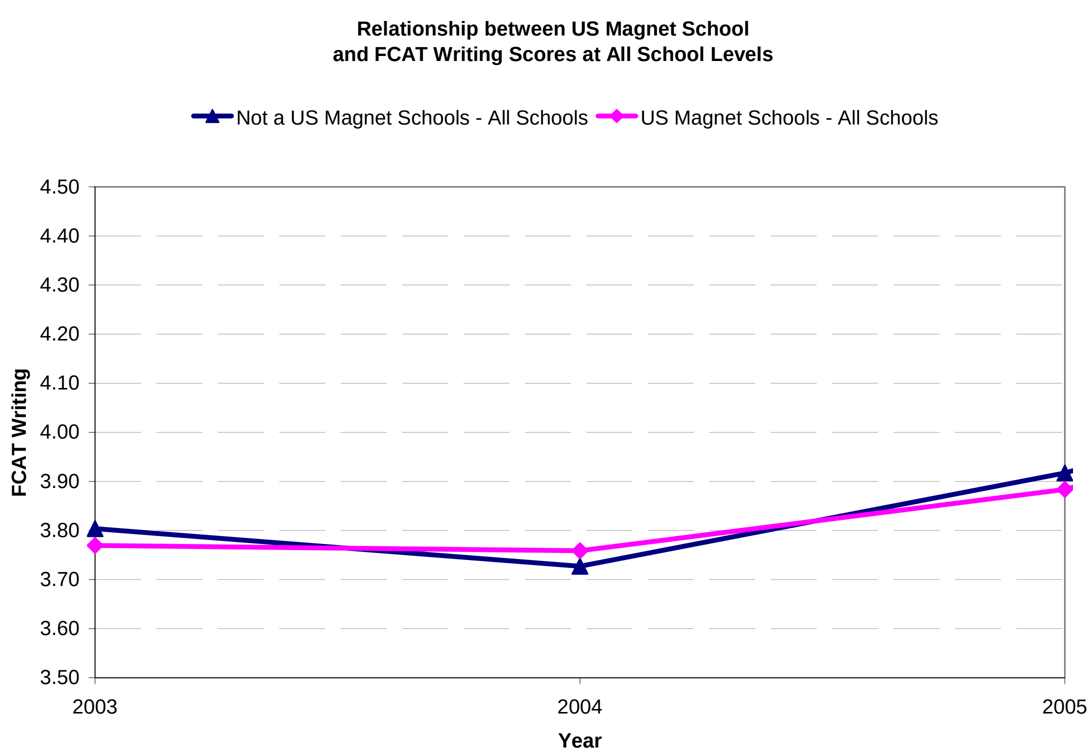

Figure 48. Relationship between U.S. Magnet School Status and Mean FCAT Writing Scores in All Schools

Overall, the inconsistent findings counter the previous positive reports about the relationship of technology integration with student achievement in reading, math, and writing (Borman, 2003; Goldberg et al., 2003; Kulick, 2003; Lowther et al., 2003; Mann, 1999; O'Dwyer et al., 2005; Penuel et al., 2002; Wenglinsky, 1998, 2005) and support newer research results reported by Dynski et al. (2007), Russell et al. (2004), and Shapley et al. (2006). More time is needed to examine this relationship in Florida. These inconsistent trends may also be due to the different ways that technology can be integrated into the curriculum for students. Future research about the relationship between technology integration and student achievement must examine how the technology is used. Another factor that may interfere with finding positive relationships between technology integration and student achievement is the measurement of achievement. Skills are best assessed using the same methods and activities in which the student customarily uses the skills (Berliner, 1990; Kim & Reeves, 2007; Russell & Higgins, 2003; Wenglinsky, 2005). Positive relationships may be found when student achievement is assessed through the technology that the students used to learn and practice those skills. In addition, only using the results of one standardized assessment each year may not adequately measure students' achievement, especially when the students are gifted and already are performing at the top of the measurement scale. Multiple assessments conducted in a variety of formats over many points in time would better represent students' growth in skills and knowledge. Another explanation for these inconsistent findings is that the relationship between the integration of technology and achievement is dynamic and the path occurs in both directions. That is, teachers influence what students do and learn, and in turn, the responses of the students influence how teachers modify and adapt or change the instructional methods that they use. The integration of technology is only one of the many factors in the complex learning phenomenon that occurs within the classroom.

Mediating Outcomes - Research Question 2

> What is the relationship between indicators of technology integration and changes in mediating outcomes of absence rate and student misconduct, when controlling for school level, school socio-economic status, minority, limited English proficiency, students with disabilities, gifted, teacher qualification, and learning environment quality?

The analysis conducted to answer the second research question examined the relationship between technology integration variables and mediating variables (percent of students absent more than 21 days and mean school student misconduct score), while controlling for moderating variables. This research question used multi-level models with percent of students absent more than 21 days and mean student misconduct score as outcomes. Misconduct was measured with a composite variable created from the sum of the mean percent of students with in-school suspensions, mean percent of students with out-of-school suspensions, and the mean number of crime incidents per student. In general, both the percentage of students absent 21+ days for all public schools in Florida and the mean school student misconduct score had significant variability and significant slopes that were curvilinear because time and $time^2$ were significant.

First, after controlling for school level and school level demographic and learning environment variables, the technology indicators that were not significantly related to percent of students with more than 21 days absent or mean school student misconduct scores were examined. The first set of indicators measured student access to software. Student access to all types of software (i.e., software for delivery of content, office suite software, and advanced production software) was not significantly related to the percent of students with more than 21 days absent nor significantly related to mean school student misconduct scores. Furthermore, the results with both datasets indicated that the frequency that students used content delivery software or tool-based software was not significantly related to percent of students with more than 21 days absent or mean school student misconduct. These results counter the findings about the relationship between student use of software and attendance found by Barron et al. (1999), but support the findings of Muir-Herzig (2004) and Shapely et al. (2006). Likewise, the frequency that students used content delivery software or tool-based software was not significantly related to mean school student misconduct either, which supports the findings of Waxman (2003) and counter the findings of Barron et al. (1999), Kmitta and Davis (2004), and Shapely et al.(2006). However, the measures in this study may not adequately measure the frequency of specific methods that students use technology. Accordingly, it is important in the future to continue to examine the relationship between how and how often students use technology and student absences and student misconduct. Future studies should include information about how technology has been integrated into the curriculum and the methods that students and teachers are using with technology that is collected from a variety of sources. Triangulation of findings would need results from teacher and student surveys and interviews and classroom observations.

Another technology indicator that had no significant relationship with percent of students with over 21 days absent or with mean school student misconduct scores in both datasets was the composite variable used to measure the level of technical support for hardware and access to the Internet. However, with the dataset that included all schools without gifted, there was a significant interaction between technical support – human and percent of students with over 21 days absent with time and time^2. Although all schools started at the same level of student absences, through the course of study the relative level of student absences in schools with two standard deviations above the mean and two standard deviations below the mean of technical support – human changed. That is, in 2004-05, schools with two standard deviations above the mean of technical support – human had the greatest absences, and in 2005-06 schools at two standard deviations above the mean had the least absences. This may be a result of the changing demands on the types and modes of support provided by the specialists. The students' response may be different to a tech specialist working in the classroom with students, as opposed to the tech specialist providing the teachers with training outside of the classroom. Closer examination of the specific supports provided by the technical support and technology integration support specialists and their relationship with student attendance is needed to understand the dynamics of this relationship.

The findings from this study indicated that the percent of teachers who regularly use technology for delivery of instruction was not significantly related to percent of students with more than 21 days absent, which supports the findings of Muir-Herzig (2004). This suggests that the path between teacher use of technology for delivery of instruction and percent of students with more than 21 days absent is not direct.

However the percent of teachers who regularly use technology to deliver instruction was significantly related to mean school student misconduct at the intercept with the dataset that included all schools without gifted. This means that schools with the greatest percent of teachers who regularly use technology to deliver instruction were predicted to begin the study with the lowest levels of school misconduct. Because the interactions with time were not significant, once established, this trend remained parallel (see Figure 49). One explanation is that when teachers use technology to deliver instruction, students find the lessons more engaging and are spending more time on-task learning, which results in decreased off-task and disruptive behavior. Another explanation is that schools that have less disruptive behavior allow more teachers to use technology to deliver instruction. Future research is needed to examine how teachers are using the technology to deliver instruction and the relationship of different instructional methods with student misconduct.

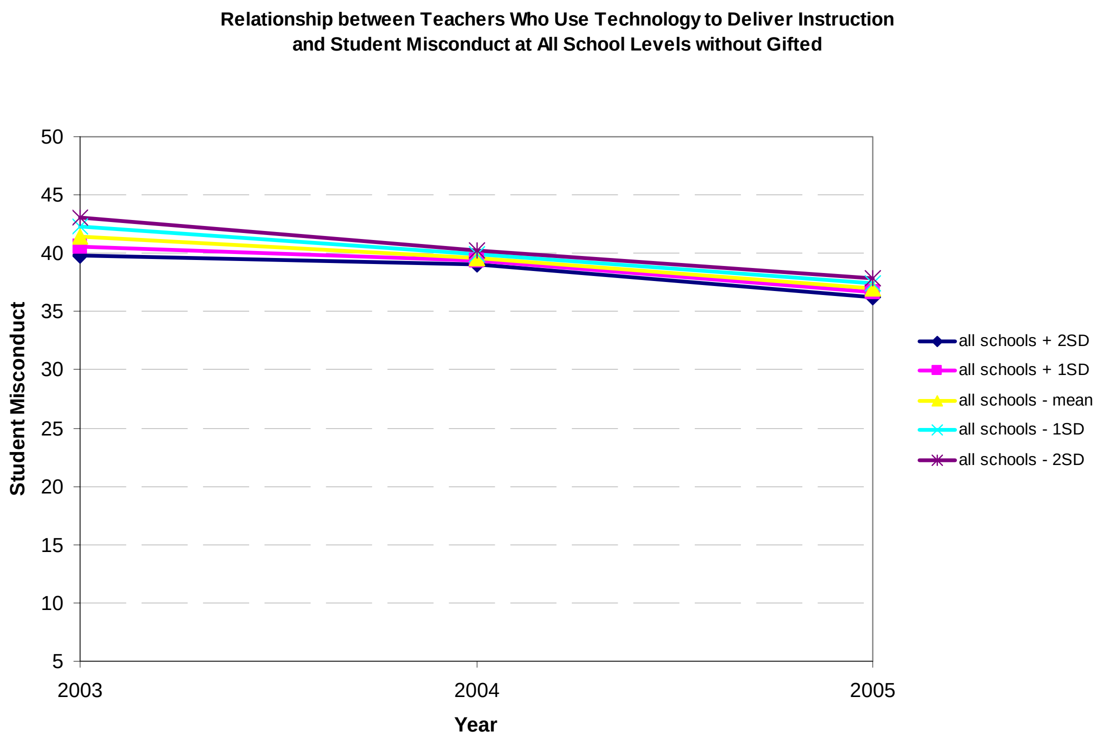

Figure 49. Relationship between Percent of Teachers Who Regularly Use Technology to Deliver Instruction and Student Misconduct at All School Levels (without Gifted)

When the data with all school levels without gifted and the data at elementary and middle school levels with gifted were examined, the technology indicator that was significantly related to percent of students with more than 21 days absent and mean school student misconduct score was the relationship with the percent of teachers who regularly use technology for administrative purposes. The relationship of the percent of teachers who regularly use technology for administrative purposes and percent of students with more than 21 days absent was significant at the intercept, time, and time^2 (see Figure 50). This resulted in curvilinear trends in both datasets with the relationship between the highest and lowest levels of the percent of teachers who regularly use technology for administrative purposes and percent of students with more than 21 days absent reversing through time.

When examining the relationship with school mean student misconduct scores in both the dataset for all schools without gifted and for elementary and middle schools with gifted, the interactions of the percent of teachers who regularly use technology for administrative purposes with time and time^2 were significant, but the intercept was not significant (see Figure 51). This meant that schools at all levels of the percent of teachers who regularly use technology for administrative purposes began the study with approximately the same level of student misconduct. The trends in both datasets were curvilinear with the relationship between the highest and lowest levels of the percent of teachers who regularly use technology for administrative purposes and mean school student misconduct reversing through time. Schools that began with two standard deviations above the mean in percent of teachers who regularly use technology for administrative purposes had the greatest decline in level of student misconduct in the first year and the least decline in the second year. This trend was reversed for schools that began the study with two standard deviations below the mean in percent of teachers who regularly use technology for administrative purposes. At the end of the study, the level of student misconduct for all schools had decreased.

This study cannot determine causality. It could be that the level of student attendance or the level of student misconduct impacts the degree that teachers regularly use technology for administrative purposes. Datasets of longer duration are needed for examining this relationship in order to understand these associations. Also, examination of the trends of the relationship between the percent of teachers who regularly use technology for administrative purposes and level of student attendance and level of student misconduct should be continued to better understand their shape and to determine if the equation for the model is cubic.

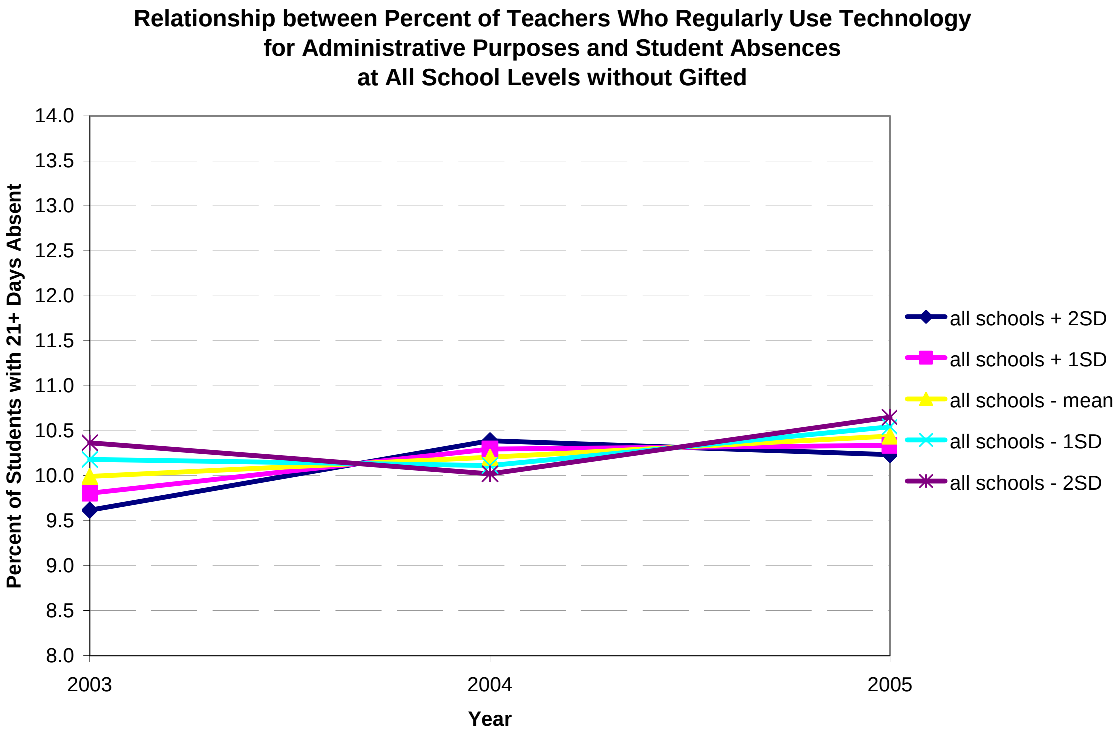

Figure 50. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Percent of Students Absent More than 21 Days in All Schools without Gifted.

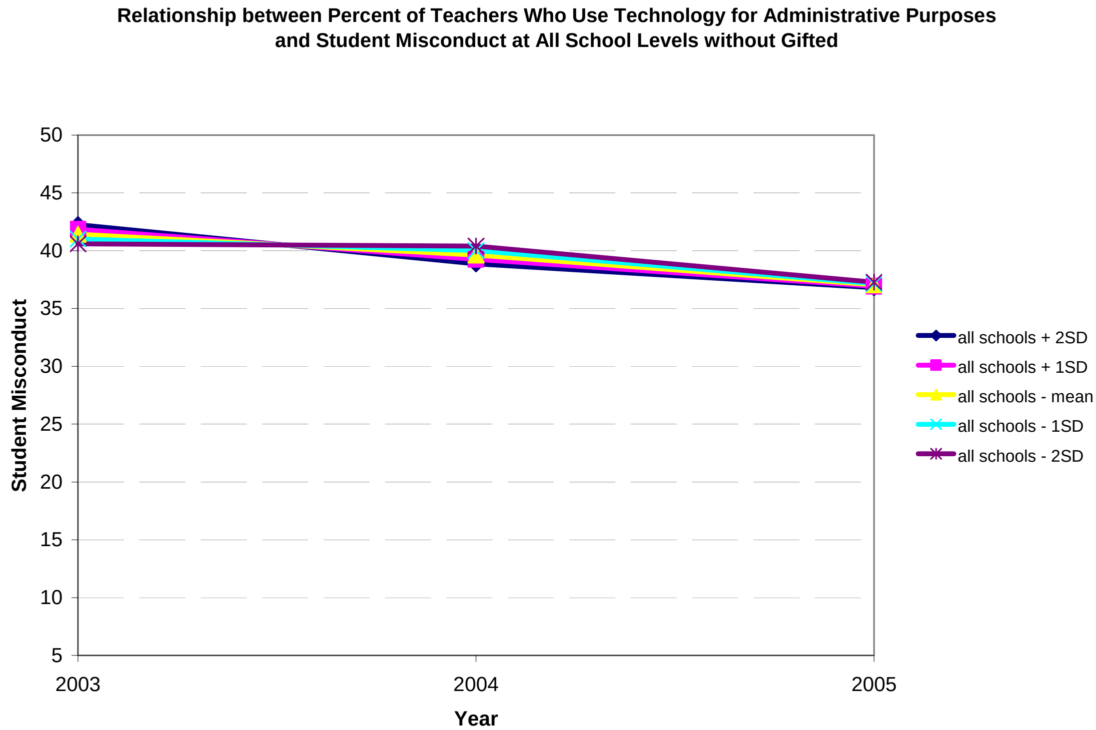

Figure 51. Relationship between Percent of Teachers Who Regularly Use Technology for Administrative Purposes and Student Misconduct at All School Levels (without Gifted)

Interestingly, this study found a significant positive relationship between U.S. magnet schools and percent of students with more than 21 days absent (see Figure 52). Being a U.S. magnet school had a significant relationship with the percent of students absent more than 21 days at the intercept and with the interaction with time and time^2. This resulted in U-shaped trends over time. Schools designated as a U.S. magnet school began the study in 2003-04 with 8.64% of students with more than 21 days absent, while those schools that were not U.S. magnet schools began with 6.71% of students with more than 21 days absent. The percent of students with more than 21 days absent in U.S. magnet schools at all school levels increased each year, while the percent of students with more than 21 days absent in schools that were not designated as a U.S. magnet school decreased each year. With the dataset that included elementary and middle schools with gifted, the relationship between U.S. magnet status with the intercept for percent of students with more than 21 days absent was not significant, but the relationships with time and time^2 were significant. This resulted in similar trends with the schools designated as U.S. magnet schools having a higher percent of students with more than 21 days absent.

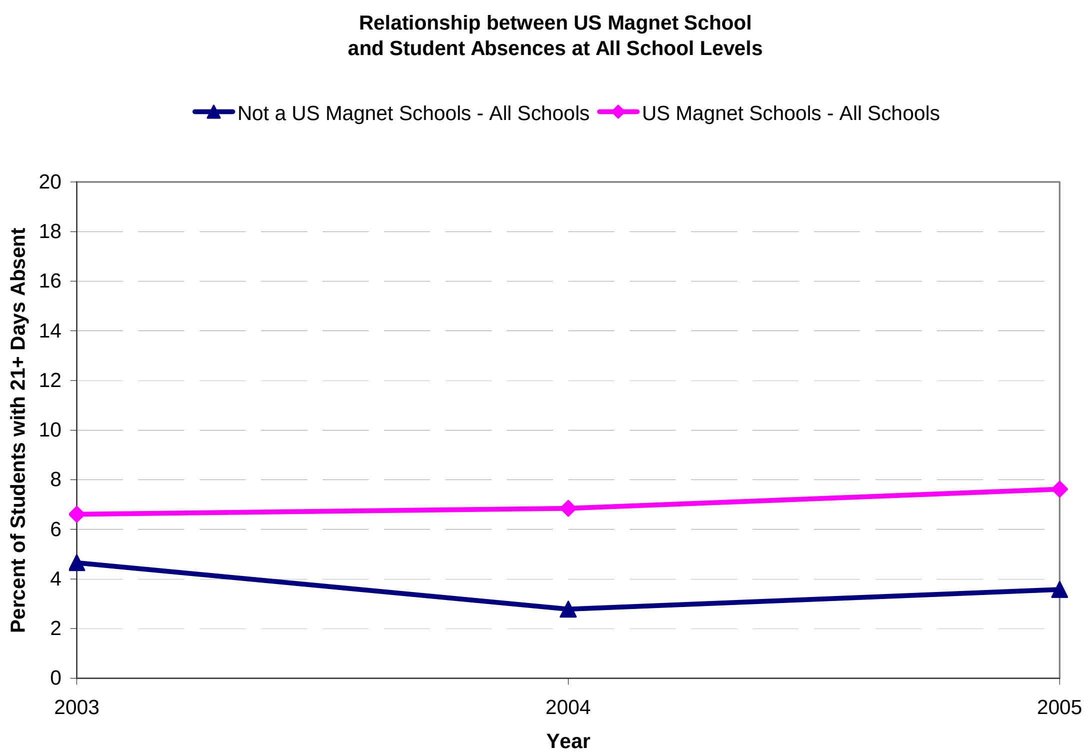

Figure 52. Relationship between U.S. Magnet School Status and Student Absences at All School Levels

However, when the relationship of percent of students with more than 21 days absent and U.S. technology magnet school was examined, only the intercept was significant. This meant that U.S. technology magnet schools were predicted to have begun the study with 3.24% less students with more than 21 days absent than schools without this designation. Over time the trends of schools with and without technology magnet status were parallel (see Figure 53).When the dataset that included elementary and middle schools with gifted was examined, again only the intercept was significant. This suggests that there may be a negative relationship between advanced levels of technology integration and student absences, or it may indicate that technology magnet schools attract more students who attend school. The sample set of U.S. technology magnet schools included only 8 schools over all three points in time.

These inconsistent patterns may be due to the dynamic nature of the interactions within the classroom. Students respond to learning activities and interactions that they have with their teachers by changing their behavior, and in turn, their teachers respond to these changes of their students by modifying and adapting their methods. The path between student behavioral outcomes and the methods teachers use to integrate technology may occur in both directions. Datasets of longer duration are needed to investigate the trends in these relationships to determine if meaningful and consistent relationships evolve.

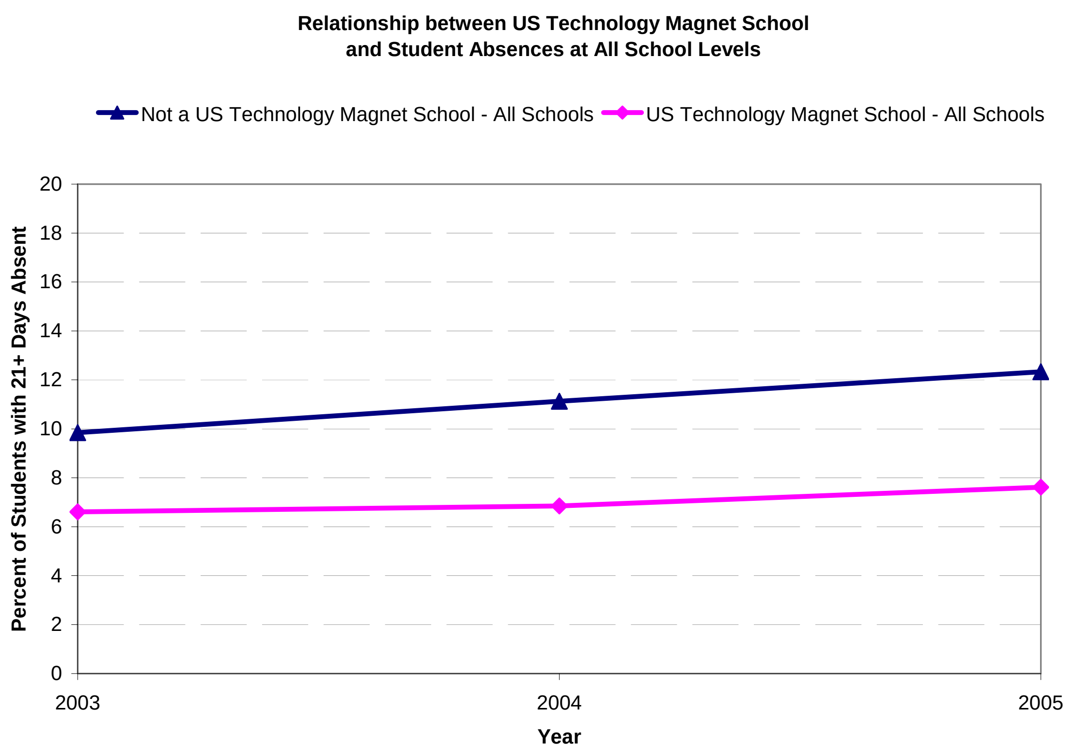

Figure 53. Relationship between US Technology Magnet School and Student Absences at All School Levels without Gifted

Variance Explained

A common result obtained from analyses across both achievement and behavioral outcomes was the change in variance explained. The variances for each achievement model estimated for all school levels without gifted and estimated for elementary and middle schools with gifted are depicted in Table 67, and each behavioral model are depicted in

Table 68. A large proportion of variance was explained when school level was added to the model as a predictor variable for each achievement outcome. This supports previous research that reports the importance of school level for influencing both instructional methods and student achievement (Barron et al., 2003; Benner et al., 2002; Hart et al., 2002; Wenglinsky, 1998, 2005). Future research must continue to look more closely at the specific methods of how technology is integrated into the instructional routines at each level of school.

The next model, which included the addition of demographics variables, resulted in a large, additional proportion of variance explained. This supports previous research that reports the importance of school level demographics (in particular economically disadvantaged status) in having relationships with the methods of instruction and use of technology within schools (Aldeman et al., 2002; Becker, 2001; DeBell & Chapman, 2006; Lubienski, 2006; National Center for Education Statistics, 2005; Parsad & Jones, 2005; Wenglinsky, 1998, 2004, 2005). Ongoing research is needed to monitor the equity of educational opportunities afforded to students in Florida's K-12 institutions.

The addition of positive learning environment variables into the models resulted in the next largest reduction in variance in the models. These models explained most of the available variance, supporting recommendations by Barron et al. (1999), Bloom (1968, 1976, 1984), Carroll (1963, 1989), Marzano, 2003, and Slavin (1987, 1994) that the learning environment is a critical component that impacts students' learning and achievement.

These reductions in variance by the moderating variables demonstrate the importance of including them in the model. However, because these variables and the technology indicators were correlated, the variance explained cannot be used as a measure of their relative importance (Pedhazur, 1997). The order for adding variables into the model determines the amount of variance explained by each model. If they had been added in a different order, the variance explained attributed to each model would have been different. Technology integration indicators were added last in order to determine which indicators were significant after controlling for all other variables. It is important that significant technology integration indicators were found.

Table 67.

Variance for Each Model for Achievement Outcomes by Dataset

Dataset and Model	Reading $\tau_{(0,0)}$	Reading σ^2	Math $\tau_{(0,0)}$	Math σ^2	Writing $\tau_{(0,0)}$	Writing σ^2
All Schools without Gifted						
Model 1: Unconditional Model	496.31	41.79	956.72	45.22	0.0678	0.0355
Model 2: Growth Model - Time as a Predictor	497.98	35.10	961.92	24.42	0.0771	0.0199
Model 2: Quadratic Model - Time^2 as a Predictor	498.62	32.55	962.73	21.19	0.0772	0.0199
Model 2: Polynomial Model -Time^3 as a Predictor	510.34	15.62	963.86	16.67	0.0777	0.0192
Model 3: School Level Model	175.28	10.93	229.53	14.21	0.0734	0.0184
Model 4: Demographics Model	40.55	10.17	70.90	13.74	0.0432	0.0183
Model 5: Learning Environment Model	32.14	10.25	57.03	13.88	0.0401	0.0183
Model 6: Technology Integration Model	32.00	10.19	56.24	13.80	0.0399	0.0182
Final Model 7: Significant Technology Integration Model	31.99	10.22	56.49	13.84	0.0399	0.0183
Elementary and Middle Schools with Gifted						
Model 1: Outcome Predicted by Average Outcome of All Schools in Florida	291.17	42.86	531.44	48.58	0.0669	0.0388
Model 4: Demographics Model	26.33	9.56	47.53	13.03	0.0429	0.0191
Model 5: Learning Environment Model	22.74	9.53	42.01	12.98	0.0416	0.0190
Model 6: Technology Integration Model	22.59	9.46	41.43	12.86	0.0414	0.0189
Final Model 7: Significant Technology Integration Model	22.68	9.48	41.59	12.92	none	

Table 68.

Variance by Each Model for Each Mediating Outcome by Dataset

Dataset and Model	Absences $\tau_{(0,0)}$	Absences σ^2	Misconduct $\tau_{(0,0)}$	Misconduct σ^2
All Schools without Gifted				
Model 1: Unconditional Model	29.34	9.08	417.19	67.87
Model 2: Growth Model - Time as a Predictor	23.94	7.42	509.77	43.53
Model 2: Quadratic Model - Time^2 as a Predictor	24.05	7.29	509.93	43.34
Model 3: School Level Model	16.22	7.18	262.07	43.29
Model 4: Demographics Model	10.57	7.46	193.62	43.60

Dataset and Model	Mediating Outcome and Variance			
	Absences		Misconduct	
	$\tau_{(0,0)}$	σ^2	$\tau_{(0,0)}$	σ^2
Model 5: Learning Environment Model	8.66	5.94	11.49	6.99
Model 6: Technology Integration Model	8.73	5.89	11.53	6.98
Final Model 7: Significant Technology Integration Model	8.71	5.88	11.52	6.96
Elementary and Middle Schools with Gifted				
Model 1: Outcome Predicted by Average Outcome of All Schools in Florida	19.11	8.03	357.88	60.26
Model 4: Demographics Model	4.30	6.24	157.77	35.04
Model 5: Learning Environment Model	3.74	5.03	6.09	6.07
Model 6: Technology Integration Model	3.76	5.02	6.05	6.09
Final Model 7: Significant Technology Integration Model	3.78	4.98	6.11	6.03

Instrumentation

At various stages of this study, issues related to the measurement of variables were a concern. The first issue was the ability to accurately count the number of computers that students have available and the locations for these computers. This is important information for policy makers, educators, and researchers to have in order to track changes in technology access, as well as for planning future initiatives.

Another issue was the reliability of the items used to measure factors of interest. The items in the Florida Innovates Survey need to be continuously evaluated and revised in order to provide accurate measures. This is especially needed for items that measure how students are using technology and how frequently they use the technology.

The Florida Innovates Survey is one method used to measure technology integration. Additional measures are needed in order to collect more detailed information about the integration of technology in the instructional routines within the schools. Teachers and students should provide information about how and how often they are using technology in order to make meaningful decisions about how technology integration is related to achievement. Finally, in order to connect technology integration with student achievement and student behavioral outcomes, student level data is needed.

Conclusions

According to complexity theory, information must be exchanged among the elements in an organization in order to maintain organization health (Caldwell, 2005; McElroy, 2000; Morrison, 2002). The exchange and availability of this information is essential for the organization to be able to adapt and survive (O'Day, 2002; Wheatley, 1999). Education is a complex phenomenon; therefore, multiple measurements over extended periods of time are required (Slavin, 1997, 1994). Spanning a four-year period, this study examined the relationship of the integration of technology with mean school achievement when controlling for moderating variables in Florida public elementary, middle, and high schools. Noteworthy, the variance explained by the addition of moderating variables demonstrate how important school level, demographics, and learning environment variables are in the complex model of school achievement.

When applied to the learning or adaptation of the school organization, the Carroll Model of School Learning (1963, 1989) and Bloom's Theory of School Learning (1968; 1976) explain why the amount of time required for observable change or opportunity to learn is critical. In order to change or increase achievement levels, the school organization must have an opportunity to change that matches the time it needs to change. During the change process the individual agents must adjust to feedback and improve their performance to support the school improvement plan (O'Day, 2002; Wheatley, 1999). Observable improvements in achievement at the school level are expected to be small because they are measured by the mean of all the changes in an outcome for all the students in the school. The small changes observed in mean school achievement over the span of this study, confirm that time is a critical factor for both learning of individuals (Berliner, 1990; Bloom, 1984; Carroll, 1963, 1989; Marzano, 2003) and school change (Borman, 2003; Weick & Quinn, 1999).

Bloom (1968; 1976) attempted to delineate the amount of variance for achievement that is explained by each of the five factors in the Carroll Model of School Learning by using correlations derived from research. He reported the following correlations between achievement and factors in his Theory of School Learning when the time allotted to learning is optimal: cognitive entry behaviors, which include Carroll's aptitude for learning and ability to understand (+.70 or one half of the variance); quality of instruction (+.50 or one fourth of the variance); and perseverance or affective entry behaviors (+.50 or one fourth of the variance). The factor that is under the control of the school is the quality of instruction or one fourth of the variance of school level achievement. Quality of instruction is complex that includes many variables such as the expertise of the teacher, the positive learning environment, and the many variables involved in the implementation of the curriculum and daily lesson plans. The integration of technology is only one of these many factors. Because all of these factors or variables that impact the student learning within the classroom environment are correlated, it is difficult to extract their unique contribution to the equation. As a result, the expected variance explained by the integration of technology, as one of the variables within the quality of instruction component of the school learning equation should be very small. Indeed, after controlling for all other variables the small variance explained by the addition of technology integration variables, demonstrate this phenomenon. It is important that after controlling for all the other moderating variables, technology integration did have a significant relationship with mean school achievement.

Moreover, this study demonstrates that the schools' responses to technology integration as an agent of change have been episodic and non-linear (Caldwell, 2005; Jacobson & Wilensky, 2006). The impact of change agents, such as new educational programs or technology initiatives, takes time to become apparent. The positive results from comprehensive school reform occurred after the fifth year (Borman et al., 2002). In addition, the inconsistencies in the significant findings about the relationship between technology integration variables and the outcomes studied support the need for more time to establish trends and patterns. Therefore, continued analyses of the longitudinal trends for Florida schools in the relationship between technology integration variables and school achievement, while controlling for moderating variables, are recommended.

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Appendix A: IRB Application for Exempt Certification

USF
UNIVERSITY OF
SOUTH FLORIDA

May 22, 2007

Tina N. Hohlfeld
College of Education, Secondary Education
EDU 162

RE: **Exempt Certification** for IRB#: 105794 I
Title: *The Relationship of Technology Integration with Achievement Gains*

Dear Ms. Hohlfeld:

On May 18, 2007, the Institutional Review Board (IRB) determined that your research **meets USF requirements and Federal Exemption criteria 4, existing data, documents, records, pathological specimens, or diagnostic specimens publicly available or recorded without identifiers.** It is your responsibility to ensure that this research is conducted in a manner reported in your application and consistent with the ethical principles outlined in the Belmont Report and with USF IRB policies and procedures.

Please note that changes to this protocol may disqualify it from exempt status. It is your responsibility to notify the IRB prior to implementing any changes.

The Division of Research Integrity and Compliance will hold your exemption application for a period of five years from the date of this letter or for three years after a Final Progress Report is received. If you wish to continue this protocol beyond those periods, you will need to submit an Exemption Certification Request form at least 30 days before this exempt certification ends. If a Final Progress Report has not been received, the IRB will send you a reminder notice prior to end of the five year period; therefore, it is important that you keep your contact information current with the IRB Office. Should you complete this study prior to the end of the five-year period, you must submit a Final IRB Progress Report for review.

Please reference the above IRB protocol number in all correspondence to the IRB c/o the Division of Research Integrity and Compliance. In addition, we have enclosed an Institutional Review Board (IRB) Quick Reference Guide providing guidelines and resources to assist you in meeting your responsibilities when conducting human subjects research. **Please read this guide carefully.**

OFFICE OF RESEARCH • DIVISION OF RESEARCH INTEGRITY & COMPLIANCE
INSTITUTIONAL REVIEW BOARDS, FWA NO. 00001669
University of South Florida • 12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-4799
(813) 974-5638 • Fax (813) 974-5618

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-9343.

Sincerely,

Paul G. Stiles, J.D., Ph.D., Chairperson
USF Institutional Review Board

Enclosures: IRB Quick Reference Guide

Cc: Various B. Menzel, USF IRB Professional Staff
Ann E. Barron, PhD

SB-EXEMPT-0602

USF
UNIVERSITY OF
SOUTH FLORIDA

June 20, 2007

Tina N. Hohlfeld, M.Ed.
College of Education, Secondary Education
EDU 162

RE: **Exempt Certification** Modification Request
IRB#: 105794
Title: *The Relationship of Techology Integration with Achievement Gains*

Dear Ms. Hohlfeld:

On May 18, 2007, it was determined that your project referenced above meets the federal criteria, which exempts it from further IRB oversight.

You have requested the following changes to your research:

1. Change in Study Title: to 'The Relationship between Technology Integration and Achievement Using Multi-Level Modeling'
2, Change in Procedures: adding another year of data to the trend analysis.

On June 20, 2007, the IRB Chairperson reviewed your request and determined this change does not impact the study's eligibility for exemption. The study continues to meet Exempt Criteria. Any grants supporting this project must be submitted to the Institutional Review Board for review.

Please note that future changes to this protocol may disqualify it from its current exempt status. It is your responsibility to notify the IRB prior to implementing any changes.

Please reference the above IRB protocol number in all correspondence to the IRB c/o the Division of Research Integrity and Compliance. It is your responsibility to ensure that this research is conducted in a manner consistent with the ethical principles outlined in the Belmont Report and with USF IRB policies and procedures.

Office of Research • Division of Research Integrity & Compliance
Institutional Review Boards, FWA No. 00001669
University of South Florida • 12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-4799
(813) 974-5638 • Fax (813) 974-5618

Appendix B: Items from STAR Survey

Side-by-side Comparison

2003-04, 2004-05, 2005-06, 2006-07

Appendix B: Items from STAR Survey

Common Items on STARS Surveys

2003-2004	2004-2005	2005-2006	2006-2007
Infrastructure and Support			
3B. Our school-based technical support person is ○ a faculty member with other responsibilities (e. g., teachers, media specialist). ○ dedicated part of the day to tech support at our school. ○ dedicated all day to tech support at our school. ○ dedicated all day to tech support at our school with help as needed (additional staff or faculty).	3B. Our school-based technical support person is ○ a faculty member with other responsibilities (e.g., teachers, media specialist). ○ dedicated part of the day to tech support at our school. ○ dedicated all day to tech support at our school. ○ dedicated all day to tech support at our school with help as needed (additional staff or faculty).	23. Our school-based technical support is provided by: ○ a faculty member with other responsibilities (e. g., teachers, media specialist). ○ dedicated part of the day to tech support at our school. ○ dedicated all day to tech support at our school. ○ dedicated all day to tech support at our school with help as needed (additional staff or faculty). ○ students ○ No school-based support.	24. Our school-based technical support is provided by: ○ a faculty member with other responsibilities (e. g., teachers, library media specialists). ○ personnel who are dedicated part of the day to tech support at our school. ○ personnel who are dedicated all day to tech support at our school. ○ personnel who are dedicated all day to tech support at our school with help as needed (additional staff or faculty). ○ students ○ No school-based support.
3E. Our school-based instructional technology specialist is ○ a faculty member with other responsibilities (e. g., teachers, media specialist) ○ dedicated part of the day to instructional technology support at our school ○ dedicated all day to instructional support at our school ○ dedicated all day to instructional technology support at our school with help as needed (additional staff or faculty)	3E. Our school-based instructional technology specialist is ○ a faculty member with other responsibilities (e.g., teachers, media specialist) ○ dedicated part of the day to instructional technology support at our school ○ dedicated all day to instructional support at our school ○ dedicated all day to instructional technology support at our school with help as needed (additional staff or faculty assistance)	26. Our school-based instructional technology specialist is: ○ a faculty member with other responsibilities. ○ dedicated part of the day to instructional technology support at our school. ○ dedicated all day to instructional support at our school. ○ dedicated all day to instructional technology support at our school with help as needed (additional staff or faculty assistance). ○ We have no school-based instructional technology specialist .	27. Our school-based instructional technology specialist is: ○ a faculty member with other responsibilities. ○ dedicated part of the day to instructional technology support at our school. ○ dedicated all day to instructional support at our school. ○ dedicated all day to instructional technology support at our school with help as needed (additional staff or faculty assistance). ○ We have no school-based instructional technology specialist.

Appendix B: Items from STAR Survey (Continued)

36. What percentage of student computers at your school have each of the following software types available on them?

	0%	1-24%	25-49%	50-74%	75-100%
concept mapping (e.g. Inspiration)					
graphics (any paint or draw program)					
multimedia authoring (e.g. HyperStudio)					
presentation software (e.g. PowerPoint)					
spreadsheet					
video editing					
web authoring (e.g. Dreamweaver)					
basic word processing (e.g. Wordpad, Notepad, TextEdit)					
robust word processing (e.g. Word, Works, AppleWorks)					

22. What percentage of student computers at your school has each of the following software types available on them?

	0%	1-24%	25-49%	50-74%	75-100%
concept mapping (e.g. Inspiration)					
graphics (any paint or draw program)					
multimedia authoring (e.g. HyperStudio)					
presentation software (e.g. PowerPoint)					
spreadsheet					
video editing					
web authoring (e.g. Dreamweaver)					
basic word processing (e.g. Wordpad, Notepad, TextEdit)					
robust word processing (e.g. Word, Works, AppleWorks)					

16. What percentage of student computers at your school have the following software types available on them?

	0%	1-24%	25-49%	50-74%	75-100%
Concept mapping (e.g. Inspiration)					
Graphics (any paint or draw program)					
Multimedia authoring (e.g. eZedia, iMovie, HyperStudio)					
Presentation software (e.g. PowerPoint, Keynote)					
Spreadsheet					
Video editing					
Web authoring (e.g. Dreamweaver)					
Basic word processing (e.g. Wordpad, Notepad, TextEdit)					
Robust word processing (e.g. Word, Works, AppleWorks)					

16. What percentage of **student computers** at your school have the following software types available on them?

	0%	1-24%	25-49%	50-74%	75-100%
Concept mapping (e.g. Inspiration)					
Graphics (any paint or draw program)					
Multimedia authoring (e.g. eZedia, iMovie, HyperStudio)					
Presentation software (e.g. PowerPoint, Keynote)					
Spreadsheet					
Video editing					
Web authoring (e.g. Dreamweaver)					
Basic word processing (e.g. Wordpad, Notepad, TextEdit)					
Robust word processing (e.g. Word, Works, AppleWorks)					

37. What percentage of student computers at your school have each of the following software types available on them?

	0%	1-24%	25-49%	50-74%	75-100%
FCAT prep tools	○	○	○	○	○
Other test prep tools	○	○	○	○	○
Integrated Learning Systems	○	○	○	○	○
Content-specific skills practice/tutorials	○	○	○	○	○
Content-specific simulation	○	○	○	○	○
Other content-specific resources	○	○	○	○	○
General Reference tools	○	○	○	○	○

23. What percentage of student computers at your school have each of the following software types available on them?

	0%	1-24%	25-49%	50-74%	75-100%
FCAT prep tools	○	○	○	○	○
Other test prep tools	○	○	○	○	○
Integrated Learning Systems	○	○	○	○	○
Content-specific skills practice/tutorials	○	○	○	○	○
Content-specific simulation	○	○	○	○	○
Other content-specific resources	○	○	○	○	○
General Reference tools	○	○	○	○	○

17. What percentage of student computers at your school have the following software types available to them?

	0%	1-24%	25-49%	50-74%	75-100%
FCAT Explorer	○	○	○	○	○
Other test prep tools	○	○	○	○	○
Integrated Learning Systems (e.g., Successmaker, Read 180)	○	○	○	○	○
Content-specific skills practice/ tutorials (e.g., Math Blaster)	○	○	○	○	○
Content-specific simulation (e.g., Frog Dissector)	○	○	○	○	○
Other content-specific resources	○	○	○	○	○
General Reference tools (e.g., encyclopedias, databases)	○	○	○	○	○

17. What percentage of **student computers** at your school have the following software types available to them?

	0%	1-24%	25-49%	50-74%	75-100%
FCAT Explorer	○	○	○	○	○
Other test prep tools	○	○	○	○	○
Integrated Learning Systems (e.g., Successmaker, Read 180)	○	○	○	○	○
Content-specific skills practice/ tutorials (e.g., Math Blaster)	○	○	○	○	○
Content-specific simulation (e.g., Frog Dissector)	○	○	○	○	○
Other content-specific resources	○	○	○	○	○
General Reference tools (e.g., encyclopedias, databases)	○	○	○	○	○

Appendix B: Items from STAR Survey (Continued)

Infrastructure and Support

32. How dependable* is your internet connection? ◯ very dependable ◯ dependable ◯ somewhat dependable ◯ not very dependable ◯ not at all dependable * Dependable - refers to how often your network connection is available ("uptime").	19. How dependable is your internet connection? ◯ very dependable (95%-100% uptime) ◯ dependable (90%-94% uptime) ◯ somewhat dependable (85%-89% uptime) ◯ not very dependable (75%-84% uptime) ◯ not at all dependable (Less than 75% uptime)	34. How dependable is the internet connection at your school? ◯ Very dependable (95%-100% uptime) ◯ Dependable (90%-94% uptime) ◯ Somewhat dependable (85%-89% uptime) ◯ Not very dependable (75%-84% uptime) ◯ Not at all dependable (Less than 75% uptime)	31. How dependable is the internet connection at your school? ◯ Very dependable (95%-100% uptime) ◯ Dependable (90%-94% uptime) ◯ Somewhat dependable (85%-89% uptime) ◯ Not very dependable (75%-84% uptime) ◯ Not at all dependable (Less than 75% uptime)
33. How frequently do you experience delays when using the internet for instruction? ◯ never ◯ 1-24% of the time ◯ 25-49% of the time ◯ 50-74% of the time ◯ 75-10% of the time	20. How frequently do you experience delays when using the internet for instruction? ◯ never ◯ 1-24% of the time ◯ 25-49% of the time ◯ 50-74% of the time ◯ 75-100% of the time	35. How often do you experience delays when using the internet at your school? ◯ 75%-100% ◯ 50-75% ◯ 25-49% ◯ 1-24% ◯ We do not experience delays when using the internet at school.	32. How often do you experience delays when using the internet at your school? ◯ 75%-100% ◯ 50-75% ◯ 25-49% ◯ 1-24% ◯ We do not experience delays when using the internet at school.
4. What is the average response time for technical support at your school? ◯ less than 4 hours ◯ 4-8 hours ◯ 9-24 hours ◯ greater than 24 hours ◯ no technical support	2. What is the average response time for technical support at your school? ◯ less than 4 hours ◯ 4-8 hours ◯ 9-24 hours ◯ greater than 24 hours ◯ no technical support	37. What is the average length of time at your school for a technical issue to be resolved? ◯ Less than 4 hours ◯ 4-8 hours ◯ 9-24 hours ◯ Greater than 24 hours ◯ No technical support	33. What is the average length of time at your school for a technical issue to be resolved? ◯ Less than 4 hours ◯ 4-8 hours ◯ 9-24 hours ◯ Greater than 24 hours ◯ No technical support

Appendix B: Items from STAR Survey (Continued)

Digital Learning Environment

38. Approximately what percentage of your teachers regularly use technology in the following ways?

	0%	1-24%	25-49%	50-74%	75-100%
administrative tasks (lesson plansgrade book, reports, attendance)	○	○	○	○	○
delivery of lessons	○	○	○	○	○
desktop video production	○	○	○	○	○
email to other school or district staff	○	○	○	○	○
email to students or parents	○	○	○	○	○
presentations	○	○	○	○	○
research	○	○	○	○	○
review of student assessmentinformation (e.g., FCAT scores)	○	○	○	○	○
video conferencing	○	○	○	○	○
webpage publishing	○	○	○	○	○

1. Approximately what percentage of your teachers regularly uses technology in the following ways?

	0%	1-24%	25-49%	50-74%	75-100%
administrative tasks (lesson plans, grade book, reports, attendance)	○	○	○	○	○
analysis of student assessment information (e.g., FCAT scores)	○	○	○	○	○
delivery of lessons	○	○	○	○	○
desktop video production	○	○	○	○	○
email to other school or district staff	○	○	○	○	○
email to students or parents	○	○	○	○	○
presentations	○	○	○	○	○
research	○	○	○	○	○
video conferencing	○	○	○	○	○
webpage publishing	○	○	○	○	○

44. Approximately what percentage of your teachers regularly uses technology in the following ways?

	0%	1-24%	25-49%	50-74%	75-100%
Administrative tasks (lesson plans, grade book, reports, attendance)	○	○	○	○	○
Delivery of lessons	○	○	○	○	○
Desktop video production	○	○	○	○	○
Email to other school or district staff	○	○	○	○	○
Email to students or parents	○	○	○	○	○
Presentations	○	○	○	○	○
Research	○	○	○	○	○
Analysis of student assessment information (e.g., FCAT scores)	○	○	○	○	○
Video conferencing	○	○	○	○	○
Webpage publishing	○	○	○	○	○

40. Approximately what percentage of your teachers regularly use technology in the following ways?

	0%	1-24%	25-49%	50-74%	75-100%
Administrative tasks (lesson plans, grade book, reports, attendance)	○	○	○	○	○
Delivery of lessons	○	○	○	○	○
Desktop video production	○	○	○	○	○
Email to other school or district staff	○	○	○	○	○
Email to students or parents	○	○	○	○	○
Presentations	○	○	○	○	○
Research	○	○	○	○	○
Analysis of student assessment information (e.g., FCAT scores)	○	○	○	○	○
Video conferencing	○	○	○	○	○
Webpage publishing	○	○	○	○	○

53. Please rank the following types of software according to the frequency of their use at your school.

	Very Often	Often	Sometimes	Not very often	Never
Drill and practice software	○	○	○	○	○
Integrated Learning Systems (ILS; comprehensive software with assessment, diagnostics, and computer-based curriculum)	○	○	○	○	○
Multimedia (e. g., paint/draw, desktop video, sound-editing)	○	○	○	○	○
Simulation software (e.g. Oregon Trail, SimCity)	○	○	○	○	○
Tool-based software (e.g. graphic organizers, word processors, preadsheets, databases)	○	○	○	○	○

7. How often do **students** at your school use the following types of software?

	Not at all	Once a month or less	Once a week	Several times a week	Every day
Drill and practice software	○	○	○	○	○
Integrated Learning Systems (ILS; comprehensive software with assessment, diagnostics, and computer-based curriculum)	○	○	○	○	○
Multimedia (e.g., paint/ draw, desktop video, sound-editing)	○	○	○	○	
Simulation software	○	○	○	○	○
Tool-based software (e.g. graphic organizers, word processors, preadsheets, databases)	○	○	○	○	○

43. How often do **students** at your school use the following types of software?

	Not at all	Once a month	Once a week	Several times a week	Every day
Drill and practice software	○	○	○	○	○
Integrated Learning Systems (ILS; comprehensive software with assessment, diagnostics, and computer-based curriculum)	○	○	○	○	○
Multimedia (e.g., paint/ draw, desktop video, sound-editing)	○	○	○	○	○
Simulation software (e.g., Oregon Trail, SimCity)	○	○	○	○	○
Tool-based software (e.g. graphic organizers, word processors, spreadsheets, databases)	○	○	○	○	○
Research (Internet, encyclopedias)	○	○	○	○	○
Presentation (PowerPoint, Keynote)	○	○	○	○	○

39. How often do **students** at your school use the following types of software?

	Not at all	Once a month	Once a week	Several times a week	Every day
Drill and practice software	○	○	○	○	○
Integrated Learning Systems (ILS; comprehensive software with assessment, diagnostics, and computer-based curriculum)	○	○	○	○	○
Multimedia (e.g., paint/ draw, desktop video, sound-editing)	○	○	○	○	○
Simulation software (e.g., Oregon Trail, SimCity)	○	○	○	○	○
Tool-based software (e.g. graphic organizers, word processors, spreadsheets, databases)	○	○	○	○	○
Research (Internet, encyclopedias)	○	○	○	○	○
Presentation (PowerPoint, Keynote)	○	○	○	○	○

Appendix C: Data Preparation Procedures

Merging Data Files

First, the Master School Identification Files (MSID) for each academic year were entered into the dataset. They were downloaded from the FLDOE website in MS Excel format or text format. The fields that were not of interest to the study were deleted with MS Excel. The data were searched for blank cells or cells with only a space in them, and these were replaced with a dot designating missing data. There were no missing schools, county and school identification codes or designated school levels. All school levels that were not elementary, middle, high, or combination schools were changed to the designation "other" school level. These cleaned files were saved in comma delimited text format so they could be imported into SAS 9.1. The number of schools and the primary assignment for accountability by the FLDOE for their school level for each year are listed in Table C 1.

In 2005-06, the FLDOE changed the way that schools were classified. Thus, the number of high schools almost doubled, while the number of elementary, middle, and combination schools also increased. At the same time the proportion of the other types of schools decreased by more than half. Since the focus of the study was on public elementary, middle, and high schools that primarily served regular education students, additional criteria were used to classify the schools. Therefore, the schools' service setting, primary function, and designation as a charter school were examined for the 2005-06 and 2006-07 school years. All schools that were not classified as having regular education as their primary service function (e.g., vocational/technical education, adult education, or alternative education) were changed to other types, and all schools that were designated as charter schools were changed to other types. Schools that had a service setting designated as virtual or university lab school were changed to other types.

Magnet school information was not available in 2003-04. In 2004-05, magnet programs and schools were listed, but their specialty was not. In 2005-06 and 2006-07, magnet schools with a specialty in technology were listed (see Table C 1).

In order to fill in missing information about magnet schools, a request for a list of magnet schools in Florida that had received grants in FY 2001 and FY 2004 was made to Steve Brockhouse, the contact person for magnet school assistance at the U.S. Department of Education (USDOE). Abstracts of these grant applications were obtained, and the list of funded magnet schools extracted. The school code for each of these schools was obtained from the MSID files. Magnet schools are only funded once by the USDOE; the district must support the continuation of these programs, because the purpose of the magnet grants is to provide seed money for school districts to equip a school with the updated infrastructure necessary to make it an attractive alternative for school choice selection in order to expedite diversifying the student population. It was assumed that technology infrastructure would be an important component for all magnet schools with all themes and foci, and after the building had been equipped with the latest technology, the school would continue to integrate technology into the curriculum. An additional field was created to designate schools that had received one of these grants for the year it was received and for every year after that date. A separate file was created for each year, so that these magnet schools were merged with the MSID files for each year. Table C 1 includes the number of USDOE funded magnet schools in each school year.

Table C 1.

Master School Identification Files: Schools by Type for each School Year

	2003-04		2004-05		2005-06		2006-07	
School Level	N	%	N	%	N	%	N	%
Combination	70	1.8	79	1.93	102	2.43	113	2.71
Elementary	1683	43.2	1688	41.23	1712	40.83	1719	41.29
High	429	11.01	431	10.53	460	10.97	461	11.07
Middle	478	12.27	487	11.9	499	11.9	510	12.25
Other Types	1236	31.72	1409	34.42	1420	33.87	1360	32.67
Magnet Program	--	--	87	2.13	142	3.39	161	3.87
Magnet School	--	--	71	1.73	127	3.03	135	3.24
Technology Magnet	--	--	--	--	21	0.5	22	0.53
Total Magnet Schools			158	3.86	269	6.42	296	7.11
Magnet Schools funded by USDOE	28	0.72	58	1.42	60	1.43	60	1.44
Technology Magnets (USDOE)	8	0.21	17	0.42	17	0.41	17	0.41
Total EL, MS, & HS	2590	66.48	1409	34.42	3343	79.73	2690	64.62
Total All Schools	3896	100	4094	100	4193	100	4163	100

The next set of files brought into the dataset were the school level mean FCAT NRT scores for reading, mathematics, and writing. These scores were used to measure the outcome variables in the study. The files were obtained for each of the four school years from the FLDOE at the Assessment and School Performance: Florida Comprehensive Assessment Test website and then merged with the MSID files to determine the number of schools at each school level with FCAT scores. The number of schools by school level that participated in the FCAT for Mathematics, Reading, and Writing each year are depicted in Table C 2. Over 3000 schools participated in the FCAT Mathematics, Reading, and Writing assessment each year. Less than one percent of the schools were missing a school level, except in 2006-07 for Writing FCAT that had just over one percent of the schools with no designated school level.

When the FCAT reading scores for the 2006-07 school year were released, Florida announced that there had been a problem with the score results reported for the Reading FCAT for 3rd grade for the 2005-06 school year. Since this year and grade had been included in the analysis, a new sample was created excluding the mean FCAT scores for third grade of elementary schools. Thus, the mean FCAT reading scores for elementary schools were based on the mean school scores from fourth and fifth grades. The number of schools did not change, just the number of grades used to create the mean score.

Table C 2.

Schools Participating in the FCAT each Year

	2003-04		2004-05		2005-06		2006-07	
School Levels	N	%	N	%	N	%	N	%
				Mathematics				
Missing	12	0.39	8	0.26	4	0.12	5	0.15
Combination	67	2.18	76	2.43	89	2.77	103	3.15
Elementary	1612	52.44	1622	51.92	1638	51.04	1649	50.46
High	406	13.21	406	13	421	13.12	423	12.94
Middle	477	15.52	483	15.46	496	15.46	508	15.54
Other Types	500	16.27	529	16.93	561	17.48	580	17.75
Total Schools	3074	100	3124	100	3209	100	3268	100
				Reading				
Missing	9	0.29	8	0.26	4	0.13	5	0.15
Combination	67	2.2	76	2.45	89	2.79	103	3.17
Elementary	1601	52.46	1609	51.89	1628	51.07	1638	50.48
High	406	13.3	406	13.09	421	13.21	423	13.04
Middle	477	15.63	483	15.58	496	15.56	508	15.65

School Levels	2003-04 N	2003-04 %	2004-05 N	2004-05 %	2005-06 N	2005-06 %	2006-07 N	2006-07 %
Other Types	492	16.12	519	16.74	550	17.25	568	17.5
Total Schools	3052	100	3101	100	3188	100	3245	100
				Writing				
Missing	9	0.3	6	0.19	8	0.25	47	1.45
Combination	67	2.21	75	2.42	90	2.83	104	3.2
Elementary	1600	52.81	1615	52.16	1628	51.23	1619	49.86
High	403	13.3	405	13.08	419	13.18	423	13.03
Middle	474	15.64	484	15.63	495	15.58	496	15.28
Other Types	477	15.74	511	16.51	538	16.93	558	17.19
Total Schools	3030	100	3096	100	3178	100	3247	100

The number of missing reported mean school level FCAT test scores for each school level is depicted in Table C 3. For all years, just over four percent of all schools were missing their mean school level FCAT Mathematics and Reading test scores. The proportion of missing scores for FCAT Writing was approximately five percent for 2003-04 to 2005-06 school years and just over five percent in 2006-07. Among elementary, middle, and high schools, high schools had the highest proportion of missing FCAT scores, with the highest proportion of missing school level FCAT scores at just over 2.5% in 2006-07.

Table C 3.

Missing Mean School Level FCAT Test Scores for Mathematics by School Level and Year

School Levels	2003-04 N	2003-04 %	2004-05 N	2004-05 %	2005-06 N	2005-06 %	2006-07 N	2006-07 %
				Mathematics				
Missing	8	66.67	2	25	0	0	0	0
Combination	2	2.99	4	5.26	10	11.24	10	9.71
Elementary	2	0.12	2	0.12	3	0.18	2	0.12
High	6	1.48	6	1.48	8	1.9	11	2.6
Middle	1	0.21	1	0.21	0	0	0	0
Other Types	111	22.2	117	22.12	110	19.61	115	19.83
Total Schools	130	4.23	132	4.23	131	4.08	138	4.22
				Reading				
Missing	5	55.56	2	25	0	0	0	0
Combination	2	2.99	4	5.26	10	11.24	10	9.71
Elementary	3	0.19	2	0.12	3	0.18	1	0.06
High	6	1.48	6	1.48	8	1.9	11	2.6
Middle	1	0.21	1	0.21	0	0	0	0

School Levels	2003-04 N	2003-04 %	2004-05 N	2004-05 %	2005-06 N	2005-06 %	2006-07 N	2006-07 %
Other Types	111	22.56	123	23.7	112	20.36	114	20.07
Total Schools	128	4.19	138	4.45	133	4.17	136	4.19
				Writing				
Missing	6	66.67	2	33.33	2	25	3	6.38
Combination	2	2.99	3	4	12	13.33	13	12.5
Elementary	5	0.31	4	0.25	4	0.25	1	0.06
High	6	1.49	7	1.73	11	2.63	11	2.6
Middle	1	0.21	0	0	0	0	1	0.2
Other Types	131	27.46	126	24.66	129	23.98	142	25.45
Total Schools	151	4.98	142	4.59	158	4.97	171	5.27

Note: Percents are given for the proportion of schools with missing scores relative to all schools in the same category

Next, the Florida School Indicators Reports (FSIR) files for each school for each year, which were obtained on-line from the FLDOE, were merged. The FSIR contained multiple records for some schools (158 in 2003-04, 194 in 2004-05, and 291 in 2005-06). All of these schools contained combinations of grade levels (e.g., elementary and middle or elementary, middle and high school). The numbers of students and the proportions of students in the various categories were different; however, the total number of staff and the proportion of instructional staff were the same. To condense these records so there would be only one per school, the means of all variables with proportions were obtained, except for variables with counts that were different for each entry (i.e., the number of students and the number of crimes) the sum was used. The school level designated in the MSID was used to reclassify each school for analysis. Thus some schools were not reclassified as combination schools, but as the specific school level used in the MSID. The changes in the number of schools included in these data sets for each year as the records for each school were condensed and then merged with the MSID are delineated in Table C 4.

The 2005-06 data were released as this study was being conducted; however, the 2006-07 report was not available. In 2003-04 the original 3037 entries condensed to 2864 schools. After the MSID file was merged and the school level identification was used to classify schools the number of schools in each classification changed. For example the 1825 original entries for elementary schools in 2003-04 dropped to 1713 schools after being condensed to one record per school, and then after being classified by the school level information in the MSID file, the number dropped to 1610 schools. The reclassification to Combination or Other Types involved 1013 schools. In another example, High Schools in 2003-04 dropped from 521 entries to 460 schools and then dropped to 412 schools when 48 schools' classification was changed to Combination or Other Types. The change designated as Other Types included the following classifications: Adult, Charter Schools, Department of Juvenile Justice Division, Other Types, Special Education Schools, and Vocational/ Technical Schools. Combination Schools provided instruction to students in grades included in both elementary and secondary levels (Bureau of Education Information and Accountability Services, 2007).

Table C 4.

Number of Schools by School Level included in the FSIR and Merged with the MSID by Year

School Level	All Entries N	All Entries %	By School ID N	By School ID %	With MSID N	With MSID %
		2003-04				
Elementary	1825	60.09	1713	59.81	1610	56.22
High	521	17.16	460	16.06	412	14.39
Middle	691	22.75	533	18.61	474	16.55
Combination					58	2.03
Other Types					310	10.82
Double Entry			143	4.99		
Triple Entry			15	0.52		
Total Multiple Entries	158	5.51				
Total Entries	3037	100				
Total Schools			2864	100	2864	100
		2004-05				
Elementary	1883	60.66	1767	60.72	1640	56.36
High	520	16.75	442	15.19	425	14.6
Middle	701	22.58	529	18.18	483	16.6
Combination					74	2.54
Other Types					288	9.9
Double Entry			150	5.15		
Triple Entry			22	0.76		
Total Multiple Entries	194	6.39				
Total Entries	3037	100				
Total Schools			2910	100	2910	100

Appendix C: Data Preparation Procedures (Continued)

School Level	All Entries N	All Entries %	By School ID N	By School ID %	With MSID N	With MSID %
		2005-06				
Elementary	1728	52.99	1728	58.18	1660	55.89
High	438	13.43	438	14.75	436	14.68
Middle	545	16.71	545	18.35	496	16.7
Combination					88	2.96
Other Types	550	16.87			290	9.76
Double Entry			227	7.64		
Triple Entry			32	1.08		
Total Multiple Entries	291	8.92				
Total Entries	3261	100				
Total Schools			2970	100	2970	100

The FSIR did not include any information about minority status or information at the high school level about the proportion of students on Free or Reduced Price Lunch Programs. Therefore, data also were obtained from the AYP Reports on the FLDOE Evaluation and Reporting website for each school for each year. These files were merged so that missing demographic information in the FSIR was filled in with data from the AYP. In addition, neither the FSIR nor the AYP reported the proportion of students who were gifted at the high school level. Consequently, all high schools in the merged FSIR and AYP dataset have missing data for the proportion of gifted students. There are no gifted programs for students at the high school level in Florida, so this information is not tracked. More missing data resulted from variables that were not reported when the population of a school had less than 10 students in order to preserve the privacy of individuals who may be identifiable. For this reason, higher proportions of schools had missing data about proportions of LEP students, students with disabilities, and gifted students.

Finally, to determine the number of variables that were missing by school level for each year, this dataset was merged with the MSID files. Thus, any gifted information at the high school level included in the final dataset came from schools that were reclassified to high school level in the MSID file. The number and proportion of missing variables are depicted in Table C 5 for 2003-04, in Table C 6 for 2004-05, and in Table C 7 for 2005-06. High schools had the highest proportion of missing indicator variables when compared to elementary or middle school for all three years.

Table C 5.

Missing Demographic Indicators in the FSIR and AYP by School Level for 2003-04

	FSIR (N=2864)		FSIR and AYP (N=2864)		FSIR, AYP, and MSID					
					EL (N=1620)		HS (N=412)		MS (N=474)	
Missing Variables	N	%	N	%	N	%	N	%	N	%
School Code	0	0	0	0	0	0	0	0	0	0
School Name	0	0	0	0	0	0	0	0	0	0
School Level	0	0	0	0	0	0	0	0	0	0
Total number of instructional staff	0	0	0	0	0	0	0	0	0	0
Total number of students	0	0	0	0	0	0	0	0	0	0
Percent students with disabilities	2864	100	66	2.3	2	0.12	16	3.88	2	0.42
Percent students eligible for free or reduced price lunch program	34	1.19	33	1.15	0	0	14	3.4	2	0.42
Percent LEP students	460	16.06	57	1.99	0	0	19	4.61	0	0
Percent gifted students	341	11.91	340	11.87	147	9.13	46	11.17	28	5.91
Percent of students absent more than 21 days	766	26.75	766	26.75	158	9.81	376	91.26	18	3.8
Total crime incidents	0	0	0	0	0	0	0	0	0	0
Stability - percent of students that remain for the year	0	0	54	1.89	2	0.12	16	3.88	2	0.42
Percent of students with in-house suspensions	21	0.73	21	0.73	0	0	12	2.91	2	0.42
Percent of students with out-of-school suspensions	0	0	0	0	0	0	0	0	0	0
Percent of teachers with an advanced degree	0	0	0	0	0	0	0	0	0	0
Average number of years experience	1	0.03	1	0.03	0	0	1	0.24	0	0
Percent of core academic classes taught by out-of-field teachers	265	9.25	265	9.25	14	0.87	18	4.37	5	1.05
Total number of instructional staff	0	0	0	0	0	0	0	0	0	0

Table C 6.

Missing Demographic Indicators in the FSIR and AYP by School Level for 2004-05

	FSIR (N=2910)		FSIR and AYP (N=2910)		FSIR, AYP, and MSID EL (N=1640)		HS (N=425)		MS (N=483)	
Missing Variables	N	%	N	%	N	%	N	%	N	%
School Code	0	0	0	0	0	0	0	0	0	0
School Name	0	0	0	0	0	0	0	0	0	0
School Level	0	0	0	0	0	0	0	0	0	0
Total number of instructional staff	0	0	0	0	0	0	0	0	0	0
Total number of students	0	0	0	0	0	0	0	0	0	0
Percent students with disabilities	2910	100	79	2.71	10	0.61	28	6.59	1	0.21
Percent students eligible for free or reduced price lunch program	30	1.03	30	1.03	5	0.3	18	4.24	0	0
Percent LEP students	442	15.19	37	1.27	0	0	24	5.65	0	0
Percent gifted students	325	11.17	248	8.52	97	5.91	46	10.82	14	2.9
Percent of students absent more than 21 days	810	27.84	810	27.84	204	12.44	394	92.71	19	3.93
Total crime incidents	0	0	0	0	0	0	0	0	0	0
Stability - percent of students that remain for the year	0	0	79	2.71	10	0.61	28	6.59	1	0.21
Percent of students with in-house suspensions	24	0.82	24	0.82	6	0.37	14	3.29	0	0
Percent of students with out-of-school suspensions	0	0	0	0	0	0	0	0	0	0
Percent of teachers with an advanced degree	0	0	0	0	0	0	0	0	0	0
Average number of years experience	0	0	0	0	0	0	0	0	0	0
Percent of core academic classes taught by out-of-field teachers	295	10.14	295	10.14	6	0.37	20	4.71	2	0.41
Total number of instructional staff	0	0	0	0	0	0	0	0	0	0

Table C 7.

Missing Demographic Indicators in the FSIR and AYP by School Level for 2005-06

	FSIR (N=2970)		FSIR and AYP (N=2970)		FSIR, AYP, and MSID					
					EL (N=1660)		HS (N=436)		MS (N=496)	
Missing Variables	N	%	N	%	N	%	N	%	N	%
School Code	0	0	0	0	0	0	0	0	0	0
School Name	0	0	0	0	0	0	0	0	0	0
School Level	0	0	0	0	0	0	0	0	0	0
Total number of instructional staff	0	0	0	0	0	0	0	0	0	0
Total number of students	0	0	0	0	0	0	0	0	0	0
Percent students with disabilities	2970	100	98	3.3	13	0.78	32	7.34	2	0.4
Percent students eligible for free or reduced price lunch program	46	1.55	44	1.48	5	0.3	17	3.9	1	0.2
Percent LEP students	438	14.75	40	1.35	0	0	22	5.05	0	0
Percent gifted students	328	11.04	234	7.88	80	4.82	42	9.63	10	2.02
Percent of students absent more than 21 days	478	16.09	478	16.09	189	11.39	103	23.62	19	3.83
Total crime incidents	0	0	0	0	0	0	0	0	0	0
Stability - percent of students that remain for the year	0	0	98	3.3	13	0.78	32	7.34	2	0.4
Percent of students with in-house suspensions	34	1.14	34	1.14	5	0.3	11	2.52	1	0.2
Percent of students with out-of-school suspensions	0	0	0	0	0	0	0	0	0	0
Percent of teachers with an advanced degree	0	0	0	0	0	0	0	0	0	0
Average number of years experience	2	0.07	2	0.07	0	0	1	0.23	0	0
Percent of core academic classes taught by out-of-field teachers	305	10.27	305	10.27	5	0.3	20	4.59	2	0.4
Total number of instructional staff	0	0	0	0	0	0	0	0	0	0

Last, the technology indicator variables from the responses to the STAR surveys were brought into the data set. When merging together the three data files that comprise the STAR data for 2006-07, it was found that one school had 3 additional duplicates. These were removed before merging the technology data with the MSID file. For the school year 2003-04, there were 251 schools (7.63%) with a school code and some data, but they were missing names and school levels (see Table C 8). After merging the STAR data with the MSID files, the missing school level variable was decreased to seven schools in 2003-04, no schools in 2004-05 and 2005-06, and no schools in 2006-07.

Table C 8.

Schools in Original STAR Data and Merged with MSID by School Level and by School Year

	2003-04				2004-05			
	Original STAR		STAR & MSID		Original STAR		STAR & MSID	
School Level	N	%	N	%	N	%	N	%
Missing	251	7.63	7	0.21	3	0.1	0	0
Combination	66	2.01	67	2.04	59	1.94	64	2.11
Elementary	1640	49.88	1647	50.09	1622	53.43	1605	52.87
High	428	13.02	428	13.02	397	13.08	391	12.88
Middle	478	14.54	478	14.54	476	15.68	470	15.48
Other Types	425	12.93	661	20.1	479	15.78	506	16.67
Total Schools	3288	100	3288	100	3036	100	3036	100
	2005-06				2006-07			
Missing	1	0.03	0	0	1	0.03	0	0
Combination	77	2.46	81	2.58	96	2.96	97	2.99
Elementary	1665	53.13	1650	52.65	1692	52.21	1667	51.43
High	415	13.24	409	13.05	418	12.9	415	12.8
Middle	501	15.99	492	15.7	517	15.95	502	15.49
Other Types	475	15.16	502	16.02	517	15.95	560	17.28
Total Schools	3134	100	3134	100	3244	100	3244	100

The variables that were going to be used to create the composites for measuring the technology integration indicators were examined for missing responses to items (see Table C 1). The first concern was why there were 272 schools with missing responses for so many items in 2003-04. The next concern was the high level of no response for two items (*Level of school-based technical support* and *Level of school-based instructional technology*) in both the 2003-04 and the 2004-05 school years. Additional items in the

2003-04 STAR survey with high levels of no response were *Level of dependability of the Internet connection* and *Degree of delays when using the Internet*.

Table C 9.

Missing Response for Items in the STARS Survey for each School Year

	2003-04		2004-05		2005-06		2006-07	
Item	N	%	N	%	N	%	N	%
Modern multi-media computers in media center (desktops)	272	8.27	0	0	2	0.06	31	0.96
Modern multi-media computers in classrooms (desktops)	272	8.27	0	0	2	0.06	31	0.96
Modern multi-media computers in computer labs primarily serving general education (desktops)	272	8.27	0	0	2	0.06	31	0.96
Modern multi-media computers in mobile computer labs (desktops)			0	0			31	0.96
Older computer or not multi-media in media center (desktops)	272	8.27	0	0	2	0.06	31	0.96
Older computer or not multi-media in classrooms (desktops)	272	8.27	0	0	2	0.06	31	0.96
Older computer or not multi-media in computer labs primarily serving general education (desktops)	272	8.27	0	0	2	0.06	31	0.96
Older computer or not multi-media in mobile computer labs (desktops)	272	8.27	0	0			31	0.96
Modern multi-media computers in media center (laptops)			1	0.03	2	0.06	31	0.96
Modern multi-media computers in classrooms (laptops)			0	0	2	0.06	31	0.96
Modern multi-media computers in computer labs primarily serving general education (laptops)			1	0.03	2	0.06	31	0.96
Modern multi-media computers in mobile computer labs (laptops)	272	8.27	0	0	2	0.06	31	0.96

Appendix C: Data Preparation Procedures (Continued)

Item	2003-04		2004-05		2005-06		2006-07	
	N	%	N	%	N	%	N	%
Older computer or not multi-media in media center (laptops)			0	0	2	0.06	31	0.96
Older computer or not multi-media in classrooms (laptops)			0	0	3	0.1	31	0.96
Older computer or not multi-media in computer labs primarily serving general education (laptops)			0	0	2	0.06	31	0.96
Older computer or not multi-media in mobile computer labs (laptops)			0	0	2	0.06	31	0.96
Percent student computers with concept mapping software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with graphics software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with multimedia authoring software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with presentation software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with spreadsheet software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with video editing software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with web authoring software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with basic word processing software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with robust word processing software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with FCAT Explorer software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with other test prep tools software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with Integrated Learning Systems software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with content-specific skills practice/tutorials software	272	8.27	0	0	2	0.06	33	1.02

Appendix C: Data Preparation Procedures (Continued)

Item	2003-04		2004-05		2005-06		2006-07	
	N	%	N	%	N	%	N	%
Percent student computers with content-specific simulation software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with other content-specific resources software	272	8.27	0	0	2	0.06	33	1.02
Percent student computers with general reference tools software	272	8.27	0	0	2	0.06	33	1.02
Administrative tasks	272	8.27	0	0	3	0.1	32	0.99
Delivery of lessons	272	8.27	0	0	3	0.1	32	0.99
Desktop video production	272	8.27	0	0	3	0.1	32	0.99
Email to other school or district staff	272	8.27	0	0	3	0.1	32	0.99
Email to students or parents	272	8.27	0	0	3	0.1	32	0.99
Presentations	272	8.27	0	0	3	0.1	32	0.99
Research	272	8.27	0	0	3	0.1	32	0.99
Analysis of student assessment information	272	8.27	0	0	3	0.1	32	0.99
Video conferencing	272	8.27	0	0	3	0.1	32	0.99
Webpage publishing	272	8.27	0	0	3	0.1	32	0.99
Frequency students use drill and practice software	272	8.27	0	0	3	0.1	32	0.99
Frequency students use Integrated Learning Systems	272	8.27	0	0	3	0.1	32	0.99
Frequency students use multimedia software	272	8.27	0	0	3	0.1	32	0.99
Frequency students use presentation software					3	0.1	32	0.99
Frequency students use simulation software	272	8.27	0	0	3	0.1	32	0.99
Frequency students use research software					3	0.1	33	1.02
Frequency students use tool-based software	272	8.27	0	0	3	0.1	32	0.99
Percent of technology budget devoted to professional development	272	8.27	0	0	1	0.03	26	0.80
Level of school-based technical support	545	16.58	243	8.00	1	0.03	25	0.77
Level of school-based instructional technology specialist support	972	29.56	666	21.94	1	0.03	25	0.77
Level of dependability of the Internet connection	310	9.43	0	0	2	0.06	33	1.02
Degree of delays when using the Internet	310	9.43	0	0	2	0.06	32	0.99

Item	2003-04 N	2003-04 %	2004-05 N	2004-05 %	2005-06 N	2005-06 %	2006-07 N	2006-07 %
Time at your school for a technical issue to be resolved	272	8.27	0	0	2	0.06	32	0.99
Total Schools	3288	100	3036	100	3134	100	3241	100

To examine the 272 missing responses for each of the items, the schools with missing responses for the first item were filtered into a separate database. The same 272 schools were missing responses for all of the items. Next the types of schools that had no responses were examined. The numbers and proportion of each school level with the non-responses are included in Table C 10. Although these schools accounted for 7.83% of all of the schools in the STAR dataset, they were only 2.65% of the schools that would be used in the research study. To further examine if there were relationships between the schools that had no responses on the survey items, the 272 schools were filtered to include only elementary, middle, and high schools, and then the frequency count of the schools in each county was conducted. Seventeen of the schools were not in any of the 67 counties that would be included in the study. The rest of the schools came from 42 different counties. The two counties with the most schools that did not respond to the survey were Hillsborough and Palm Beach, each with 29 schools, which was 12.61% of Hillsborough schools and 14.15% of Palm Beach schools. The proportion of schools out of all schools in the districts ranged from a minimum of 1.75% (one school in the county) to a maximum of 100% (15 out of 15 schools). A total of five counties were excluded from the analysis because they had no schools (N=35) respond to any of the technology indicators. Thirteen counties had more than 15% of their schools not respond. Forty-six out of 67 counties (69%) had greater than 90% response rate from their schools.

Table C 10.

Schools with Missing Responses for All STAR Items in 2003-04

School Level	N	% of Missing Schools	% of All Schools
Combination	9	3.31	0.27
Elementary	38	13.97	1.16
High	36	13.24	1.09
Middle	13	4.78	0.40
Other Types	176	64.71	5.35
Total EL, HS, & MS	87	31.99	2.65
Total Missing Response Schools	272	100	8.27
Total All Schools	3288	--	100

The original wording of the items and response options were examined for additional items with high levels of no response. The two items (*Level of school-based technical support* and *Level of school-based instructional technology*) in both the 2003-04 and the 2004-05 school years did not have any option for schools to designate that they did not have any technical support or instructional technology support. It would seem reasonable that the lack of response was really meant to be a response for no level of support. An option for no level of support was added to these two items for the 2005-06 school year, and the lack of response dropped to only one school. To verify that the schools with the lack of response in 2003-04 and 2004-05 meant no level of support, the 2005-06 responses of these schools were examined to see if the same schools chose the option for no support. For the item measuring the level of school-based technical support 61 schools were missing responses in both 2003-04 and 2004-05, but only 13 schools were missing responses in years 2003-04 and 2004-05 and indicated no support in 2005-06, while 78 schools selected the no technical support option for the 2005-06 school year. This suggests that different schools report having no technical support each year. The change in number of schools with missing information for the 2003-04 and 2004-05 school years (61) to only one school not reporting information in 2005-06 suggested that not having the option to select no support impacted the way the schools responded. The responses of the schools to the level of school-based instructional technology support suggested that missing responses in 2003-04 and 2004-05 were meant to indicate no level of support, because there were 220 schools with missing responses for both 2003-04 and 2004-05 school year but only one missing response in 2005-06. Seventy-three schools had missing information for 2003-04 and 2004-05 and indicated no level of instructional technology support in 2005-06, which suggests that not having an option for selecting no support impacted how schools responded in 2003-04 and 2004-05. However, there were 271 schools that selected no instructional technology support in 2005-06, which suggests that different schools also report different levels of support each year (see Table C 11).

For this study, missing responses to the technology indicators were set to zero, after the 272 schools in 2003-04 with no responses to any of the technology indicators had been deleted from the 2003-04 dataset.

Table C 11.

Number of schools only Missing Responses for Level of Support Items for 2003-04 to 2005-06

Item	N	%
Level of school-based technical support		
No Missing Responses	2432	86.58
Missing 2005-06	1	0.04
No Support 2005-06	61	2.17
Missing one year	283	10.07
Missing 2003-04 and 2004-05	61	2.17
Missing 2004-05 and No Support 2005-06	15	0.53
Missing 2003-04 and No Support 2005-06	4	0.14
Missing 2004-05, 2004-05, and NS 2005-06	13	0.46
Level of school-based instructional technology specialist support		
No Missing Responses	1912	68.07
Missing 2005-06	1	0.04
No Support 2005-06	271	9.65
Missing one year	649	23.10
Missing 2003-04 and 2004-05	220	7.83
Missing 2004-05 and No Support 2005-06	43	1.53
Missing 2003-04 and No Support 2005-06	33	1.17
Missing 2004-05, 2004-05, and NS 2005-06	73	2.60

The 272 schools that were missing technology integration indicator responses for all the survey items for the school year 2003-04 were deleted from the dataset for 2003-04. The combined dataset for each school year was filtered to include only elementary, middle, and high public schools with primary function of serving regular education students from the 67 counties in Florida. This included 2464 schools in 2003-04 and 2004-05, 2549 schools in 2005-06, and 2586 schools in 2006-07. These files were merged into one dataset that was filtered to include only schools that participated in the STAR survey for all four school years. This resulted in the sample of 2345 schools for the research study.

The 2006-07 dataset was sorted by 3 missing variables that seemed to be commonly missing to visually inspect the file for schools that did not respond to any of the items of the survey. There were 12 schools that had all missing data. This missing indicators dataset was filtered by having missing information for the three variables. Eight schools were other types, two were elementary, one was middle, and one was high schools. One county had three schools, but two were in the other category. It seemed reasonable to delete these schools from the dataset, leaving at total of 3232 schools to merge into the total dataset.

Descriptive Statistics

To assure that the dataset did not contain any unusual responses, the responses were analyzed using descriptive statistics. Variables with absolute skewness values over one and absolute kurtosis values over three were flagged. Results are in the Table C 12. The FCAT Mathematics scores appeared to be approximately normal. The mean score for all schools ranged between 655.53 with standard deviation of 32.45 in 2004-05 to 667.39 with standard deviation of 29.94 in 2006-07. Skewness for all four years ranged between 0.51 and 0.75 and kurtosis ranged between -0.23 and -0.62. However, when examining the data at each school level, high school had high kurtosis (1.65 to 3.65) for all four years. A similar pattern was found with FCAT Reading scores. The mean score for all schools ranged between 657.90 with standard deviation of 25.13 in 2004-05 to 668.81 with standard deviation of 21.86 in 2005-06. Skewness for all four years ranged between 0.28 and 0.72, and kurtosis ranged between -0.50 to 0.02. Again at the high school level, kurtosis ranged between 1.05 and 1.61. The mean FCAT writing scores for all four years for all schools ranged between 3.70 with standard deviation of 0.31 in 2003-04 to 3.91 with standard deviation of 0.32 in 2006-07. The FCAT outcome data were not transformed for any of the analyses.

Table C 12.

Descriptive Statistics for FCAT Outcome Scores

Level and Year	N	Mean	Std. Dev.	Min	Max	Skew	*	Kurt	**
FCAT Mathematics									
All School Levels									
2003-04	2313	658.42	30.31	595	792	0.75		-0.23	
2004-05	2313	655.53	32.45	592	785	0.56		-0.62	
2005-06	2313	664.03	32.39	594	794	0.60		-0.47	
2006-07	2313	667.39	29.94	604	781	0.51		-0.48	
Elementary									
2003-04	1520	640.20	13.91	595	689	0.10		-0.28	
2004-05	1520	635.84	16.36	592	697	0.22		-0.16	
2005-06	1520	644.78	16.69	594	705	0.21		-0.27	
2006-07	1520	650.14	17.05	604	712	0.16		-0.23	
High									
2003-04	347	710.58	15.03	672	792	0.61		2.39	
2004-05	347	708.86	13.25	676	785	0.82		3.25	**
2005-06	347	717.56	14.79	675	794	0.71		2.28	
2006-07	347	716.15	13.79	677	781	0.64		1.65	
Middle									
2003-04	446	679.90	14.81	641	719	0.11		-0.21	
2004-05	446	681.16	14.84	647	723	0.31		-0.18	
2005-06	446	687.95	16.02	652	736	0.30		-0.24	
2006-07	446	688.22	14.55	657	731	0.33		-0.36	
FCAT Reading									
All School Levels									
2003-04	2298	664.61	21.69	613	754	0.28		-0.50	
2004-05	2298	657.90	25.13	607	768	0.72		-0.06	
2005-06	2298	668.81	21.86	622	767	0.58		0.02	
2006-07	2298	667.66	22.33	619	763	0.63		-0.03	
Elementary									
2003-04	1505	652.97	14.60	613	701	0.05		-0.45	
2004-05	1505	643.58	13.24	607	693	0.18		-0.24	
2005-06	1505	657.34	13.72	622	704	0.17		-0.35	
2006-07	1505	655.57	13.29	619	705	0.19		-0.26	
High									
2003-04	347	693.19	13.07	650	754	0.25		1.60	
2004-05	347	699.84	14.65	658	768	0.42		1.61	
2005-06	347	703.93	13.82	668	767	0.48		1.57	
2006-07	347	703.48	14.10	669	763	0.42		1.05	
Middle									

Level and Year	N	Mean	Std. Dev.	Min	Max	Skew	*	Kurt	**
2003-04	446	681.62	13.81	643	716	-0.03		-0.16	
2004-05	446	673.58	13.70	640	711	0.11		-0.10	
2005-06	446	680.20	12.08	650	712	0.06		-0.21	
2006-07	446	680.57	12.69	650	716	0.13		-0.33	
			FCAT Writing						
All School Levels									
2003-04	2276	3.70	0.31	3	5	0.20		0.53	
2004-05	2276	3.75	0.30	3	5	0.27		0.58	
2005-06	2276	3.88	0.31	3	5	0.22		0.43	
2006-07	2276	3.91	0.32	3	5	0.27		0.64	
Elementary									
2003-04	1489	3.64	0.30	3	5	0.09		0.20	
2004-05	1489	3.70	0.29	3	5	0.13		0.14	
2005-06	1489	3.84	0.31	3	5	0.12		-0.07	
2006-07	1489	3.84	0.29	3	5	-0.02		0.24	
High									
2003-04	348	3.83	0.26	3	5	0.74		3.23	**
2004-05	348	3.86	0.28	3	5	0.57		2.48	
2005-06	348	3.92	0.30	3	5	0.79		2.25	
2006-07	348	3.96	0.29	3	5	0.75		1.70	
Middle									
2003-04	439	3.79	0.33	3	5	0.36		-0.02	
2004-05	439	3.82	0.30	3	5	0.55		0.18	
2005-06	439	3.98	0.27	3	5	0.59		0.42	
2006-07	439	4.13	0.31	4	5	0.55		-0.12	

Note.
* skewness > 1
** kurtosis > 3

Descriptive statistics for the demographic variables obtained from the Florida School Indicators Report for 2003-04, 2004-05, and 2005-06 that were used in the analysis were computed and are listed in the Table C 13. The FSIR indicators for 2006-07 were not available. Many variables had skewness over 1.0 and kurtosis over 3.0. These variables included the counts of instructional staff, students, and LEP and gifted populations of students that were all positively skewed with high kurtosis. Two other categories of variables with high skew and kurtosis were the proportions of suspensions and teachers teaching out of their subject area. Skew ranged from a low of -1.76 to high of 4.09. Kurtosis ranged from a low -1.0 of to a high of 23.11. To determine if this lack of normality impacted the analysis, exploratory factor analysis of the variables that were to be grouped into composites were run with the data in both its original form and after it had been normalized through log transformation.

Table C 13.

Descriptive Statistics of Demographic Variables in the Florida School Indicators Reports

Level and Variable	N	Mean	Std Dev	Min	Max	Skew		Kurt	
			2003-04						
All School Levels									
Total number of instructional staff	2327	58.74	30.04	0	213	1.87	*	4.54	**
Total number of students	2327	978.23	611.05	0	4655	2.15	*	6.06	**
Percent students with disabilities	2324	15.54	5.43	0.5	40.6	0.68		1.39	**
Percent students eligible for free or reduced price lunch program	2324	52.26	25.32	1	100	0.10		-0.94	
Percent LEP students	2153	8.73	10.68	0	63.3	1.97	*	3.97	**
Percent gifted students	1835	4.97	5.75	0.1	52.3	2.91	*	12.30	**
Percent of students absent more than 21 days	2327	8.31	5.51	0	38.9	1.56	*	3.40	**
Total crime incidents	2324	0.07	0.11	0	1	3.11	*	15.17	**
Stability - percent of students who remain for the year	2325	93.71	2.79	71.3	100	-0.97		2.70	**
Percent of students with in-house suspensions	2327	7.20	10.94	0	63.6	1.60	*	1.64	**
Percent of students with out-of-school suspensions	2327	7.19	8.05	0	75.9	1.81	*	4.69	**
Percent of teachers with an advanced degree	2327	33.47	11.17	0	78.2	0.34		0.26	
Average number of years experience	2302	12.62	3.24	3.8	33.7	0.50		1.81	**
Percent of core academic classes taught by out-of-field teachers	2327	5.99	9.58	0	73.7	2.88	*	10.91	**
Elementary									
Total number of instructional staff	1527	46.34	13.40	0	123	0.31		1.17	**
Total number of students	1527	714.54	240.46	16	2328	0.62		1.82	**
Percent students with disabilities	1527	16.09	5.72	1.2	40.6	0.80		1.22	**
Percent students eligible for free or reduced price lunch program	1527	57.12	26.17	1	100	-0.14		-1.00	**
Percent LEP students	1399	10.79	12.21	0.1	63.3	1.56	*	1.97	**
Percent gifted students	1380	4.30	5.40	0.1	52.3	3.41	*	17.36	**
Percent of students absent more than 21 days	1527	6.29	3.15	0	24.5	0.82		1.31	**
Total crime incidents	1526	0.04	0.10	0	1	4.09	*	23.11	**
Stability - percent of students who remain for the year	1527	93.96	2.82	71.3	100	-1.08	*	3.30	**

Level and Variable	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent of students with in-house suspensions	1527	1.77	3.55	0	36.55	4.03	*	22.25	**
Percent of students with out-of-school suspensions	1527	3.26	3.71	0	36.1	2.67	*	11.46	**
Percent of teachers with an advanced degree	1527	32.35	11.46	0	70.8	0.51		0.25	
Average number of years experience	1514	12.59	3.36	3.8	33.7	0.52		1.78	**
Percent of core academic classes taught by out-of-field teachers	1527	5.72	10.40	0	73.7	3.04	*	11.10	**
High									
Total number of instructional staff	352	104.24	43.87	0	213	0.03		-0.28	
Total number of students	352	1909.10	905.16	0	4655	0.35		0.09	
Percent students with disabilities	349	13.25	4.45	0.7	31.05	0.03		0.89	
Percent students eligible for free or reduced price lunch program	349	35.51	17.14	1.8	93.3	0.45		0.17	
Percent LEP students	329	4.50	4.76	0	23.1	1.47	*	1.75	**
Percent gifted students	22	7.04	9.92	0.4	39.8	2.54	*	6.35	**
Percent of students absent more than 21 days	352	13.81	7.71	0	35.6	0.44		-0.19	
Total crime incidents	350	0.12	0.10	0	1	2.67	*	15.29	**
Stability - percent of students who remain for the year	350	92.55	2.52	82.5	99.4	-0.48		1.26	**
Percent of students with in-house suspensions	352	16.84	13.11	0	51.3	0.26		-0.88	
Percent of students with out-of-school suspensions	352	13.23	7.30	0	42	0.86		1.07	**
Percent of teachers with an advanced degree	352	38.74	9.98	0	78.2	-0.44		2.82	**
Average number of years experience	345	13.43	2.80	4.4	29.7	0.43		3.36	**
Percent of core academic classes taught by out-of-field teachers	352	5.77	7.72	0	54.1	2.63	*	10.28	**
Middle									
Total number of instructional staff	448	65.26	19.28	8	124	-0.01		0.21	
Total number of students	448	1145.61	392.71	178	2662	0.39		0.63	
Percent students with disabilities	448	15.47	4.57	0.5	27.9	-0.13		0.18	
Percent students eligible for free or reduced price lunch program	448	48.78	21.32	3.7	100	0.11		-0.66	
Percent LEP students	425	5.21	5.43	0.1	32.5	1.70	*	3.54	**
Percent gifted students	433	6.99	6.05	0.1	37.3	2.04	*	5.19	**

Appendix C: Data Preparation Procedures (Continued)

Level and Variable	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent of students absent more than 21 days	448	10.89	5.75	0	38.9	0.90		2.04	**
Total crime incidents	448	0.09	0.11	0	0.8	2.22	*	8.56	**
Stability - percent of students who remain for the year	448	93.78	2.67	79.5	98.9	-1.25	*	3.27	**
Percent of students with in-house suspensions	448	18.15	12.27	0	63.6	0.12		-0.61	
Percent of students with out-of-school suspensions	448	15.84	9.56	0.1	75.9	1.14	*	3.48	**
Percent of teachers with an advanced degree	448	33.16	9.81	10.5	68	0.46		0.32	
Average number of years experience	443	12.08	2.99	4.1	24.8	0.58		1.20	**
Percent of core academic classes taught by out-of-field teachers	448	7.07	7.71	0	45.3	1.45	*	2.38	**
			2004-05						
All School Levels									
Total number of instructional staff	2341	61.65	31.10	0	228	1.85	*	4.66	**
Total number of students	2341	978.12	613.01	0	4723	2.14	*	5.98	**
Percent students with disabilities	2339	15.32	5.33	0.4	43.9	0.72		1.96	**
Percent students eligible for free or reduced price lunch program	2338	52.71	24.09	0.9	102.1	0.01		-0.90	
Percent LEP students	2232	8.52	10.65	0	85.5	2.11	*	5.07	**
Percent gifted students	1811	4.96	5.85	0.1	54.9	2.96	*	12.64	**
Percent of students absent more than 21 days	2341	9.31	6.41	0	47.5	1.51	*	3.23	**
Total crime incidents	2333	0.05	0.09	0	0.8	2.98	*	14.17	**
Stability - percent of students who remain for the year	2338	93.15	2.98	78.1	100	-0.76		0.92	
Percent of students with in-house suspensions	2341	6.89	10.46	0	51.5	1.66	*	1.88	**
Percent of students with out-of-school suspensions	2341	6.86	7.80	0	57.9	1.80	*	3.96	**
Percent of teachers with an advanced degree	2341	33.10	10.77	0	100	0.40		0.80	
Average number of years experience	2336	12.45	3.19	2.8	30	0.34		1.03	**
Percent of core academic classes taught by out-of-field teachers	2341	6.43	11.09	0	84.3	2.71	*	8.55	**
Elementary									
Total number of instructional staff	1540	49.11	14.64	0	126	0.37		1.02	**
Total number of students	1540	714.62	246.99	8	2260	0.62		1.43	**

Level and Variable	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent students with disabilities	1540	15.83	5.60	1.6	43.9	0.90		1.93	**
Percent students eligible for free or reduced price lunch program	1540	56.61	24.83	0.9	100	-0.21		-0.93	
Percent LEP students	1461	10.48	12.19	0	85.5	1.70	*	2.87	**
Percent gifted students	1360	4.25	5.48	0.1	54.9	3.50	*	18.21	**
Percent of students absent more than 21 days	1540	7.63	4.79	0.2	47.5	1.88	*	6.46	**
Total crime incidents	1536	0.03	0.09	0	0.8	4.03	*	22.62	**
Stability - percent of students who remain for the year	1539	93.47	2.95	80.4	100	-0.85		0.96	
Percent of students with in-house suspensions	1540	1.73	3.28	0	37	3.81	*	21.34	**
Percent of students with out-of-school suspensions	1540	3.15	3.54	0	27	2.13	*	5.57	**
Percent of teachers with an advanced degree	1540	32.00	10.87	0	71.5	0.49		0.36	
Average number of years experience	1539	12.43	3.26	2.8	30	0.30		0.79	
Percent of core academic classes taught by out-of-field teachers	1540	6.71	12.52	0	84.3	2.61	*	7.17	**
High									
Total number of instructional staff	353	108.41	45.35	0	228	0.07		-0.09	
Total number of students	353	1931.27	896.26	0	4723	0.33		0.14	
Percent students with disabilities	351	13.16	4.51	0.4	27.6	-0.19		0.41	
Percent students eligible for free or reduced price lunch program	350	38.85	18.02	3.8	102.1	0.59		0.69	
Percent LEP students	335	4.35	4.65	0	26	1.53	*	2.11	**
Percent gifted students	20	7.60	10.36	0.7	39.6	2.20	*	4.50	**
Percent of students absent more than 21 days	353	14.02	8.46	0	38.4	0.50		-0.16	
Total crime incidents	350	0.11	0.09	0	0.8	2.64	*	13.08	**
Stability - percent of students who remain for the year	351	91.64	2.91	78.1	98.8	-0.59		2.01	**
Percent of students with in-house suspensions	353	15.73	12.50	0	47.1	0.40		-0.75	
Percent of students with out-of-school suspensions	353	12.50	7.49	0	39	0.85		0.85	
Percent of teachers with an advanced degree	353	38.23	10.45	0	100	0.15		4.89	**
Average number of years experience	350	13.24	2.88	5.4	29.8	0.57		3.31	**

Level and Variable	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent of core academic classes taught by out-of-field teachers	353	5.16	7.07	0	42.3	2.17	*	5.52	**
Middle									
Total number of instructional staff	448	67.89	19.94	9	129	0.11		0.28	
Total number of students	448	1132.88	379.43	172	2558	0.39		0.48	
Percent students with disabilities	448	15.26	4.48	0.5	28.7	-0.16		0.20	
Percent students eligible for free or reduced price lunch program	448	50.15	21.15	3.3	100	0.04		-0.61	
Percent LEP students	436	5.16	5.42	0.1	36.4	1.90	*	4.90	**
Percent gifted students	431	7.09	6.18	0.1	39.1	2.09	*	5.56	**
Percent of students absent more than 21 days	448	11.37	6.96	0	44.4	1.09	*	2.77	**
Total crime incidents	447	0.07	0.09	0	0.7	1.90	*	7.30	**
Stability - percent of students who remain for the year	448	93.23	2.78	81.2	99.4	-0.78		0.80	
Percent of students with in-house suspensions	448	17.65	11.98	0	51.5	0.13		-0.68	
Percent of students with out-of-school suspensions	448	15.20	9.41	0	57.9	1.00	*	1.64	**
Percent of teachers with an advanced degree	448	32.82	9.47	10.7	60.7	0.32		-0.07	
Average number of years experience	447	11.89	3.07	4.8	26.2	0.46		0.85	
Percent of core academic classes taught by out-of-field teachers	448	6.49	7.93	0	40.3	1.60	*	2.25	**
			2005-06						
All School Levels									
Total number of instructional staff	2341	62.65	31.26	0	250	1.89	*	5.09	**
Total number of students	2341	968.70	602.43	0	5060	2.17	*	6.19	**
Percent students with disabilities	2338	15.32	5.45	0.3	72.55	1.48	*	9.51	**
Percent students eligible for free or reduced price lunch program	2337	52.31	23.87	1.7	100	-0.04		-0.96	
Percent LEP students	2248	8.79	10.71	0	78.9	2.05	*	4.69	**
Percent gifted students	2098	4.88	5.78	0	57.2	3.03	*	13.84	**
Percent of students absent more than 21 days	2341	9.38	6.59	0	57.6	1.59	*	3.79	**
Total crime incidents	2332	0.05	0.09	0	0.9	2.99	*	13.78	**
Stability - percent of students who remain for the year	2339	92.99	3.22	63.1	99.5	-1.43	*	5.86	**

Level and Variable	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent of students with in-house suspensions	2341	6.66	10.45	0	56.5	1.76	*	2.32	**
Percent of students with out-of-school suspensions	2341	6.44	7.77	0	64.9	2.03	*	5.51	**
Percent of teachers with an advanced degree	2341	31.72	11.93	0	100	-0.09		0.95	
Average number of years experience	2338	12.64	3.21	4	31.3	0.49		1.54	**
Percent of core academic classes taught by out-of-field teachers	2341	6.95	11.52	0	80	2.51	*	7.20	**
Elementary									
Total number of instructional staff	1540	50.58	15.43	1	135	0.49		1.19	**
Total number of students	1540	716.14	243.58	11	2258	0.61		1.42	**
Percent students with disabilities	1540	16.05	5.77	1.9	72.55	1.77	*	10.39	**
Percent students eligible for free or reduced price lunch program	1540	56.13	24.69	1.7	100	-0.25		-0.97	
Percent LEP students	1472	10.78	12.21	0.1	78.9	1.64	*	2.62	**
Percent gifted students	1374	4.16	5.55	0.1	57.2	3.69	*	20.49	**
Percent of students absent more than 21 days	1540	7.55	5.12	0.1	57.6	2.33	*	10.04	**
Total crime incidents	1535	0.04	0.09	0	0.9	3.87	*	20.31	**
Stability - percent of students who remain for the year	1540	93.25	3.26	63.1	99.5	-1.76	*	8.18	**
Percent of students with in-house suspensions	1540	1.75	3.24	0	26.4	3.51	*	15.83	**
Percent of students with out-of-school suspensions	1540	3.13	3.81	0	29.6	2.66	*	10.12	**
Percent of teachers with an advanced degree	1540	30.62	11.89	0	71.2	-0.01		0.56	
Average number of years experience	1540	12.63	3.29	4	31	0.51		1.29	**
Percent of core academic classes taught by out-of-field teachers	1540	7.01	12.76	0	80	2.44	*	6.12	**
High									
Total number of instructional staff	353	109.52	45.80	0	250	0.15		0.13	
Total number of students	353	1930.55	877.98	0	5060	0.28		0.27	
Percent students with disabilities	350	13.12	4.52	0.3	30.85	-0.08		0.66	
Percent students eligible for free or reduced price lunch program	349	38.67	17.16	2.5	93.7	0.17		-0.34	
Percent LEP students	337	4.41	4.65	0	28.3	1.61	*	2.78	**
Percent gifted students	291	4.74	5.03	0	37.4	2.67	*	11.00	**

Appendix C: Data Preparation Procedures (Continued)

Level and Variable	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent of students absent more than 21 days	353	15.15	8.64	0	48.7	0.59		0.64	
Total crime incidents	349	0.10	0.08	0	0.7	2.37	*	11.49	**
Stability - percent of students who remain for the year	351	91.81	2.96	77	99	-0.57		1.68	**
Percent of students with in-house suspensions	353	14.85	12.90	0	51.8	0.46		-0.80	
Percent of students with out-of-school suspensions	353	11.43	8.06	0	43.7	0.97		1.37	**
Percent of teachers with an advanced degree	353	36.64	12.20	0	100	-0.40		3.50	**
Average number of years experience	350	13.29	2.80	5.3	31.3	0.64		4.86	**
Percent of core academic classes taught by out-of-field teachers	353	6.68	8.34	0	48.1	2.12	*	5.78	**
Middle									
Total number of instructional staff	448	67.20	19.68	9	130	0.17		0.31	
Total number of students	448	1078.98	354.95	154	2300	0.38		0.47	
Percent students with disabilities	448	14.53	4.30	0.8	28.7	-0.08		0.25	
Percent students eligible for free or reduced price lunch program	448	49.79	21.16	3.9	100	0.02		-0.79	
Percent LEP students	439	5.45	5.69	0.1	37.4	2.05	*	5.78	**
Percent gifted students	433	7.27	6.34	0.1	39.5	2.10	*	5.78	**
Percent of students absent more than 21 days	448	11.11	6.11	0	35.7	0.67		0.62	
Total crime incidents	448	0.07	0.09	0	0.6	1.77	*	4.75	**
Stability - percent of students who remain for the year	448	93.04	3.08	78.9	99	-1.09	*	2.14	**
Percent of students with in-house suspensions	448	17.08	12.64	0	56.5	0.24		-0.65	
Percent of students with out-of-school suspensions	448	13.90	10.07	0	64.9	1.12	*	2.31	**
Percent of teachers with an advanced degree	448	31.63	10.81	0	62	-0.25		0.70	
Average number of years experience	448	12.18	3.16	4.6	25.3	0.46		0.97	
Percent of core academic classes taught by out-of-field teachers	448	6.96	8.88	0	72.1	2.26	*	8.51	**

Note.
* skewness > 1
** kurtosis > 3

Descriptive statistics were calculated for the technology integration variables for all four years (2003-04, 2004-05, 2005-06, and 2006-07) and are listed in Table C 14. Skewness for the variables for all four years ranged between -9.86 and 47.61; and Kurtosis ranged between -1.65 and 2287.37. All of the variables with the highest absolute amounts of skewness and kurtosis were counts of computers.

Table C 14.

Descriptive Statistics of the Technology Integration Variables from the Florida Innovates (STAR) Survey

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
2003-04									
All School Levels									
Modern multi-media computers in Media center (desktops)	2327	13.32	13.13	0	120	2.34	*	8.67	*
Modern multi-media computers in Classrooms (desktops)	2327	106.39	104.12	0	1735	3.52	*	32.13	*
Modern multi-media computers in Computer labs primarily serving general education (desktops)	2327	42.61	47.08	0	525	3.51	*	20.43	*
Modern multi-media computers in Mobile computer labs (laptops)	2327	8.24	22.21	0	352	5.75	*	54.82	*
Older computer or not multi-media in Media center (desktops)	2327	3.26	7.27	0	92	4.72	*	32.66	*
Older computer or not multi-media in Classrooms (desktops)	2327	46.29	63.80	0	600	2.83	*	12.84	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	2327	8.56	22.24	0	271	4.79	*	34.95	*
Older computer or not multi-media in Mobile computer labs (laptops)	2327	1.03	7.81	0	176	12.36	*	196.89	*
Percent student computers with Concept mapping software	2327	2.29	1.36	1	5	0.92		-0.42	
Percent student computers with Graphics software	2327	4.39	1.12	1	5	-1.71	*	1.61	
Percent student computers with Multimedia authoring software	2327	2.56	1.40	1	5	0.65		-0.90	
Percent student computers with Presentation software	2327	4.16	1.19	1	5	-1.16	*	0.03	
Percent student computers with Spreadsheet software	2327	4.44	1.02	1	5	-1.81	*	2.26	
Percent student computers with Video editing software	2327	2.06	1.03	1	5	1.40	*	1.81	
Percent student computers with Web authoring software	2327	2.02	1.10	1	5	1.51	*	1.82	
Percent student computers with Basic word processing software	2327	4.78	0.76	1	5	-3.81	*	13.90	*

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with Robust word processing software	2327	4.60	0.92	1	5	-2.45	*	5.19	*
Percent student computers with FCAT Explorer software	2327	4.08	1.28	1	5	-1.18	*	0.08	
Percent student computers with Other test prep tools software	2327	3.20	1.52	1	5	-0.11		-1.50	
Percent student computers with Integrated Learning Systems software	2327	3.19	1.54	1	5	-0.11		-1.51	
Percent student computers with Content-specific skills practice/tutorials software	2327	3.76	1.31	1	5	-0.57		-1.07	
Percent student computers with Content-specific simulation software	2327	2.87	1.45	1	5	0.26		-1.33	
Percent student computers with Other content-specific resources software	2327	3.13	1.46	1	5	0.02		-1.44	
Percent student computers with General Reference tools software	2327	3.93	1.34	1	5	-0.87		-0.67	
Administrative tasks	2327	4.31	1.04	1	5	-1.33	*	0.54	
Delivery of lessons	2327	2.94	0.98	1	5	0.51		-0.65	
Desktop video production	2327	1.84	0.68	1	5	1.15	*	3.60	*
Email to other school or district staff	2327	4.61	0.88	1	5	-2.31	*	4.40	*
Email to students or parents	2327	3.07	1.22	1	5	0.19		-1.11	
Presentations	2327	2.82	0.98	1	5	0.70		-0.36	
Research	2327	3.86	1.00	1	5	-0.48		-0.73	
Analysis of student assessment information	2327	3.85	1.18	1	5	-0.61		-0.86	
Video conferencing	2327	1.23	0.51	1	5	2.92	*	12.63	*
Webpage publishing	2327	2.00	0.78	1	5	1.56	*	4.15	*
Degree students use Drill and practice software	2327	2.05	0.96	1	5	0.57		-0.42	
Degree students use Integrated Learning Systems	2327	2.03	1.17	1	5	1.07	*	0.30	
Degree students use Multimedia	2327	3.00	0.95	1	5	-0.14		-0.34	
Degree students use Simulation software	2327	3.42	0.95	1	5	-0.24		-0.20	
Degree students use Tool-based software	2327	2.13	1.02	1	5	0.55		-0.49	
% of technology $ devoted to professional development	2327	13.54	14.91	0	100	2.19	*	7.80	*
Level of school-based technical support	2177	2.21	1.07	0	4	0.40		-1.07	
Level of school-based instructional technology specialist support	1871	2.10	1.14	1	4	0.49		-1.26	
Level of dependability of the Internet connection	2324	4.17	0.71	1	5	-0.51		0.10	

Appendix C: Data Preparation Procedures (Continued)

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Degree of delays when using the Internet	2324	3.85	0.63	1	5	-2.00	*	6.18	*
Time at your school for a technical issue to be resolved	2327	3.70	1.14	1	5	-0.24		-1.36	
Elementary									
Modern multi-media computers in Media center (desktops)	1531	8.67	7.02	0	60	1.79	*	5.32	*
Modern multi-media computers in Classrooms (desktops)	1531	96.51	69.36	0	420	1.04	*	1.50	
Modern multi-media computers in Computer labs primarily serving general education (desktops)	1531	28.11	21.70	0	215	1.10	*	4.38	*
Modern multi-media computers in Mobile computer labs (laptops)	1531	5.22	13.85	0	150	4.14	*	24.83	*
Older computer or not multi-media in Media center (desktops)	1531	2.40	4.39	0	56	3.62	*	24.14	*
Older computer or not multi-media in Classrooms (desktops)	1531	45.74	51.94	0	340	1.84	*	4.74	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	1531	5.82	14.17	0	120	3.02	*	10.70	*
Older computer or not multi-media in Mobile computer labs (laptops)	1531	0.81	6.60	0	176	16.34	*	367.22	*
Percent student computers with Concept mapping software	1531	2.34	1.41	1	5	0.81		-0.70	
Percent student computers with Graphics software	1531	4.36	1.16	1	5	-1.69	*	1.56	
Percent student computers with Multimedia authoring software	1531	2.58	1.43	1	5	0.59		-1.03	
Percent student computers with Presentation software	1531	3.93	1.29	1	5	-0.80		-0.75	
Percent student computers with Spreadsheet software	1531	4.29	1.13	1	5	-1.46	*	0.96	
Percent student computers with Video editing software	1531	2.02	1.08	1	5	1.34	*	1.39	
Percent student computers with Web authoring software	1531	1.88	1.07	1	5	1.73	*	2.64	
Percent student computers with Basic word processing software	1531	4.74	0.83	1	5	-3.44	*	11.08	*
Percent student computers with Robust word processing software	1531	4.48	1.03	1	5	-2.01	*	3.02	*
Percent student computers with FCAT Explorer software	1531	4.04	1.31	1	5	-1.18	*	0.08	
Percent student computers with Other test prep tools software	1531	3.22	1.59	1	5	-0.19		-1.55	

Appendix C: Data Preparation Procedures (Continued)

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with Integrated Learning Systems software	1531	3.35	1.60	1	5	-0.34		-1.48	
Percent student computers with Content-specific skills practice/tutorials software	1531	4.03	1.25	1	5	-1.05	*	-0.15	
Percent student computers with Content-specific simulation software	1531	2.93	1.54	1	5	0.13		-1.50	
Percent student computers with Other content-specific resources software	1531	3.28	1.51	1	5	-0.20		-1.45	
Percent student computers with General Reference tools software	1531	3.89	1.35	1	5	-0.85		-0.67	
Administrative tasks	1531	4.11	1.13	1	5	-0.97		-0.35	
Delivery of lessons	1531	2.85	0.99	1	5	0.63		-0.55	
Desktop video production	1531	1.75	0.70	1	5	1.23	*	3.64	*
Email to other school or district staff	1531	4.55	0.93	1	5	-2.08	*	3.27	*
Email to students or parents	1531	2.90	1.19	1	5	0.35		-0.94	
Presentations	1531	2.67	0.95	1	5	0.91		0.13	
Research	1531	3.76	1.02	1	5	-0.39		-0.81	
Analysis of student assessment information	1531	3.90	1.16	1	5	-0.68		-0.73	
Video conferencing	1531	1.19	0.50	1	5	3.49	*	16.93	*
Webpage publishing	1531	1.92	0.75	1	5	1.47	*	4.24	*
Degree students use Drill and practice software	1531	1.89	0.92	1	5	0.80		0.04	
Degree students use Integrated Learning Systems	1531	1.95	1.22	1	5	1.24	*	0.53	
Degree students use Multimedia	1531	3.15	0.93	1	5	-0.22		-0.21	
Degree students use Simulation software	1531	3.40	0.98	1	5	-0.18		-0.35	
Degree students use Tool-based software	1531	2.33	1.04	1	5	0.34		-0.61	
% of technology $ devoted to professional development	1531	13.13	15.19	0	100	2.26	*	7.94	*
Level of school-based technical support	1430	2.14	1.03	1	4	0.44		-0.97	
Level of school-based instructional technology specialist support	1218	2.04	1.13	1	4	0.53		-1.21	
Level of dependability of the Internet connection	1529	4.15	0.70	1	5	-0.46		0.04	
Degree of delays when using the Internet	1529	3.85	0.66	1	5	-1.86	*	5.30	*
Time at your school for a technical issue to be resolved	1531	3.64	1.15	1	5	-0.16		-1.41	

Appendix C: Data Preparation Procedures (Continued)

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
High									
Modern multi-media computers in Media center (desktops)	350	28.44	19.05	0	120	1.22	*	2.94	
Modern multi-media computers in Classrooms (desktops)	350	147.48	185.97	0	1735	2.95	*	16.24	*
Modern multi-media computers in Computer labs primarily serving general education (desktops)	350	87.06	83.63	0	525	2.03	*	5.42	*
Modern multi-media computers in Mobile computer labs (laptops)	350	17.17	40.43	0	352	4.38	*	25.24	*
Older computer or not multi-media in Media center (desktops)	350	5.22	11.72	0	78	3.25	*	12.12	*
Older computer or not multi-media in Classrooms (desktops)	350	48.39	91.42	0	600	3.19	*	12.16	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	350	14.89	35.52	0	271	3.97	*	19.50	*
Older computer or not multi-media in Mobile computer labs (laptops)	350	1.13	9.19	0	120	10.66	*	123.71	*
Percent student computers with Concept mapping software	350	2.09	1.19	1	5	1.32	*	0.94	
Percent student computers with Graphics software	350	4.43	1.06	1	5	-1.66	*	1.28	
Percent student computers with Multimedia authoring software	350	2.53	1.29	1	5	0.81		-0.48	
Percent student computers with Presentation software	350	4.67	0.72	2	5	-2.29	*	4.44	*
Percent student computers with Spreadsheet software	350	4.75	0.64	1	5	-2.84	*	8.23	*
Percent student computers with Video editing software	350	2.18	0.77	1	5	2.18	*	5.86	*
Percent student computers with Web authoring software	350	2.56	1.09	1	5	1.24	*	0.47	
Percent student computers with Basic word processing software	350	4.95	0.36	2	5	-7.39	*	55.13	*
Percent student computers with Robust word processing software	350	4.86	0.49	2	5	-4.31	*	20.07	*
Percent student computers with FCAT Explorer software	350	4.16	1.18	1	5	-1.08	*	-0.27	
Percent student computers with Other test prep tools software	350	3.16	1.30	1	5	0.28		-1.40	
Percent student computers with Integrated Learning Systems software	350	2.65	1.20	1	5	0.74		-0.42	
Percent student computers with Content-specific skills practice/tutorials software	350	3.07	1.15	1	5	0.51		-1.08	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with Content-specific simulation software	350	2.68	1.14	1	5	0.81		-0.32	
Percent student computers with Other content-specific resources software	350	2.71	1.22	1	5	0.70		-0.66	
Percent student computers with General Reference tools software	350	3.99	1.30	1	5	-0.89		-0.70	
Administrative tasks	350	4.68	0.75	2	5	-2.43	*	4.96	*
Delivery of lessons	350	3.15	0.87	1	5	0.22		-0.64	
Desktop video production	350	2.08	0.58	1	5	1.63	*	6.06	*
Email to other school or district staff	350	4.71	0.75	1	5	-2.80	*	7.38	*
Email to students or parents	350	3.51	1.17	1	5	-0.20		-1.18	
Presentations	350	3.19	0.96	1	5	0.33		-0.78	
Research	350	4.10	0.92	2	5	-0.76		-0.31	
Analysis of student assessment information	350	3.68	1.23	1	5	-0.39		-1.19	
Video conferencing	350	1.37	0.54	1	5	1.52	*	4.67	*
Webpage publishing	350	2.21	0.69	1	5	2.14	*	6.06	*
Degree students use Drill and practice software	350	2.37	0.97	1	5	0.09		-0.90	
Degree students use Integrated Learning Systems	350	2.31	1.03	1	5	0.62		0.03	
Degree students use Multimedia	350	2.47	0.84	1	5	0.00		-0.43	
Degree students use Simulation software	350	3.57	0.85	1	5	-0.53		0.62	
Degree students use Tool-based software	350	1.44	0.69	1	4	1.52	*	1.78	
% of technology $ devoted to professional development	350	14.70	14.65	0	100	2.42	*	10.26	*
Level of school-based technical support	338	2.36	1.16	1	4	0.30		-1.37	
Level of school-based instructional technology specialist support	289	2.16	1.19	1	4	0.45		-1.36	
Level of dependability of the Internet connection	350	4.25	0.68	2	5	-0.57		0.14	
Degree of delays when using the Internet	350	3.89	0.52	1	5	-2.56	*	10.86	*
Time at your school for a technical issue to be resolved	350	3.81	1.11	2	5	-0.35		-1.26	
Middle									
Modern multi-media computers in Media center (desktops)	446	17.40	13.28	0	92	1.65	*	4.78	*
Modern multi-media computers in Classrooms (desktops)	446	108.07	106.46	0	564	1.51	*	2.68	

Appendix C: Data Preparation Procedures (Continued)

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Modern multi-media computers in Computer labs primarily serving general education (desktops)	446	57.52	44.50	0	350	1.56	*	5.34	*
Modern multi-media computers in Mobile computer labs (laptops)	446	11.61	23.04	0	128	2.57	*	7.30	*
Older computer or not multi-media in Media center (desktops)	446	4.69	9.75	0	92	3.77	*	20.97	*
Older computer or not multi-media in Classrooms (desktops)	446	46.50	73.77	0	531	2.57	*	8.69	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	446	12.98	28.79	0	260	3.48	*	17.42	*
Older computer or not multi-media in Mobile computer labs (laptops)	446	1.72	10.10	0	120	7.81	*	71.03	*
Percent student computers with Concept mapping software	446	2.29	1.32	1	5	1.04	*	-0.08	
Percent student computers with Graphics software	446	4.45	1.05	1	5	-1.78	*	1.80	
Percent student computers with Multimedia authoring software	446	2.52	1.35	1	5	0.76		-0.65	
Percent student computers with Presentation software	446	4.54	0.84	1	5	-1.95	*	3.26	*
Percent student computers with Spreadsheet software	446	4.70	0.69	1	5	-2.60	*	6.62	*
Percent student computers with Video editing software	446	2.13	1.02	1	5	1.50	*	2.12	
Percent student computers with Web authoring software	446	2.08	1.07	1	5	1.46	*	1.87	
Percent student computers with Basic word processing software	446	4.80	0.73	1	5	-3.98	*	15.14	*
Percent student computers with Robust word processing software	446	4.79	0.68	1	5	-3.83	*	15.20	*
Percent student computers with FCAT Explorer software	446	4.16	1.23	1	5	-1.18	*	0.05	
Percent student computers with Other test prep tools software	446	3.15	1.47	1	5	-0.01		-1.44	
Percent student computers with Integrated Learning Systems software	446	3.07	1.45	1	5	0.07		-1.41	
Percent student computers with Content-specific skills practice/tutorials software	446	3.38	1.32	1	5	-0.07		-1.38	
Percent student computers with Content-specific simulation software	446	2.79	1.35	1	5	0.41		-1.07	
Percent student computers with Other content-specific resources software	446	2.96	1.39	1	5	0.27		-1.28	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with General Reference tools software	446	4.00	1.31	1	5	-0.90		-0.67	
Administrative tasks	446	4.72	0.69	2	5	-2.63	*	6.34	*
Delivery of lessons	446	3.05	0.96	1	5	0.42		-0.68	
Desktop video production	446	1.95	0.65	1	5	1.21	*	4.14	*
Email to other school or district staff	446	4.73	0.78	1	5	-3.03	*	8.56	*
Email to students or parents	446	3.34	1.21	1	5	-0.02		-1.21	
Presentations	446	3.02	0.96	1	5	0.50		-0.78	
Research	446	3.98	0.94	2	5	-0.54		-0.68	
Analysis of student assessment information	446	3.84	1.18	1	5	-0.56		-0.95	
Video conferencing	446	1.24	0.51	1	5	2.61	*	10.19	*
Webpage publishing	446	2.13	0.90	1	5	1.58	*	3.05	*
Degree students use Drill and practice software	446	2.33	0.95	1	5	0.31		-0.46	
Degree students use Integrated Learning Systems	446	2.07	1.05	1	5	0.81		0.04	
Degree students use Multimedia	446	2.88	0.93	1	5	-0.18		-0.44	
Degree students use Simulation software	446	3.36	0.87	1	5	-0.27		-0.10	
Degree students use Tool-based software	446	1.95	0.89	1	5	0.62		-0.34	
% of technology $ devoted to professional development	446	14.06	14.09	0	100	1.77	*	5.27	*
Level of school-based technical support	409	2.33	1.10	0	4	0.30		-1.19	
Level of school-based instructional technology specialist support	364	2.21	1.16	1	4	0.37		-1.34	
Level of dependability of the Internet connection	445	4.18	0.73	1	5	-0.60		0.28	
Degree of delays when using the Internet	445	3.84	0.61	1	5	-2.24	*	7.26	*
Time at your school for a technical issue to be resolved	446	3.80	1.13	1	5	-0.41		-1.19	
			2004-05						
All School Levels									
Modern multi-media computers in Media center (desktops)	2327	13.76	14.19	0	130	2.55	*	10.38	*
Modern multi-media computers in Classrooms (desktops)	2327	113.67	108.88	0	2106	4.45	*	55.52	*
Modern multi-media computers in Computer labs primarily serving general education (desktops)	2327	42.08	48.68	0	525	3.63	*	20.95	*
Modern multi-media computers in Mobile computer labs (desktops)	2327	1.62	8.61	0	106	7.06	*	58.58	*

Appendix C: Data Preparation Procedures (Continued)

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Older computer or not multi-media in Media center (desktops)	2327	3.64	7.29	0	67	3.66	*	17.71	*
Older computer or not multi-media in Classrooms (desktops)	2327	50.46	79.26	0	2106	9.07	*	198.66	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	2327	8.22	20.46	0	220	4.30	*	26.44	*
Older computer or not multi-media in Mobile computer labs (desktops)	2327	0.94	6.61	0	120	10.59	*	141.36	*
Modern multi-media computers in Media center (laptop)	2326	2.72	60.18	0	2890	47.56	*	2282.47	*
Modern multi-media computers in Classrooms (laptops)	2327	11.64	92.87	0	2890	22.69	*	602.43	*
Modern multi-media computers in Computer labs primarily serving general education (laptops)	2326	4.21	61.62	0	2890	44.34	*	2072.27	*
Modern multi-media computers in Mobile computer labs (laptops)	2327	10.88	26.54	0	399	5.35	*	49.00	*
Older computer or not multi-media in Media center (laptops)	2327	0.38	3.03	0	70	13.90	*	240.43	*
Older computer or not multi-media in Classrooms (laptops)	2327	1.85	13.32	0	351	16.31	*	347.76	*
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	2327	0.71	8.23	0	220	18.64	*	405.80	*
Older computer or not multi-media in Mobile computer labs (laptops)	2327	0.18	2.56	0	75	20.58	*	499.50	*
Percent student computers with Concept mapping software	2327	2.27	1.38	1	5	0.93		-0.44	
Percent student computers with Graphics software	2327	4.37	1.17	1	5	-1.67	*	1.32	
Percent student computers with Multimedia authoring software	2327	2.38	1.37	1	5	0.82		-0.60	
Percent student computers with Presentation software	2327	4.33	1.10	1	5	-1.47	*	0.89	
Percent student computers with Spreadsheet software	2327	4.57	0.92	1	5	-2.25	*	4.28	*
Percent student computers with Video editing software	2327	2.14	1.14	1	5	1.20	*	0.75	
Percent student computers with Web authoring software	2327	2.03	1.14	1	5	1.42	*	1.40	
Percent student computers with Basic word processing software	2327	4.84	0.67	1	5	-4.65	*	21.29	*
Percent student computers with Robust word processing software	2327	4.65	0.89	1	5	-2.73	*	6.71	*
Percent student computers with FCAT Explorer software	2327	4.32	1.15	1	5	-1.64	*	1.57	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with Other test prep tools software	2327	3.45	1.52	1	5	-0.39		-1.37	
Percent student computers with Integrated Learning Systems software	2327	3.32	1.54	1	5	-0.24		-1.47	
Percent student computers with Content-specific skills practice/tutorials software	2327	3.87	1.27	1	5	-0.71		-0.85	
Percent student computers with Content-specific simulation software	2327	2.94	1.49	1	5	0.16		-1.42	
Percent student computers with Other content-specific resources software	2327	3.24	1.47	1	5	-0.12		-1.43	
Percent student computers with General Reference tools software	2327	4.07	1.31	1	5	-1.10	*	-0.22	
Administrative tasks	2327	4.48	0.92	1	5	-1.73	*	1.96	
Delivery of lessons	2327	3.09	0.99	1	5	0.30		-0.77	
Desktop video production	2327	1.87	0.73	1	5	1.26	*	3.47	*
Email to other school or district staff	2327	4.74	0.69	1	5	-2.87	*	8.01	*
Email to students or parents	2327	3.27	1.25	1	5	0.03		-1.24	
Presentations	2327	2.99	0.98	1	5	0.44		-0.66	
Research	2327	3.95	0.98	1	5	-0.61		-0.56	
Analysis of student assessment information	2327	4.11	1.07	1	5	-0.98		-0.13	
Video conferencing	2327	1.27	0.58	1	5	2.97	*	12.14	*
Webpage publishing	2327	2.09	0.86	1	5	1.68	*	3.77	*
Degree students use Drill and practice software	2327	3.63	1.01	1	5	-0.63		-0.12	
Degree students use Integrated Learning Systems	2327	3.49	1.20	1	5	-0.61		-0.51	
Degree students use Multimedia	2327	2.36	1.02	1	5	0.73		0.01	
Degree students use Simulation software	2327	2.02	0.97	1	5	0.83		0.09	
Degree students use Tool-based software	2327	3.13	1.08	1	5	0.03		-0.89	
% of technology $ devoted to professional development	2327	11.89	13.10	0	100	1.95	*	6.86	*
Level of school-based technical support	2202	2.35	1.09	1	4	0.03		-1.34	
Level of school-based instructional technology specialist support	1922	2.06	1.11	1	4	0.49		-1.23	
Level of dependability of the Internet connection	2327	4.41	0.74	1	5	-1.12	*	1.01	
Degree of delays when using the Internet	2327	3.85	0.66	1	5	-2.05	*	6.05	*
Time at your school for a technical issue to be resolved	2327	3.64	1.18	1	5	-0.17		-1.46	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Elementary									
Modern multi-media computers in Media center (desktops)	1531	8.74	7.06	0	46	1.55	*	3.41	*
Modern multi-media computers in Classrooms (desktops)	1531	102.05	72.59	0	476	1.06	*	1.65	
Modern multi-media computers in Computer labs primarily serving general education (desktops)	1531	27.98	22.03	0	143	0.84		1.46	
Modern multi-media computers in Mobile computer labs (desktops)	1531	0.93	5.32	0	75	7.14	*	60.07	*
Older computer or not multi-media in Media center (desktops)	1531	2.78	4.62	0	39	2.56	*	8.96	*
Older computer or not multi-media in Classrooms (desktops)	1531	49.07	54.02	0	350	1.76	*	4.31	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	1531	5.70	13.47	0	143	3.12	*	13.69	*
Older computer or not multi-media in Mobile computer labs (desktops)	1531	0.82	5.38	0	100	9.77	*	129.64	*
Modern multi-media computers in Media center (laptop)	1531	0.95	3.87	0	42	5.77	*	39.36	*
Modern multi-media computers in Classrooms (laptops)	1531	7.13	28.54	0	340	6.49	*	50.10	*
Modern multi-media computers in Computer labs primarily serving general education (laptops)	1531	2.09	9.13	0	143	6.56	*	61.01	*
Modern multi-media computers in Mobile computer labs (laptops)	1531	7.04	17.10	0	184	4.02	*	23.59	*
Older computer or not multi-media in Media center (laptops)	1531	0.25	1.82	0	40	13.23	*	226.59	*
Older computer or not multi-media in Classrooms (laptops)	1531	1.72	10.34	0	199	10.99	*	154.68	*
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	1531	0.43	4.99	0	143	19.52	*	481.34	*
Older computer or not multi-media in Mobile computer labs (laptops)	1531	0.11	1.44	0	29	16.50	*	290.39	*
Percent student computers with Concept mapping software	1531	2.33	1.43	1	5	0.83		-0.71	
Percent student computers with Graphics software	1531	4.35	1.20	1	5	-1.64	*	1.20	
Percent student computers with Multimedia authoring software	1531	2.37	1.42	1	5	0.80		-0.70	
Percent student computers with Presentation software	1531	4.14	1.20	1	5	-1.10	*	-0.17	
Percent student computers with Spreadsheet software	1531	4.45	1.02	1	5	-1.88	*	2.50	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with Video editing software	1531	2.07	1.19	1	5	1.18	*	0.51	
Percent student computers with Web authoring software	1531	1.85	1.09	1	5	1.71	*	2.47	
Percent student computers with Basic word processing software	1531	4.81	0.73	1	5	-4.18	*	16.90	*
Percent student computers with Robust word processing software	1531	4.56	0.97	1	5	-2.36	*	4.65	*
Percent student computers with FCAT Explorer software	1531	4.31	1.16	1	5	-1.69	*	1.74	
Percent student computers with Other test prep tools software	1531	3.47	1.60	1	5	-0.47		-1.40	
Percent student computers with Integrated Learning Systems software	1531	3.47	1.60	1	5	-0.45		-1.42	
Percent student computers with Content-specific skills practice/tutorials software	1531	4.14	1.19	1	5	-1.20	*	0.25	
Percent student computers with Content-specific simulation software	1531	2.98	1.58	1	5	0.07		-1.56	
Percent student computers with Other content-specific resources software	1531	3.39	1.52	1	5	-0.34		-1.39	
Percent student computers with General Reference tools software	1531	4.03	1.33	1	5	-1.07	*	-0.27	
Administrative tasks	1531	4.33	1.02	1	5	-1.36	*	0.66	
Delivery of lessons	1531	2.99	1.00	1	5	0.41		-0.75	
Desktop video production	1531	1.76	0.72	1	5	1.29	*	3.54	*
Email to other school or district staff	1531	4.71	0.72	1	5	-2.72	*	7.07	*
Email to students or parents	1531	3.07	1.22	1	5	0.23		-1.11	
Presentations	1531	2.83	0.96	1	5	0.64		-0.36	
Research	1531	3.86	1.00	1	5	-0.49		-0.71	
Analysis of student assessment information	1531	4.12	1.08	1	5	-1.01	*	-0.06	
Video conferencing	1531	1.23	0.58	1	5	3.54	*	16.24	*
Webpage publishing	1531	2.00	0.83	1	5	1.70	*	4.26	*
Degree students use Drill and practice software	1531	3.85	0.89	1	5	-0.83		0.86	
Degree students use Integrated Learning Systems	1531	3.59	1.22	1	5	-0.79		-0.26	
Degree students use Multimedia	1531	2.14	0.88	1	5	0.74		0.42	
Degree students use Simulation software	1531	2.00	0.97	1	5	0.77		-0.16	
Degree students use Tool-based software	1531	2.85	1.02	1	5	0.22		-0.70	
% of technology $ devoted to professional development	1531	11.46	13.18	0	100	1.96	*	6.67	*

Appendix C: Data Preparation Procedures (Continued)

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Level of school-based technical support	1439	2.24	1.06	1	4	0.16		-1.30	
Level of school-based instructional technology specialist support	1237	1.97	1.07	1	4	0.61		-1.04	
Level of dependability of the Internet connection	1531	4.38	0.74	1	5	-1.05	*	0.85	
Degree of delays when using the Internet	1531	3.84	0.65	1	5	-2.00	*	5.70	*
Time at your school for a technical issue to be resolved	1531	3.54	1.19	1	5	-0.04		-1.50	
High									
Modern multi-media computers in Media center (desktops)	350	30.75	21.65	0	130	1.35	*	3.11	*
Modern multi-media computers in Classrooms (desktops)	350	164.69	197.92	0	2106	3.84	*	28.10	*
Modern multi-media computers in Computer labs primarily serving general education (desktops)	350	83.89	86.23	0	525	2.15	*	5.66	*
Modern multi-media computers in Mobile computer labs (desktops)	350	3.33	13.79	0	102	4.89	*	25.26	*
Older computer or not multi-media in Media center (desktops)	350	5.09	11.04	0	63	2.85	*	8.35	*
Older computer or not multi-media in Classrooms (desktops)	350	56.37	146.33	0	2106	8.71	*	111.36	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	350	14.54	33.06	0	220	3.46	*	14.03	*
Older computer or not multi-media in Mobile computer labs (desktops)	350	1.24	8.91	0	115	9.05	*	94.36	*
Modern multi-media computers in Media center (laptop)	349	11.50	154.83	0	2890	18.57	*	346.26	*
Modern multi-media computers in Classrooms (laptops)	350	31.42	223.23	0	2890	10.44	*	115.21	*
Modern multi-media computers in Computer labs primarily serving general education (laptops)	349	13.72	156.67	0	2890	17.91	*	329.13	*
Modern multi-media computers in Mobile computer labs (laptops)	350	20.18	44.65	0	399	4.65	*	29.81	*
Older computer or not multi-media in Media center (laptops)	350	1.03	6.02	0	70	8.49	*	81.68	*
Older computer or not multi-media in Classrooms (laptops)	350	1.59	16.51	0	300	17.13	*	308.62	*
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	350	1.70	15.06	0	220	11.91	*	154.48	*
Older computer or not multi-media in Mobile computer labs (laptops)	350	0.55	5.57	0	75	11.37	*	135.98	*

Appendix C: Data Preparation Procedures (Continued)

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with Concept mapping software	350	2.05	1.18	1	5	1.33	*	1.02	
Percent student computers with Graphics software	350	4.45	1.05	1	5	-1.69	*	1.39	
Percent student computers with Multimedia authoring software	350	2.39	1.19	1	5	0.95		0.06	
Percent student computers with Presentation software	350	4.77	0.65	1	5	-3.24	*	10.76	*
Percent student computers with Spreadsheet software	350	4.83	0.56	1	5	-4.01	*	17.18	*
Percent student computers with Video editing software	350	2.30	0.92	1	5	1.68	*	2.70	
Percent student computers with Web authoring software	350	2.59	1.10	1	5	1.19	*	0.38	
Percent student computers with Basic word processing software	350	4.91	0.50	1	5	-6.28	*	40.76	*
Percent student computers with Robust word processing software	350	4.82	0.67	1	5	-4.21	*	17.69	*
Percent student computers with FCAT Explorer software	350	4.31	1.08	1	5	-1.34	*	0.42	
Percent student computers with Other test prep tools software	350	3.32	1.30	1	5	0.06		-1.41	
Percent student computers with Integrated Learning Systems software	350	2.82	1.26	1	5	0.45		-0.92	
Percent student computers with Content-specific skills practice/tutorials software	350	3.15	1.21	1	5	0.32		-1.21	
Percent student computers with Content-specific simulation software	350	2.78	1.19	1	5	0.55		-0.75	
Percent student computers with Other content-specific resources software	350	2.88	1.25	1	5	0.49		-0.96	
Percent student computers with General Reference tools software	350	4.13	1.25	1	5	-1.11	*	-0.22	
Administrative tasks	350	4.79	0.58	2	5	-3.13	*	9.98	*
Delivery of lessons	350	3.26	0.90	1	5	0.13		-0.50	
Desktop video production	350	2.13	0.65	1	5	1.85	*	5.93	*
Email to other school or district staff	350	4.75	0.67	2	5	-2.88	*	7.83	*
Email to students or parents	350	3.69	1.15	1	5	-0.34		-1.20	
Presentations	350	3.41	0.93	2	5	0.10		-0.86	
Research	350	4.19	0.88	2	5	-0.87		-0.04	
Analysis of student assessment information	350	3.99	1.05	1	5	-0.73		-0.53	
Video conferencing	350	1.45	0.61	1	4	1.33	*	2.20	
Webpage publishing	350	2.28	0.80	1	5	2.03	*	4.58	*

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Degree students use Drill and practice software	350	3.29	1.12	1	5	-0.14		-0.97	
Degree students use Integrated Learning Systems	350	3.32	1.17	1	5	-0.28		-0.87	
Degree students use Multimedia	350	3.08	1.13	1	5	0.18		-1.05	
Degree students use Simulation software	350	2.00	1.03	1	5	1.07	*	0.74	
Degree students use Tool-based software	350	3.97	0.93	1	5	-0.67		-0.25	
% of technology $ devoted to professional development	350	12.70	13.72	0	100	2.48	*	10.74	*
Level of school-based technical support	340	2.70	1.11	1	4	-0.40		-1.18	
Level of school-based instructional technology specialist support	302	2.33	1.23	1	4	0.15		-1.59	
Level of dependability of the Internet connection	350	4.44	0.74	2	5	-1.18	*	0.74	
Degree of delays when using the Internet	350	3.87	0.64	1	5	-1.94	*	6.39	*
Time at your school for a technical issue to be resolved	350	3.83	1.11	2	5	-0.37		-1.25	
Middle									
Modern multi-media computers in Media center (desktops)	446	17.63	13.61	0	95	1.51	*	4.23	*
Modern multi-media computers in Classrooms (desktops)	446	113.51	103.00	0	548	1.14	*	1.01	
Modern multi-media computers in Computer labs primarily serving general education (desktops)	446	57.67	50.84	0	364	1.94	*	6.81	*
Modern multi-media computers in Mobile computer labs (desktops)	446	2.62	11.65	0	106	5.60	*	35.66	*
Older computer or not multi-media in Media center (desktops)	446	5.44	10.08	0	67	2.71	*	8.61	*
Older computer or not multi-media in Classrooms (desktops)	446	50.61	77.29	0	478	2.38	*	6.77	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	446	11.89	25.32	0	180	3.09	*	12.06	*
Older computer or not multi-media in Mobile computer labs (desktops)	446	1.12	8.17	0	120	10.55	*	128.55	*
Modern multi-media computers in Media center (laptop)	446	1.90	7.05	0	60	4.66	*	24.09	*
Modern multi-media computers in Classrooms (laptops)	446	11.61	53.14	0	841	10.19	*	139.50	*
Modern multi-media computers in Computer labs primarily serving general education (laptops)	446	4.07	16.35	0	161	5.08	*	30.80	*

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Modern multi-media computers in Mobile computer labs (laptops)	446	16.77	30.98	0	253	2.73	*	10.43	*
Older computer or not multi-media in Media center (laptops)	446	0.32	2.79	0	40	11.67	*	148.49	*
Older computer or not multi-media in Classrooms (laptops)	446	2.51	18.62	0	351	15.48	*	279.50	*
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	446	0.89	9.43	0	180	16.30	*	297.91	*
Older computer or not multi-media in Mobile computer labs (laptops)	446	0.14	1.60	0	30	16.34	*	289.28	*
Percent student computers with Concept mapping software	446	2.23	1.31	1	5	0.98		-0.20	
Percent student computers with Graphics software	446	4.40	1.15	1	5	-1.74	*	1.54	
Percent student computers with Multimedia authoring software	446	2.43	1.37	1	5	0.81		-0.60	
Percent student computers with Presentation software	446	4.62	0.80	1	5	-2.31	*	4.86	*
Percent student computers with Spreadsheet software	446	4.76	0.65	1	5	-3.06	*	9.93	*
Percent student computers with Video editing software	446	2.26	1.11	1	5	1.29	*	1.04	
Percent student computers with Web authoring software	446	2.22	1.19	1	5	1.22	*	0.65	
Percent student computers with Basic word processing software	446	4.90	0.56	1	5	-6.04	*	36.67	*
Percent student computers with Robust word processing software	446	4.80	0.66	1	5	-3.71	*	14.04	*
Percent student computers with FCAT Explorer software	446	4.35	1.14	1	5	-1.68	*	1.65	
Percent student computers with Other test prep tools software	446	3.49	1.39	1	5	-0.33		-1.26	
Percent student computers with Integrated Learning Systems software	446	3.21	1.43	1	5	-0.10		-1.34	
Percent student computers with Content-specific skills practice/tutorials software	446	3.53	1.29	1	5	-0.26		-1.28	
Percent student computers with Content-specific simulation software	446	2.92	1.36	1	5	0.24		-1.21	
Percent student computers with Other content-specific resources software	446	3.03	1.38	1	5	0.16		-1.29	
Percent student computers with General Reference tools software	446	4.15	1.25	1	5	-1.15	*	-0.15	
Administrative tasks	446	4.76	0.60	2	5	-2.74	*	7.16	*

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Delivery of lessons	446	3.27	0.97	1	5	0.11		-0.73	
Desktop video production	446	2.00	0.76	1	5	1.28	*	3.25	*
Email to other school or district staff	446	4.81	0.58	1	5	-3.56	*	13.48	*
Email to students or parents	446	3.63	1.25	1	5	-0.36		-1.14	
Presentations	446	3.23	0.94	1	5	0.24		-0.72	
Research	446	4.08	0.97	1	5	-0.83		-0.14	
Analysis of student assessment information	446	4.20	1.06	1	5	-1.11	*	0.09	
Video conferencing	446	1.25	0.52	1	5	2.69	*	10.37	*
Webpage publishing	446	2.24	0.95	1	5	1.56	*	2.44	
Degree students use Drill and practice software	446	3.16	1.08	1	5	-0.17		-0.82	
Degree students use Integrated Learning Systems	446	3.30	1.10	1	5	-0.30		-0.66	
Degree students use Multimedia	446	2.55	1.07	1	5	0.60		-0.39	
Degree students use Simulation software	446	2.07	0.96	1	5	0.83		0.32	
Degree students use Tool-based software	446	3.43	0.98	1	5	-0.19		-0.79	
% of technology $ devoted to professional development	446	12.71	12.25	0	80	1.39	*	3.18	*
Level of school-based technical support	423	2.45	1.08	1	4	-0.11		-1.30	
Level of school-based instructional technology specialist support	383	2.15	1.12	1	4	0.34		-1.33	
Level of dependability of the Internet connection	446	4.46	0.73	1	5	-1.36	*	2.01	
Degree of delays when using the Internet	446	3.86	0.68	1	5	-2.28	*	7.01	*
Time at your school for a technical issue to be resolved	446	3.84	1.16	1	5	-0.46		-1.26	
			2005-06						
All School Levels									
Modern multi-media computers in Media center (desktops)	2327	10.65	13.69	0	120	2.58	*	9.44	*
Modern multi-media computers in Classrooms (desktops)	2327	79.67	106.77	0	2000	5.30	*	62.15	*
Modern multi-media computers in Computer labs primarily serving general education (desktops)	2327	31.31	41.31	0	538	3.87	*	25.36	*
Modern multi-media computers in Mobile computer labs (laptops)	2327	14.13	47.79	0	859	6.69	*	67.33	*
Older computer or not multi-media in Media center (desktops)	2327	6.48	9.90	0	89	2.96	*	12.55	*
Older computer or not multi-media in Classrooms (desktops)	2327	73.50	74.03	0	721	1.72	*	5.57	*

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	2327	15.82	28.65	0	370	4.09	*	30.71	*
Modern multi-media computers in Media center (laptops)	2327	1.94	10.13	0	214	10.77	*	162.35	*
Modern multi-media computers in Classrooms (laptops)	2327	12.29	83.00	0	2520	20.80	*	560.10	*
Modern multi-media computers in Computer labs primarily serving general education (laptops)	2327	3.47	23.93	0	496	13.28	*	220.38	*
Older computer or not multi-media in Media center (laptops)	2327	0.65	4.00	0	84	10.41	*	148.28	*
Older computer or not multi-media in Classrooms (laptops)	2326	3.06	18.09	0	314	10.63	*	134.49	*
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	2327	0.84	8.56	0	238	17.95	*	400.49	*
Older computer or not multi-media in Mobile computer labs (laptops)	2327	3.43	16.35	0	361	10.41	*	156.58	*
Percent student computers with Concept mapping software	2327	2.54	1.52	1	5	0.60		-1.15	
Percent student computers with Graphics software	2327	4.45	1.12	1	5	-1.94	*	2.40	
Percent student computers with Multimedia authoring software	2327	2.71	1.45	1	5	0.46		-1.20	
Percent student computers with Presentation software	2327	4.47	0.96	1	5	-1.86	*	2.58	
Percent student computers with Spreadsheet software	2327	4.61	0.87	1	5	-2.48	*	5.61	*
Percent student computers with Video editing software	2327	2.29	1.26	1	5	0.99		-0.07	
Percent student computers with Web authoring software	2327	1.99	1.15	1	5	1.45	*	1.43	
Percent student computers with Basic word processing software	2327	4.87	0.60	1	5	-5.08	*	26.12	*
Percent student computers with Robust word processing software	2327	4.63	0.95	1	5	-2.72	*	6.43	*
Percent student computers with FCAT Explorer software	2327	4.75	0.71	1	5	-3.38	*	11.72	*
Percent student computers with Other test prep tools software	2327	3.70	1.51	1	5	-0.70		-1.07	
Percent student computers with Integrated Learning Systems software	2327	3.20	1.54	1	5	-0.07		-1.55	
Percent student computers with Content-specific skills practice/tutorials software	2327	3.60	1.38	1	5	-0.38		-1.32	

Appendix C: Data Preparation Procedures (Continued)

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with Content-specific simulation software	2327	2.06	1.33	1	5	1.19	*	0.15	
Percent student computers with Other content-specific resources software	2327	3.06	1.56	1	5	0.07		-1.55	
Percent student computers with General Reference tools software	2327	4.11	1.33	1	5	-1.16	*	-0.18	
Administrative tasks	2326	4.67	0.74	1	5	-2.54	*	6.11	*
Delivery of lessons	2326	3.25	1.03	1	5	0.17		-0.98	
Desktop video production	2326	1.91	0.79	1	5	1.10	*	2.01	
Email to other school or district staff	2326	4.79	0.63	1	5	-3.43	*	12.04	*
Email to students or parents	2326	3.35	1.22	1	5	-0.08		-1.16	
Presentations	2326	3.05	1.01	1	5	0.37		-0.83	
Research	2326	4.03	0.96	1	5	-0.69		-0.47	
Analysis of student assessment information	2326	4.28	0.98	1	5	-1.23	*	0.55	
Video conferencing	2326	1.30	0.63	1	5	2.85	*	10.65	*
Webpage publishing	2326	2.09	0.91	1	5	1.41	*	2.43	
Degree students use Drill and practice software	2326	3.72	1.09	1	5	-0.76		-0.04	
Degree students use Integrated Learning Systems	2326	3.71	1.26	1	5	-0.82		-0.35	
Degree students use Multimedia	2326	2.70	1.25	1	5	0.37		-0.93	
Degree students use Presentation	2326	2.62	1.24	1	5	0.49		-0.85	
Degree students use Simulation software	2326	1.98	1.11	1	5	0.98		0.04	
Degree students use Research software	2326	3.70	1.09	1	5	-0.41		-0.84	
Degree students use Tool-based software	2326	3.43	1.21	1	5	-0.25		-1.04	
% of technology $ devoted to professional development	2326	11.74	13.45	0	100	2.10	*	7.51	*
Level of school-based technical support	2326	2.36	1.15	1	6	0.26		-0.72	
Level of school-based instructional technology specialist support	2326	2.29	1.36	1	5	0.58		-0.97	
Level of dependability of the Internet connection	2327	4.50	0.74	1	5	-1.51	*	2.08	
Degree of delays when using the Internet	2327	3.64	1.01	1	5	-1.37	*	1.21	
Time at your school for a technical issue to be resolved	2327	3.47	1.14	1	5	0.04		-1.35	
Elementary									
Modern multi-media computers in Media center (desktops)	1531	6.71	7.56	0	90	2.40	*	12.36	*
Modern multi-media computers in Classrooms (desktops)	1531	70.62	68.73	0	436	1.46	*	2.67	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Modern multi-media computers in Computer labs primarily serving general education (desktops)	1531	21.40	20.93	0	199	1.51	*	6.60	*
Modern multi-media computers in Mobile computer labs (laptops)	1531	9.01	30.73	0	240	4.92	*	26.08	*
Older computer or not multi-media in Media center (desktops)	1531	4.76	6.44	0	89	3.70	*	30.35	*
Older computer or not multi-media in Classrooms (desktops)	1531	75.80	63.58	0	393	0.91		0.76	
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	1531	10.77	17.52	0	143	1.95	*	5.33	*
Modern multi-media computers in Media center (laptops)	1531	1.27	6.79	0	168	12.72	*	257.24	*
Modern multi-media computers in Classrooms (laptops)	1531	8.33	32.90	0	360	5.39	*	33.84	*
Modern multi-media computers in Computer labs primarily serving general education (laptops)	1531	1.86	10.27	0	192	10.27	*	141.04	*
Older computer or not multi-media in Media center (laptops)	1531	0.45	2.66	0	30	7.86	*	69.21	*
Older computer or not multi-media in Classrooms (laptops)	1531	3.20	17.59	0	237	9.58	*	105.15	*
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	1531	0.63	6.42	0	190	20.81	*	546.89	*
Older computer or not multi-media in Mobile computer labs (laptops)	1531	2.07	9.55	0	128	8.04	*	82.27	*
Percent student computers with Concept mapping software	1531	2.61	1.57	1	5	0.50		-1.32	
Percent student computers with Graphics software	1531	4.42	1.17	1	5	-1.89	*	2.17	
Percent student computers with Multimedia authoring software	1531	2.72	1.50	1	5	0.39		-1.32	
Percent student computers with Presentation software	1531	4.31	1.07	1	5	-1.46	*	1.07	
Percent student computers with Spreadsheet software	1531	4.49	0.99	1	5	-2.03	*	3.22	*
Percent student computers with Video editing software	1531	2.21	1.31	1	5	0.99		-0.18	
Percent student computers with Web authoring software	1531	1.81	1.08	1	5	1.76	*	2.67	
Percent student computers with Basic word processing software	1531	4.82	0.71	1	5	-4.27	*	18.01	*
Percent student computers with Robust word processing software	1531	4.52	1.06	1	5	-2.27	*	3.99	*

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with FCAT Explorer software	1531	4.73	0.73	1	5	-3.19	*	10.65	*
Percent student computers with Other test prep tools software	1531	3.67	1.58	1	5	-0.71		-1.14	
Percent student computers with Integrated Learning Systems software	1531	3.36	1.65	1	5	-0.33		-1.57	
Percent student computers with Content-specific skills practice/tutorials software	1531	3.94	1.27	1	5	-0.86		-0.55	
Percent student computers with Content-specific simulation software	1531	1.97	1.38	1	5	1.26	*	0.18	
Percent student computers with Other content-specific resources software	1531	3.19	1.62	1	5	-0.13		-1.61	
Percent student computers with General Reference tools software	1531	4.10	1.34	1	5	-1.16	*	-0.17	
Administrative tasks	1530	4.56	0.84	1	5	-2.06	*	3.57	*
Delivery of lessons	1530	3.13	1.05	1	5	0.31		-0.94	
Desktop video production	1530	1.79	0.76	1	5	1.13	*	2.08	
Email to other school or district staff	1530	4.77	0.67	1	5	-3.27	*	10.78	*
Email to students or parents	1530	3.16	1.21	1	5	0.09		-1.09	
Presentations	1530	2.86	0.99	1	5	0.59		-0.56	
Research	1530	3.97	0.99	1	5	-0.64		-0.57	
Analysis of student assessment information	1530	4.28	0.99	1	5	-1.25	*	0.57	
Video conferencing	1530	1.27	0.63	1	5	3.17	*	12.67	*
Webpage publishing	1530	1.99	0.90	1	5	1.49	*	2.84	
Degree students use Drill and practice software	1530	3.84	1.01	1	5	-0.90		0.58	
Degree students use Integrated Learning Systems	1530	3.73	1.27	1	5	-0.92		-0.17	
Degree students use Multimedia	1530	2.36	1.08	1	5	0.58		-0.40	
Degree students use Presentation	1530	2.16	1.02	1	5	0.86		0.20	
Degree students use Simulation software	1530	1.90	1.06	1	5	1.03	*	0.16	
Degree students use Research software	1530	3.42	1.06	1	5	-0.17		-0.88	
Degree students use Tool-based software	1530	3.07	1.13	1	5	0.01		-0.90	
% of technology $ devoted to professional development	1530	11.16	13.13	0	100	2.03	*	6.95	*
Level of school-based technical support	1530	2.24	1.15	1	6	0.47		-0.44	
Level of school-based instructional technology specialist support	1530	2.23	1.38	1	5	0.72		-0.80	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Level of dependability of the Internet connection	1531	4.46	0.77	1	5	-1.41	*	1.76	
Degree of delays when using the Internet	1531	3.59	1.04	1	5	-1.31	*	0.92	
Time at your school for a technical issue to be resolved	1531	3.37	1.15	1	5	0.15		-1.35	
High									
Modern multi-media computers in Media center (desktops)	350	24.38	21.85	0	120	1.08	*	1.25	
Modern multi-media computers in Classrooms (desktops)	350	116.77	201.32	0	2000	4.27	*	27.68	*
Modern multi-media computers in Computer labs primarily serving general education (desktops)	350	63.89	74.74	0	538	2.32	*	7.40	*
Modern multi-media computers in Mobile computer labs (laptops)	350	26.53	80.79	0	859	5.70	*	41.56	*
Older computer or not multi-media in Media center (desktops)	350	11.35	16.40	0	85	1.77	*	3.11	*
Older computer or not multi-media in Classrooms (desktops)	350	69.66	101.19	0	721	2.51	*	8.35	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	350	30.62	49.91	0	370	3.25	*	14.82	*
Modern multi-media computers in Media center (laptops)	350	3.09	13.00	0	158	7.04	*	65.82	*
Modern multi-media computers in Classrooms (laptops)	350	29.21	189.35	0	2520	10.92	*	131.65	*
Modern multi-media computers in Computer labs primarily serving general education (laptops)	350	6.26	40.45	0	496	10.44	*	120.54	*
Older computer or not multi-media in Media center (laptops)	350	1.05	4.55	0	32	4.98	*	25.22	*
Older computer or not multi-media in Classrooms (laptops)	349	3.10	20.57	0	314	11.47	*	157.24	*
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	350	0.98	8.75	0	128	12.08	*	158.22	*
Older computer or not multi-media in Mobile computer labs (laptops)	350	5.70	20.68	0	210	5.62	*	39.02	*
Percent student computers with Concept mapping software	350	2.31	1.37	1	5	1.00	*	-0.23	
Percent student computers with Graphics software	350	4.47	1.05	1	5	-1.81	*	1.82	
Percent student computers with Multimedia authoring software	350	2.70	1.23	1	5	0.77		-0.62	
Percent student computers with Presentation software	350	4.82	0.57	2	5	-3.53	*	12.44	*

Appendix C: Data Preparation Procedures (Continued)

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with Spreadsheet software	350	4.88	0.47	2	5	-4.32	*	19.45	*
Percent student computers with Video editing software	350	2.53	1.07	1	5	1.22	*	0.53	
Percent student computers with Web authoring software	350	2.61	1.15	1	5	1.02	*	0.00	
Percent student computers with Basic word processing software	350	4.96	0.31	2	5	-8.55	*	75.59	*
Percent student computers with Robust word processing software	350	4.87	0.57	1	5	-5.16	*	27.49	*
Percent student computers with FCAT Explorer software	350	4.77	0.72	1	5	-3.40	*	10.92	*
Percent student computers with Other test prep tools software	350	3.69	1.31	1	5	-0.46		-1.20	
Percent student computers with Integrated Learning Systems software	350	2.70	1.16	1	5	0.80		-0.41	
Percent student computers with Content-specific skills practice/tutorials software	350	2.64	1.26	1	5	0.75		-0.58	
Percent student computers with Content-specific simulation software	350	2.21	1.13	1	5	1.26	*	0.97	
Percent student computers with Other content-specific resources software	350	2.60	1.28	1	5	0.78		-0.55	
Percent student computers with General Reference tools software	350	4.18	1.27	1	5	-1.20	*	-0.11	
Administrative tasks	350	4.89	0.40	2	5	-4.46	*	22.50	*
Delivery of lessons	350	3.45	0.93	2	5	0.11		-0.85	
Desktop video production	350	2.16	0.67	1	5	1.46	*	3.99	*
Email to other school or district staff	350	4.83	0.54	2	5	-3.76	*	14.70	*
Email to students or parents	350	3.78	1.09	1	5	-0.41		-0.98	
Presentations	350	3.44	0.94	2	5	0.08		-0.88	
Research	350	4.13	0.89	2	5	-0.73		-0.35	
Analysis of student assessment information	350	4.15	1.00	1	5	-0.91		-0.20	
Video conferencing	350	1.38	0.59	1	5	1.70	*	4.46	*
Webpage publishing	350	2.31	0.81	1	5	1.63	*	2.96	
Degree students use Drill and practice software	350	3.55	1.24	1	5	-0.57		-0.69	
Degree students use Integrated Learning Systems	350	3.72	1.28	1	5	-0.67		-0.74	
Degree students use Multimedia	350	3.81	1.20	1	5	-0.77		-0.45	
Degree students use Presentation	350	3.77	1.11	1	5	-0.49		-0.99	
Degree students use Simulation software	350	2.09	1.19	1	5	0.86		-0.37	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Degree students use Research software	350	4.49	0.77	1	5	-1.51	*	1.91	
Degree students use Tool-based software	350	4.43	0.87	1	5	-1.56	*	1.74	
% of technology $ devoted to professional development	350	13.08	14.09	0	100	2.26	*	9.02	*
Level of school-based technical support	350	2.69	1.15	1	6	-0.25		-0.89	
Level of school-based instructional technology specialist support	350	2.45	1.33	1	5	0.26		-1.30	
Level of dependability of the Internet connection	350	4.61	0.66	2	5	-1.77	*	2.84	
Degree of delays when using the Internet	350	3.68	0.97	1	5	-1.46	*	1.68	
Time at your school for a technical issue to be resolved	350	3.64	1.10	2	5	-0.15		-1.30	
Middle									
Modern multi-media computers in Media center (desktops)	446	13.37	14.11	0	99	2.02	*	6.81	*
Modern multi-media computers in Classrooms (desktops)	446	81.60	100.97	0	548	1.64	*	2.54	
Modern multi-media computers in Computer labs primarily serving general education (desktops)	446	39.78	42.29	0	364	2.24	*	9.96	*
Modern multi-media computers in Mobile computer labs (laptops)	446	21.98	57.44	0	400	4.02	*	17.77	*
Older computer or not multi-media in Media center (desktops)	446	8.53	11.19	0	65	1.63	*	2.70	
Older computer or not multi-media in Classrooms (desktops)	446	68.61	81.63	0	421	1.67	*	2.73	
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	446	21.54	31.44	0	200	2.01	*	5.42	*
Modern multi-media computers in Media center (laptops)	446	3.30	15.50	0	214	8.50	*	92.70	*
Modern multi-media computers in Classrooms (laptops)	446	12.62	62.36	0	936	9.24	*	115.05	*
Modern multi-media computers in Computer labs primarily serving general education (laptops)	446	6.80	36.34	0	420	7.35	*	61.30	*
Older computer or not multi-media in Media center (laptops)	446	0.99	6.54	0	84	9.20	*	94.93	*
Older computer or not multi-media in Classrooms (laptops)	446	2.56	17.76	0	300	12.88	*	193.72	*
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	446	1.46	13.44	0	238	13.78	*	223.63	*

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Older computer or not multi-media in Mobile computer labs (laptops)	446	6.29	27.02	0	361	8.54	*	90.07	*
Percent student computers with Concept mapping software	446	2.49	1.45	1	5	0.67		-0.94	
Percent student computers with Graphics software	446	4.54	0.99	1	5	-2.15	*	3.49	*
Percent student computers with Multimedia authoring software	446	2.68	1.42	1	5	0.55		-1.07	
Percent student computers with Presentation software	446	4.75	0.63	1	5	-3.06	*	10.51	*
Percent student computers with Spreadsheet software	446	4.83	0.49	1	5	-3.72	*	16.98	*
Percent student computers with Video editing software	446	2.38	1.20	1	5	1.10	*	0.24	
Percent student computers with Web authoring software	446	2.14	1.20	1	5	1.29	*	0.81	
Percent student computers with Basic word processing software	446	4.96	0.31	1	5	-9.70	*	102.44	*
Percent student computers with Robust word processing software	446	4.80	0.71	1	5	-4.10	*	17.00	*
Percent student computers with FCAT Explorer software	446	4.83	0.65	1	5	-4.26	*	18.63	*
Percent student computers with Other test prep tools software	446	3.81	1.42	1	5	-0.76		-0.90	
Percent student computers with Integrated Learning Systems software	446	3.02	1.31	1	5	0.32		-1.19	
Percent student computers with Content-specific skills practice/tutorials software	446	3.15	1.37	1	5	0.23		-1.40	
Percent student computers with Content-specific simulation software	446	2.25	1.29	1	5	1.04	*	-0.03	
Percent student computers with Other content-specific resources software	446	2.95	1.45	1	5	0.28		-1.38	
Percent student computers with General Reference tools software	446	4.13	1.33	1	5	-1.15	*	-0.26	
Administrative tasks	446	4.89	0.44	2	5	-4.61	*	23.47	*
Delivery of lessons	446	3.50	0.94	2	5	-0.12		-0.88	
Desktop video production	446	2.14	0.87	1	5	1.09	*	1.43	
Email to other school or district staff	446	4.84	0.52	2	5	-3.66	*	13.84	*
Email to students or parents	446	3.67	1.21	1	5	-0.41		-1.07	
Presentations	446	3.40	0.95	1	5	0.06		-0.86	
Research	446	4.15	0.89	2	5	-0.78		-0.29	
Analysis of student assessment information	446	4.39	0.91	1	5	-1.46	*	1.43	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Video conferencing	446	1.34	0.66	1	5	2.64	*	8.91	*
Webpage publishing	446	2.28	0.95	1	5	1.32	*	1.66	
Degree students use Drill and practice software	446	3.44	1.20	1	5	-0.38		-0.84	
Degree students use Integrated Learning Systems	446	3.64	1.23	1	5	-0.63		-0.63	
Degree students use Multimedia	446	3.00	1.27	1	5	0.11		-1.10	
Degree students use Presentation	446	3.27	1.17	1	5	0.03		-1.23	
Degree students use Simulation software	446	2.17	1.19	1	5	0.88		-0.16	
Degree students use Research software	446	4.03	0.98	1	5	-0.74		-0.37	
Degree students use Tool-based software	446	3.87	1.09	1	5	-0.66		-0.59	
% of technology $ devoted to professional development	446	12.69	13.90	0	97	2.17	*	7.78	*
Level of school-based technical support	446	2.51	1.11	1	6	-0.04		-0.78	
Level of school-based instructional technology specialist support	446	2.40	1.32	1	5	0.38		-1.10	
Level of dependability of the Internet connection	446	4.56	0.70	1	5	-1.68	*	2.86	
Degree of delays when using the Internet	446	3.77	0.94	1	5	-1.50	*	2.09	
Time at your school for a technical issue to be resolved	446	3.66	1.09	1	5	-0.17		-1.22	
			2006-07						
All School Levels									
Modern multi-media computers in Media center (desktops)	2327	11.16	15.25	0	186	3.34	*	20.68	*
Modern multi-media computers in Media center (laptops)	2327	1.73	12.49	0	446	24.94	*	797.45	*
Modern multi-media computers in Classrooms (desktops)	2327	81.74	93.73	0	909	2.22	*	8.80	*
Modern multi-media computers in Classrooms (laptops)	2327	12.31	83.86	0	2580	20.96	*	563.86	*
Modern multi-media computers in Computer labs primarily serving general education (desktops)	2327	28.69	42.81	0	685	5.40	*	53.08	*
Modern multi-media computers in Computer labs primarily serving general education (laptops)	2327	2.54	20.57	0	600	19.34	*	471.73	*
Modern multi-media computers in Mobile computer labs (desktops)	2327	23.07	64.28	0	1204	5.97	*	63.90	*
Modern multi-media computers in Mobile computer labs (laptops)	2327	5.80	41.91	0	925	11.30	*	166.64	*

Appendix C: Data Preparation Procedures (Continued)

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Older computer or not multi-media in Media center (desktops)	2327	5.23	9.60	0	99	3.45	*	16.92	*
Older computer or not multi-media in Media center (laptops)	2327	0.63	4.41	0	128	14.66	*	331.90	*
Older computer or not multi-media in Classrooms (desktops)	2327	64.48	79.13	0	722	2.14	*	8.34	*
Older computer or not multi-media in Classrooms (laptops)	2327	3.07	15.81	0	260	9.04	*	101.42	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	2327	12.96	26.62	0	411	4.05	*	31.34	*
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	2327	0.48	3.94	0	97	13.06	*	228.33	*
Older computer or not multi-media in Mobile computer labs (desktops)	2327	6.02	23.39	0	474	8.11	*	102.24	*
Older computer or not multi-media in Mobile computer labs (laptops)	2327	1.55	41.77	0	1975	45.52	*	2145.63	*
Percent student computers with Concept mapping software	2327	1.58	1.55	0	4	0.56		-1.25	
Percent student computers with Graphics software	2327	3.50	1.10	0	4	-2.11	*	3.08	*
Percent student computers with Multimedia authoring software	2327	1.80	1.54	0	4	0.32		-1.44	
Percent student computers with Presentation software	2327	3.64	0.82	0	4	-2.52	*	5.93	*
Percent student computers with Spreadsheet software	2327	3.71	0.77	0	4	-3.10	*	9.66	*
Percent student computers with Video editing software	2327	1.54	1.46	0	4	0.65		-1.02	
Percent student computers with Web authoring software	2327	0.91	1.16	0	4	1.53	*	1.61	
Percent student computers with Basic word processing software	2327	3.90	0.53	0	4	-5.92	*	36.12	*
Percent student computers with Robust word processing software	2327	3.67	0.92	0	4	-2.99	*	8.05	*
Percent student computers with FCAT Explorer software	2327	3.85	0.56	0	4	-4.58	*	22.83	*
Percent student computers with Other test prep tools software	2327	2.83	1.48	0	4	-0.85		-0.85	
Percent student computers with Integrated Learning Systems software	2327	2.23	1.56	0	4	-0.10		-1.57	
Percent student computers with Content-specific skills practice/tutorials software	2327	2.53	1.44	0	4	-0.34		-1.40	

Appendix C: Data Preparation Procedures (Continued)

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with Content-specific simulation software	2327	0.96	1.29	0	4	1.36	*	0.67	
Percent student computers with Other content-specific resources software	2327	2.02	1.58	0	4	0.11		-1.57	
Percent student computers with General Reference tools software	2327	3.18	1.33	0	4	-1.32	*	0.21	
Administrative tasks	2327	3.80	0.58	0	4	-3.29	*	11.35	*
Delivery of lessons	2327	2.50	1.04	0	4	-0.16		-0.88	
Desktop video production	2327	1.04	0.86	0	4	1.19	*	2.02	
Email to other school or district staff	2327	3.87	0.49	0	4	-4.48	*	22.32	*
Email to students or parents	2327	2.61	1.23	0	4	-0.34		-1.18	
Presentations	2327	2.34	1.05	0	4	0.07		-1.01	
Research	2327	3.18	0.91	0	4	-0.90		-0.01	
Analysis of student assessment information	2327	3.39	0.89	0	4	-1.42	*	1.26	
Video conferencing	2327	0.36	0.66	0	4	2.32	*	6.73	*
Webpage publishing	2327	1.20	0.99	0	4	1.31	*	1.64	
Degree students use Drill and practice software	2327	2.76	1.15	0	4	-0.86		-0.01	
Degree students use Integrated Learning Systems	2327	2.77	1.27	0	4	-0.89		-0.26	
Degree students use Multimedia	2327	1.77	1.28	0	4	0.31		-1.04	
Degree students use presentation	2327	1.88	1.25	0	4	0.29		-1.07	
Degree students use Simulation software	2327	0.91	1.11	0	4	1.06	*	0.10	
Degree students use Tool-based software	2327	2.52	1.22	0	4	-0.34		-1.03	
Degree students use research software	2327	2.86	1.07	0	4	-0.60		-0.68	
% of technology $ devoted to professional development	2327	12.77	16.09	0	100	2.47	*	8.28	*
Level of school-based technical support	2327	3.36	1.06	0	5	-0.21		-0.92	
Level of school-based instructional technology specialist support	2327	1.85	1.23	0	4	0.31		-1.03	
Level of dependability of the Internet connection	2327	3.63	0.65	0	4	-1.92	*	3.94	*
Degree of delays when using the Internet	2327	2.73	0.97	0	4	-1.45	*	1.77	
Time at your school for a technical issue to be resolved	2327	2.67	1.13	1	4	-0.18		-1.38	
Elementary									
Modern multi-media computers in Media center (desktops)	1531	6.98	8.16	0	111	2.84	*	20.15	*

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Modern multi-media computers in Media center (laptops)	1531	1.03	4.33	0	40	5.41	*	31.46	*
Modern multi-media computers in Classrooms (desktops)	1531	80.14	77.11	0	561	1.30	*	2.06	
Modern multi-media computers in Classrooms (laptops)	1531	8.51	32.84	0	434	6.05	*	47.88	*
Modern multi-media computers in Computer labs primarily serving general education (desktops)	1531	19.48	19.54	0	160	0.95		1.69	
Modern multi-media computers in Computer labs primarily serving general education (laptops)	1531	1.73	9.51	0	242	13.69	*	290.79	*
Modern multi-media computers in Mobile computer labs (desktops)	1531	14.44	41.36	0	395	4.10	*	20.05	*
Modern multi-media computers in Mobile computer labs (laptops)	1531	3.08	20.44	0	262	7.96	*	70.04	*
Older computer or not multi-media in Media center (desktops)	1531	3.61	5.50	0	47	2.40	*	8.35	*
Older computer or not multi-media in Media center (laptops)	1531	0.40	2.55	0	34	8.78	*	86.42	*
Older computer or not multi-media in Classrooms (desktops)	1531	64.85	67.22	0	469	1.04	*	0.93	
Older computer or not multi-media in Classrooms (laptops)	1531	3.24	15.25	0	190	7.75	*	71.50	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	1531	9.32	18.64	0	206	3.28	*	18.47	*
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	1531	0.51	4.09	0	97	13.36	*	243.51	*
Older computer or not multi-media in Mobile computer labs (desktops)	1531	4.60	18.29	0	184	6.13	*	44.00	*
Older computer or not multi-media in Mobile computer labs (laptops)	1531	0.66	7.56	0	122	13.61	*	194.40	*
Percent student computers with Concept mapping software	1531	1.64	1.60	0	4	0.46		-1.41	
Percent student computers with Graphics software	1531	3.46	1.15	0	4	-2.03	*	2.75	
Percent student computers with Multimedia authoring software	1531	1.76	1.60	0	4	0.32		-1.51	
Percent student computers with Presentation software	1531	3.51	0.94	0	4	-1.99	*	3.22	*
Percent student computers with Spreadsheet software	1531	3.61	0.89	0	4	-2.55	*	6.08	*
Percent student computers with Video editing software	1531	1.41	1.50	0	4	0.72		-0.98	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with Web authoring software	1531	0.71	1.09	0	4	1.91	*	3.04	*
Percent student computers with Basic word processing software	1531	3.86	0.62	0	4	-5.14	*	26.69	*
Percent student computers with Robust word processing software	1531	3.58	1.02	0	4	-2.55	*	5.45	*
Percent student computers with FCAT Explorer software	1531	3.85	0.55	0	4	-4.79	*	25.66	*
Percent student computers with Other test prep tools software	1531	2.85	1.53	0	4	-0.93		-0.77	
Percent student computers with Integrated Learning Systems software	1531	2.43	1.66	0	4	-0.40		-1.55	
Percent student computers with Content-specific skills practice/tutorials software	1531	2.89	1.35	0	4	-0.84		-0.70	
Percent student computers with Content-specific simulation software	1531	0.85	1.32	0	4	1.50	*	0.86	
Percent student computers with Other content-specific resources software	1531	2.15	1.65	0	4	-0.09		-1.65	
Percent student computers with General Reference tools software	1531	3.18	1.34	0	4	-1.35	*	0.32	
Administrative tasks	1531	3.73	0.66	0	4	-2.79	*	7.75	*
Delivery of lessons	1531	2.39	1.08	0	4	-0.04		-1.00	
Desktop video production	1531	0.93	0.86	0	4	1.26	*	2.24	
Email to other school or district staff	1531	3.86	0.50	0	4	-4.29	*	20.41	*
Email to students or parents	1531	2.42	1.24	0	4	-0.12		-1.27	
Presentations	1531	2.16	1.05	0	4	0.25		-0.95	
Research	1531	3.13	0.95	0	4	-0.83		-0.20	
Analysis of student assessment information	1531	3.41	0.89	0	4	-1.50	*	1.53	
Video conferencing	1531	0.33	0.68	0	4	2.59	*	7.79	*
Webpage publishing	1531	1.15	1.01	0	4	1.35	*	1.72	
Degree students use Drill and practice software	1531	2.85	1.07	0	4	-0.99		0.54	
Degree students use Integrated Learning Systems	1531	2.79	1.28	0	4	-0.96		-0.13	
Degree students use Multimedia	1531	1.40	1.11	0	4	0.57		-0.48	
Degree students use presentation	1531	1.44	1.09	0	4	0.69		-0.28	
Degree students use Simulation software	1531	0.80	1.04	0	4	1.18	*	0.44	
Degree students use Tool-based software	1531	2.16	1.17	0	4	-0.04		-1.01	
Degree students use research software	1531	2.58	1.06	0	4	-0.32		-0.84	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
% of technology $ devoted to professional development	1531	13.11	17.05	0	100	2.43	*	7.61	*
Level of school-based technical support	1531	3.23	1.06	0	5	-0.04		-0.95	
Level of school-based instructional technology specialist support	1531	1.70	1.19	0	4	0.46		-0.79	
Level of dependability of the Internet connection	1531	3.62	0.67	0	4	-1.94	*	4.13	*
Degree of delays when using the Internet	1531	2.71	0.99	0	4	-1.42	*	1.56	
Time at your school for a technical issue to be resolved	1531	2.56	1.15	1	4	-0.03		-1.43	
High									
Modern multi-media computers in Media center (desktops)	350	24.52	24.38	0	180	1.60	*	5.10	*
Modern multi-media computers in Media center (laptops)	350	4.47	25.97	0	446	14.46	*	241.21	*
Modern multi-media computers in Classrooms (desktops)	350	98.98	145.00	0	909	2.37	*	6.82	*
Modern multi-media computers in Classrooms (laptops)	350	29.54	192.34	0	2580	10.82	*	129.48	*
Modern multi-media computers in Computer labs primarily serving general education (desktops)	350	54.67	77.96	0	550	2.92	*	11.55	*
Modern multi-media computers in Computer labs primarily serving general education (laptops)	350	6.83	45.66	0	600	10.38	*	119.56	*
Modern multi-media computers in Mobile computer labs (desktops)	350	47.09	110.95	0	1204	4.93	*	37.05	*
Modern multi-media computers in Mobile computer labs (laptops)	350	12.53	80.63	0	925	7.87	*	68.44	*
Older computer or not multi-media in Media center (desktops)	350	10.47	17.34	0	99	2.04	*	4.36	*
Older computer or not multi-media in Media center (laptops)	350	1.04	5.34	0	56	6.80	*	52.28	*
Older computer or not multi-media in Classrooms (desktops)	350	70.60	115.66	0	722	2.70	*	8.78	*
Older computer or not multi-media in Classrooms (laptops)	350	3.01	16.45	0	260	11.83	*	173.79	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	350	23.33	44.93	0	411	3.42	*	18.30	*
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	350	0.27	2.99	0	45	12.70	*	171.89	*
Older computer or not multi-media in Mobile computer labs (desktops)	350	9.02	34.15	0	474	8.86	*	104.98	*

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Older computer or not multi-media in Mobile computer labs (laptops)	350	5.97	105.57	0	1975	18.70	*	349.70	*
Percent student computers with Concept mapping software	350	1.39	1.37	0	4	0.93		-0.43	
Percent student computers with Graphics software	350	3.54	1.02	0	4	-1.99	*	2.35	
Percent student computers with Multimedia authoring software	350	1.93	1.35	0	4	0.46		-1.22	
Percent student computers with Presentation software	350	3.91	0.40	1	4	-5.62	*	34.55	*
Percent student computers with Spreadsheet software	350	3.94	0.30	1	4	-6.01	*	41.58	*
Percent student computers with Video editing software	350	1.81	1.28	0	4	0.76		-0.90	
Percent student computers with Web authoring software	350	1.60	1.10	0	4	1.13	*	0.18	
Percent student computers with Basic word processing software	350	3.97	0.29	1	4	-9.83	*	98.48	*
Percent student computers with Robust word processing software	350	3.86	0.61	0	4	-5.03	*	26.10	*
Percent student computers with FCAT Explorer software	350	3.82	0.62	0	4	-3.73	*	13.78	*
Percent student computers with Other test prep tools software	350	2.67	1.37	0	4	-0.44		-1.29	
Percent student computers with Integrated Learning Systems software	350	1.63	1.15	0	4	0.91		-0.13	
Percent student computers with Content-specific skills practice/tutorials software	350	1.60	1.24	0	4	0.83		-0.41	
Percent student computers with Content-specific simulation software	350	1.14	1.03	0	4	1.37	*	1.77	
Percent student computers with Other content-specific resources software	350	1.58	1.26	0	4	0.86		-0.40	
Percent student computers with General Reference tools software	350	3.15	1.33	0	4	-1.18	*	-0.24	
Administrative tasks	350	3.93	0.34	1	4	-6.60	*	50.04	*
Delivery of lessons	350	2.69	0.91	0	4	-0.32		-0.45	
Desktop video production	350	1.28	0.75	0	4	1.67	*	3.37	*
Email to other school or district staff	350	3.86	0.54	0	4	-4.78	*	25.32	*
Email to students or parents	350	3.04	1.03	0	4	-0.77		-0.46	
Presentations	350	2.72	0.93	0	4	-0.21		-0.74	
Research	350	3.30	0.86	0	4	-1.12	*	0.66	
Analysis of student assessment information	350	3.30	0.94	0	4	-1.23	*	0.66	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Video conferencing	350	0.44	0.62	0	4	1.53	*	3.71	*
Webpage publishing	350	1.37	0.88	0	4	1.58	*	2.38	
Degree students use Drill and practice software	350	2.61	1.30	0	4	-0.64		-0.76	
Degree students use Integrated Learning Systems	350	2.77	1.27	0	4	-0.81		-0.47	
Degree students use Multimedia	350	2.92	1.19	0	4	-0.85		-0.41	
Degree students use presentation	350	3.00	1.04	0	4	-0.79		-0.48	
Degree students use Simulation software	350	1.13	1.24	0	4	0.83		-0.47	
Degree students use Tool-based software	350	3.51	0.82	0	4	-1.95	*	3.69	*
Degree students use research software	350	3.61	0.70	0	4	-2.02	*	4.34	*
% of technology $ devoted to professional development	350	11.04	10.96	0	50	1.34	*	2.07	
Level of school-based technical support	350	3.66	1.01	1	5	-0.53		-0.76	
Level of school-based instructional technology specialist support	350	2.15	1.24	0	4	0.01		-1.26	
Level of dependability of the Internet connection	350	3.66	0.60	1	4	-1.72	*	2.58	
Degree of delays when using the Internet	350	2.76	0.93	0	4	-1.39	*	1.91	
Time at your school for a technical issue to be resolved	350	2.90	1.10	1	4	-0.51		-1.10	
Middle									
Modern multi-media computers in Media center (desktops)	446	15.04	17.47	0	186	3.30	*	22.96	*
Modern multi-media computers in Media center (laptops)	446	2.00	14.63	0	280	16.13	*	297.28	*
Modern multi-media computers in Classrooms (desktops)	446	73.68	93.17	0	538	1.66	*	2.56	
Modern multi-media computers in Classrooms (laptops)	446	11.84	61.25	0	967	10.25	*	139.26	*
Modern multi-media computers in Computer labs primarily serving general education (desktops)	446	39.89	50.50	0	685	5.26	*	59.39	*
Modern multi-media computers in Computer labs primarily serving general education (laptops)	446	1.96	15.74	0	255	12.33	*	174.96	*
Modern multi-media computers in Mobile computer labs (desktops)	446	33.83	72.36	0	560	3.47	*	14.56	*
Modern multi-media computers in Mobile computer labs (laptops)	446	9.85	50.69	0	460	5.94	*	36.68	*
Older computer or not multi-media in Media center (desktops)	446	6.67	10.43	0	74	2.20	*	6.28	*

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Older computer or not multi-media in Media center (laptops)	446	1.10	7.50	0	128	12.28	*	189.48	*
Older computer or not multi-media in Classrooms (desktops)	446	58.39	81.43	0	542	2.05	*	5.18	*
Older computer or not multi-media in Classrooms (laptops)	446	2.52	17.13	0	240	10.19	*	117.70	*
Older computer or not multi-media in Computer labs primarily serving general education (desktops)	446	17.33	27.85	0	134	1.70	*	2.30	
Older computer or not multi-media in Computer labs primarily serving general education (laptops)	446	0.51	4.03	0	64	11.34	*	153.58	*
Older computer or not multi-media in Mobile computer labs (desktops)	446	8.52	27.83	0	290	6.00	*	45.98	*
Older computer or not multi-media in Mobile computer labs (laptops)	446	1.16	12.76	0	230	15.09	*	250.73	*
Percent student computers with Concept mapping software	446	1.52	1.51	0	4	0.65		-1.07	
Percent student computers with Graphics software	446	3.62	0.98	0	4	-2.49	*	4.89	*
Percent student computers with Multimedia authoring software	446	1.84	1.48	0	4	0.34		-1.35	
Percent student computers with Presentation software	446	3.87	0.47	0	4	-4.90	*	28.76	*
Percent student computers with Spreadsheet software	446	3.88	0.46	0	4	-4.73	*	25.76	*
Percent student computers with Video editing software	446	1.76	1.40	0	4	0.57		-1.13	
Percent student computers with Web authoring software	446	1.05	1.18	0	4	1.39	*	1.17	
Percent student computers with Basic word processing software	446	3.95	0.33	0	4	-8.34	*	78.17	*
Percent student computers with Robust word processing software	446	3.81	0.70	0	4	-4.27	*	18.35	*
Percent student computers with FCAT Explorer software	446	3.86	0.56	0	4	-4.75	*	23.80	*
Percent student computers with Other test prep tools software	446	2.89	1.40	0	4	-0.85		-0.80	
Percent student computers with Integrated Learning Systems software	446	2.03	1.32	0	4	0.33		-1.22	
Percent student computers with Content-specific skills practice/tutorials software	446	2.06	1.41	0	4	0.26		-1.40	
Percent student computers with Content-specific simulation software	446	1.21	1.32	0	4	1.13	*	0.10	

Label	N	Mean	Std Dev	Min	Max	Skew		Kurt	
Percent student computers with Other content-specific resources software	446	1.93	1.49	0	4	0.28		-1.41	
Percent student computers with General Reference tools software	446	3.20	1.29	0	4	-1.31	*	0.17	
Administrative tasks	446	3.89	0.37	1	4	-4.29	*	21.95	*
Delivery of lessons	446	2.72	0.91	0	4	-0.30		-0.61	
Desktop video production	446	1.22	0.86	0	4	1.14	*	1.49	
Email to other school or district staff	446	3.90	0.42	1	4	-4.77	*	24.65	*
Email to students or parents	446	2.96	1.14	0	4	-0.76		-0.65	
Presentations	446	2.65	0.96	1	4	-0.17		-0.92	
Research	446	3.28	0.83	1	4	-0.94		0.15	
Analysis of student assessment information	446	3.41	0.85	1	4	-1.32	*	0.82	
Video conferencing	446	0.40	0.63	0	4	1.92	*	5.23	*
Webpage publishing	446	1.26	0.98	0	4	1.19	*	1.25	
Degree students use Drill and practice software	446	2.55	1.24	0	4	-0.57		-0.69	
Degree students use Integrated Learning Systems	446	2.72	1.23	0	4	-0.72		-0.51	
Degree students use Multimedia	446	2.13	1.24	0	4	-0.04		-1.14	
Degree students use presentation	446	2.49	1.09	0	4	-0.16		-1.14	
Degree students use Simulation software	446	1.11	1.19	0	4	0.81		-0.43	
Degree students use Tool-based software	446	2.96	1.06	0	4	-0.78		-0.31	
Degree students use research software	446	3.24	0.92	1	4	-1.04	*	0.10	
% of technology $ devoted to professional development	446	12.94	16.05	0	100	2.51	*	8.61	*
Level of school-based technical support	446	3.55	1.05	0	5	-0.57		-0.38	
Level of school-based instructional technology specialist support	446	2.11	1.26	0	4	0.05		-1.25	
Level of dependability of the Internet connection	446	3.66	0.63	1	4	-1.92	*	3.50	*
Degree of delays when using the Internet	446	2.78	0.93	0	4	-1.57	*	2.51	
Time at your school for a technical issue to be resolved	446	2.89	1.06	1	4	-0.41		-1.13	

Note.
* skewness > 1
** kurtosis > 3

In 2003, eighteen schools had missing variables for number of students. Three of these schools also had missing variables for number of students for 2004-05 and 200-06. These schools were inspected and found to be PreK schools, so they were removed from the data set. Two schools reported zero students. These schools were inspected and found to be 9th grade centers that were associated with high schools. It is assumed that these schools have their students reported in the high school count, so they were removed from the analysis. The other 15 schools were matched with schools in 2004-05 and 2005-06 to see if the number of students had been provided. All of these schools had the number of students provided in both years, so the missing number of students in 2003-04 was replaced with the number of students in 2004-05.

To obtain counts of computers, all of the variables for modern computer types were summed and then all of the old computer types were summed. The results were added together to get a total computer count. If the total number of computers was not equal to zero, the number of students in the school was divided by this total computer count. In 2003, eighteen schools had the variable for number of students missing. Seven schools reported they had no computers. These schools generated missing data. The data were sorted by students per computer, and then the dataset was visually inspected. There appeared to be many entries that had the exact same number for modern computers and non-modern computers. An additional variable was made to determine which schools had the exact same number entered for each computer type for both modern and non-modern. There were 98 schools that had entered information into the STAR survey this way. In 2004-05, three schools had no information for the number of students, one school had no computers, and 50 schools had the same data for modern and non modern computers. In 2005-06, four schools had no computers, three had no information about the number of students, and 70 had the same number of computers for both modern and non modern computer types. In 2006-07, three schools reported that they had no computers, all schools supplied the number of students enrolled, and only 7 schools entered the same information for modern and non modern computers. It was decided to delete the schools that appeared to have the same information entered twice; 2125 schools remained in the dataset, and the descriptive statistics were run again.

Further inspection of the computer counts for just the modern computers found that 25 schools had no modern computers, 27 additional schools reported the same number of computers in media centers and in the general education labs, another 10 schools reported the same number of computers in media centers and mobile labs, 13 additional schools reported the exact same number for media centers and classrooms, and 5 schools reported the exact same number for classrooms and mobile labs. This means that 55 schools that had modern computers reported the same number of computers in different categories. Although this information may be accurate, it may also indicate that the person completing the survey misunderstood the purpose of the item by focusing on the use of the computer as opposed to the location or category of computer. Some schools may have used the computers in their media centers as labs for classroom teachers, and others may have viewed this same scenario as the media center being used as a classroom. Other schools may have housed their mobile computer labs in the media center or in the classroom and included these computers in the counts for the storage location as well as the mobile lab count. In addition, 3 schools indicated that they had more modern student computers than students, and 39 schools indicated that they had less than 2 students per modern computer.

Additional years were investigated to determine if the counts of computers exhibited similar patterns. In 2004-05, 21 schools reported they had no modern computers or non-modern computers, 61 schools had the exact same number of modern and non modern computers. When each indicator of modern and non-modern computers were compared separately after schools that reported having no computers were removed, 50 schools reported the exact same number of modern and non-modern desktop computers in each of the following location: media centers, classrooms, general education labs, and mobile labs; and 1194 schools reported the exact same number of laptops in each of the following locations: media centers, classrooms, general education labs, and mobile labs. When the separate categories of modern computers was examined after schools with no computers were removed, 18 schools reported the same number of desktop computers in media centers and general education computer labs, 6 schools reported the same number of desktop computers in the media centers and classrooms, 12 schools reported the same number of laptop computers in the media center and mobile computer labs , 51 schools reported the exact same number of laptop computers in classrooms and mobile computer labs, 11 schools reported the same number of laptop and desktop computers in media centers, general education labs, and mobile computer labs, and 5 schools reported the exact same numbers of computers in media centers, classrooms, and mobile computer labs. These categories were mutually exclusive, so in all, there were 103 schools that appeared to report computers in multiple categories. In addition, 12 schools reported having more modern computers than students; while 87 more schools had less than 2 students per modern computer.

In 2005-06, four schools had no computers and 69 had no modern computers, and 72 schools reported having the exact same number of modern and non-modern computers. Sixty-eight schools reported the exact same number of modern and non-modern student desktop computers in media centers, classrooms, and general education labs. Eighteen schools reported having the same number of modern and non-modern laptop computers in media centers, classrooms, and mobile computer carts. When examining only numbers of modern student computers, 27 schools reported the exact same number of computers in media centers and general education labs; 17 schools reported the exact same number of computers in media centers and mobile computer labs; 12 schools reported the exact same number of computers in media centers and classrooms; 37 schools reported the same number of computers in media centers, general education labs, and mobile computer labs; and two reported the same number of computers in media centers, classrooms, general education labs, and mobile computer labs. These categories were mutually exclusive, so in all, 95 schools appear to have reported having the same computers in multiple places. In addition after excluding 69 schools that reported having no modern computers, three schools reported having more modern student computers than students, and 68 more schools reported having less than 2 students per modern computer.

In 2006-07, six schools reported on the STAR survey that they had no students, and another school reported that it had one student enrolled. Three schools reported that they had no modern or non-modern computers, and only 7 schools entered the same information for modern and non modern computers. When this was broken down by specific categories of modern and non-modern computers only two had the exact same counts for modern and non-modern student desktop computers in media centers, classrooms, general education labs and mobile computer labs, and no laptops had the exact same number for category. One hundred twenty-six schools reported having no modern computers. After these schools were excluded, 3 schools reported the exact same number of modern student computers in media centers and general education labs; 4 reported the same numbers of modern computers in the media center and mobile computer lab; 8 schools reported the exact same number of computers in media centers and classrooms; 20 schools reported the exact same number of computers in the classrooms and mobile computer labs; 39 schools reported the exact same number of computers in the media centers, general education labs, and mobile computer labs, while only one school reported the same counts between media centers, classrooms and mobile computer labs, and only one school reported the same counts of modern student computers in media centers, classrooms, general education labs, and mobile computer labs. These categories were mutually exclusive, so that in all, 76 schools seemed to report computers in more than one category. In addition after excluding the schools that reported having no students and schools reporting no modern student computers, 21 schools reported having more modern student computers than students, and an additional 91 schools reported having less than two students per modern computer.

Each year seemed to follow the same pattern with some schools reporting computers in more than one category, and some schools reporting having more modern computers than students. Also, each year the number of schools with less than 2 students per computer has increased. Removing all schools with questionable entries, no modern computers, or with no students would decrease the sample for the study from 2327 schools to 1841 or a reduction of almost 21%.

Skewness of the technology indicator variables ranged between -6.14 and 42.53; and kurtosis ranged between -3.34 and 1819.36. Although was an improvement, the data were still not normal. Since it cannot be verified that the counts of the computers by the schools identified have been duplicated, nor can it be verified that the schools not identified entered accurate information, choosing to remove 21% of the schools does not seem to be a viable alternative. Therefore, for this study, the category of access to computer hardware was removed from the analysis. It was assumed that access to the software was an adequate proxy for access to the hardware. However with the removal of the variables of computers in classrooms and computers in labs, the relationship between the location of the computer and school level achievement cannot be determined in this study.

Because many of the variables in this study were not normally distributed, the data were transformed using the natural log. To determine if this transformation was necessary the exploratory factor analysis was conducted with both the original data and the transformed data. The results were the same, so the original data were used in the rest of the analysis.

Exploratory Factor Analysis

The results of the exploratory factor analysis are delineated for each year for each of the composite variables used in the analysis.

Student learning environment. First, exploratory factor analysis was conducted with the variables predicted to measure the aspects of the student learning environment for each year separately. These variables had correlated communality estimates that ranged from .21 to .57 in 2003-04, .20 to .55 in 2004-05, and .19 to .56 in 2005-06. Data for 2006-07 was not available. The standardized regression coefficients of the rotated factor patterns and the correlations of the factor structure obtained from the common factor analysis with oblique rotation are depicted in Table C 15. For all three years, both the original data and the transformed data loaded on only one factor. One variable was dropped because factor loadings were below .3. That was the ratio of students per instructional staff. A composite score was created to measure the positive student learning environment by summing the percentage of students who did not serve out-of-school suspensions, the percentage of students who did not serve in-school suspensions, the percentage of students who were not absent more than 21 days, and the percentage stability rate. The total crime incidents per student (times 100) was subtracted from the result.

Table C 15.

Common Factor Analysis with Oblique Rotation: Student Learning Environments

	Factor Pattern					
Item	2003		2004		2005	
Percent of students with out-of-school suspensions	82	*	82	*	75	*
Percent of students with in-house suspensions	65	*	63	*	63	*
Percent of Students with Over 21 Days Absences	69	*	58	*	58	*
Total Crime Incidents/student	58	*	57	*	49	*
Percent Instability	47	*	48	*	46	*

Note: Printed values are multiplied by 100 and rounded to the nearest integer. Values greater than 0.3 are flagged by an '*'.

Teacher qualifications. Next, exploratory factor analysis was conducted with the variables predicted to measure the teacher qualifications for each year separately. These variables had correlated communality estimates that ranged from .03 to .06 in 2003-04, .06 to .10 in 2004-05, and .04 to .08 in 2005-06. Data for 2006-07 were not available. The standardized regression coefficients of the rotated factor patterns and the correlations of the factor structure obtained from the common factor analysis with oblique rotation are depicted in Table C 16. For all three years, only one factor was obtained with both the original data and the transformed data.

Table C 16.

Common Factor Analysis with Oblique Rotation: Teacher Qualifications

Item	Factor Pattern					
	2003		2004		2005	
Percent of Teachers with an advanced degree	39	*	45	*	43	*
Average number of years experience	38	*	45	*	33	*
Percent of classes taught by teachers with certification	31	*	38	*	34	*

Note: Printed values are multiplied by 100 and rounded to the nearest integer. Values greater than 0.3 are flagged by an '*'.

Student access to software. Exploratory factor analysis was conducted with variables predicted to measure the types of software available on student computers for each year separately. The variables had correlated communality estimates that ranged from .13 to .57 in 2003-04, .09 to .56 in 2004-05, .13 to .60 in 2005-06, and .11 to .54 in 2006-07. The standardized regression coefficients of the rotated factor patterns and the correlations of the factor structure obtained from the common factor analysis with oblique rotation are depicted in Table C 17. For consistency of interpretability over all four years, the number of factors was specified to be three. Both the original data and the transformed data loaded the same three factors on the same variables: Content Software, Office/ Production Software, and Advanced Production Software. These three factors were used in the multi-level modeling analysis as separate composite variables. After designating all missing items as zero, the composite was made from the mean of all of the included variables.

Table C 17.

Common Factor Analysis with Oblique Rotation: Student Access to Software

Item	Rotated Factor Pattern (Standardized Regression Coefficients)			Factor Structure (Correlations)		
	Content Software	Office/ Production Software	Advanced Production Software	Content Software	Office/ Production Software	Advanced Production Software
			2003			
Percent student computers with Other test prep tools software	66*	1	-11	62*	7	18
Percent student computers with Content-specific skills practice/tutorials software	66*	-5	4	67*	6	31*
Percent student computers with Content-specific simulation software	63*	-8	11	67*	6	36*
Percent student computers with Other content-specific resources software	63*	-5	14	68*	9	39*
Percent student computers with FCAT Explorer software	57*	18	-17	52*	20	15
Percent student computers with Integrated Learning Systems software	54*	-5	0	54*	3	22
Percent student computers with General Reference tools software	50*	16	6	55*	25	33*
Percent student computers with Spreadsheet software	-1	80*	2	11	81*	30*
Percent student computers with Presentation software	2	72*	-4	11	71*	23
Percent student computers with Robust word processing software	-2	63*	6	10	65*	28
Percent student computers with Graphics software	6	35*	20	20	43*	35*

Appendix C: Data Preparation Procedures (Continued)

Item	Rotated Factor Pattern (Standardized Regression Coefficients)			Factor Structure (Correlations)		
	Content Software	Office/ Production Software	Advanced Production Software	Content Software	Office/ Production Software	Advanced Production Software
Percent student computers with Basic word processing software	3	31*	5	10	33*	18
Percent student computers with Multimedia authoring software	3	4	56*	28	25	59*
Percent student computers with Video editing software	-5	9	48*	17	26	49*
Percent student computers with Concept mapping software	9	-2	46*	29	16	49*
Percent student computers with Web authoring software	-7	17	39*	13	30*	42*
2004						
Percent student computers with Content-specific skills practice/tutorials software	69*	-7	2	69*	4	28
Percent student computers with Other content-specific resources software	68*	-3	7	71*	10	34*
Percent student computers with Other test prep tools software	66*	2	-9	63*	8	19
Percent student computers with Content-specific simulation software	64*	-3	8	66*	9	33*
Percent student computers with Integrated Learning Systems software	58*	-4	-4	56*	3	19
Percent student computers with FCAT Explorer software	51*	15	-10	49*	19	17
Percent student computers with General Reference tools software	48*	12	10	54*	23	34*

Appendix C: Data Preparation Procedures (Continued)

Item	Rotated Factor Pattern (Standardized Regression Coefficients)			Factor Structure (Correlations)		
	Content Software	Office/ Production Software	Advanced Production Software	Content Software	Office/ Production Software	Advanced Production Software
Percent student computers with Spreadsheet software	-1	81*	1	11	81*	30*
Percent student computers with Presentation software	4	73*	-6	13	72*	23
Percent student computers with Robust word processing software	0	57*	9	12	60*	30*
Percent student computers with Graphics software	3	28	27	18	38*	39*
Percent student computers with Basic word processing software	2	25	9	9	29	19
Percent student computers with Multimedia authoring software	4	0	55*	26	21	57*
Percent student computers with Video editing software	-6	7	52*	16	25	52*
Percent student computers with Concept mapping software	12	-2	46*	31*	16	50*
Percent student computers with Web authoring software	-8	15	38*	10	27	40*
2005						
Percent student computers with Spreadsheet software	83*	-4	3	83*	13	30*
Percent student computers with Presentation software	78*	1	-6	76*	15	22
Percent student computers with Robust word processing software	59*	-5	10	62*	11	28
Percent student computers with Basic word processing software	35*	8	-1	37*	15	15

Appendix C: Data Preparation Procedures (Continued)

Item	Rotated Factor Pattern (Standardized Regression Coefficients)			Factor Structure (Correlations)		
	Content Software	Office/ Production Software	Advanced Production Software	Content Software	Office/ Production Software	Advanced Production Software
Percent student computers with Graphics software	29	16	16	38*	28	33*
Percent student computers with Other content-specific resources software	3	65*	-3	15	65*	25
Percent student computers with Content-specific skills practice/tutorials software	-7	62*	-1	5	60*	22
Percent student computers with Content-specific simulation software	-1	51*	6	12	54*	27
Percent student computers with Other test prep tools software	8	43*	-4	15	43*	16
Percent student computers with General Reference tools software	14	42*	10	26	49*	32*
Percent student computers with Integrated Learning Systems software	-6	36*	8	3	38*	20
Percent student computers with FCAT Explorer software	24	31*	-6	28	33*	15
Percent student computers with Multimedia authoring software	-4	1	70*	22	30	70*
Percent student computers with Video editing software	4	-5	67*	27	24	66*
Percent student computers with Concept mapping software	-2	21	41*	17	38*	49*
Percent student computers with Web authoring software	15	-1	36*	28	17	41*
2006						
Percent student computers with Spreadsheet software	79*	-5	3	79*	10	26

Appendix C: Data Preparation Procedures (Continued)

Item	Rotated Factor Pattern (Standardized Regression Coefficients)			Factor Structure (Correlations)		
	Content Software	Office/ Production Software	Advanced Production Software	Content Software	Office/ Production Software	Advanced Production Software
Percent student computers with Presentation software	76*	-1	-5	74*	10	20
Percent student computers with Robust word processing software	45*	1	13	50*	14	28
Percent student computers with Basic word processing software	34*	6	0	35*	12	14
Percent student computers with Graphics software	25	13	20	33*	26	33*
Percent student computers with Content-specific skills practice/tutorials software	-6	60*	-1	4	59*	23
Percent student computers with Other content-specific resources software	-1	59*	4	10	61*	29
Percent student computers with Other test prep tools software	8	50*	-12	12	46*	12
Percent student computers with Content-specific simulation software	3	43*	11	13	48*	30
Percent student computers with General Reference tools software	13	40*	12	23	47*	33*
Percent student computers with Integrated Learning Systems software	-4	38*	1	3	38*	16
Percent student computers with FCAT Explorer software	24	27	-5	27	29	14
Percent student computers with Multimedia authoring software	-4	1	74*	21	32*	73*

Item	Rotated Factor Pattern (Standardized Regression Coefficients)			Factor Structure (Correlations)		
	Content Software	Office/ Production Software	Advanced Production Software	Content Software	Office/ Production Software	Advanced Production Software
Percent student computers with Video editing software	4	-6	66*	25	23	65*
Percent student computers with Concept mapping software	-3	15	46*	14	34*	52*
Percent student computers with Web authoring software	10	-6	41*	22	13	41*

Note: Printed values are multiplied by 100 and rounded to the nearest integer.
Values greater than 0.3 are flagged by an '*'.

Teachers regularly use technology. Exploratory factor analysis was conducted with variables predicted to measure the percent of teachers who regularly use technology for different tasks. The exploratory factor analysis was conducted for each year separately. The variables had correlated communality estimates that ranged from .14 to .47 in 2003-04, .14 to .47 in 2004-05, .15 to .49 in 2005-06, and .13 to .49 in 2006-07. The standardized regression coefficients of the rotated factor patterns and the correlations of the factor structure obtained from the common factor analysis with oblique rotation are depicted in Table C 18. For consistency of interpretability over all four years, the number of factors was specified to be two. Both the original data and the transformed data loaded the same two factors with the same variables: delivery of instruction and administrative purposes. These two factors were used in the multi-level modeling analysis as separate composite variables. After designating all missing items as zero, the composite was made from the mean of all of the included variables.

Table C 18.

Common Factor Analysis with Oblique Rotation: Teachers Regularly use Technology

Items	Rotated Factor Pattern (Standardized Regression Coefficients)		Factor Structure (Correlations)	
	Delivery of Instruction	Administrative Purposes	Delivery of Instruction	Administrative Purposes
		2003		
Presentations	63 *	15	73 *	56 *

	Rotated Factor Pattern (Standardized Regression Coefficients)				Factor Structure (Correlations)			
Items	Delivery of Instruction		Administrative Purposes		Delivery of Instruction		Administrative Purposes	
Delivery of lessons	58	*	12		66	*	50	*
Desktop video production	53	*	-2		52	*	33	*
Video conferencing	48	*	-11		41	*	21	
Webpage publishing	37	*	13		45	*	37	*
Email to other school or district staff	-13		67	*	31	*	59	*
Administrative tasks	1		53	*	36	*	54	*
Email to students or parents	14		48	*	45	*	57	*
Research	29		33	*	50	*	52	*
Analysis of student assessment information	20		32	*	40	*	44	*
			2004					
Desktop video production	57	*	-8		52	*	29	
Presentations	56	*	20		69	*	56	*
Delivery of lessons	50	*	25		66	*	57	*
Video conferencing	50	*	-15		41	*	17	
Webpage publishing	38	*	8		43	*	32	*
Email to other school or district staff	-13		62	*	27		54	*
Administrative tasks	-8		61	*	31	*	56	*
Analysis of student assessment information	6		44	*	34	*	47	*
Research	26		38	*	50	*	55	*
Email to students or parents	25		33	*	46	*	49	*
			2005					
Presentations	63	*	15		73	*	56	*
Desktop video production	63	*	-7		59	*	33	*
Delivery of lessons	58	*	17		69	*	55	*
Video	50	*	-14		41	*	18	

	Rotated Factor Pattern (Standardized Regression Coefficients)				Factor Structure (Correlations)			
Items	Delivery of Instruction		Administrative Purposes		Delivery of Instruction		Administrative Purposes	
conferencing								
Webpage publishing	34	*	15		44	*	37	*
Email to other school or district staff	-13		61	*	26		53	*
Administrative tasks	-5		54	*	29		51	*
Research	20		47	*	50	*	60	*
Analysis of student assessment information	5		45	*	33	*	48	*
Email to students or parents	21		37	*	45	*	51	*
2006								
Desktop video production	64	*	-13		55	*	29	
Presentations	55	*	26		72	*	62	*
Video conferencing	51	*	-17		40	*	16	
Delivery of lessons	46	*	29		65	*	60	*
Webpage publishing	40	*	1		41	*	28	
Administrative tasks	-15		52	*	19		42	*
Email to other school or district staff	-14		51	*	20		42	*
Research	18		48	*	50	*	60	*
Analysis of student assessment information	4		43	*	33	*	46	*
Email to students or parents	24		29		42	*	44	*

Note: Printed values are multiplied by 100 and rounded to the nearest integer. Values greater than 0.3 are flagged by an '*'.

Frequency students use software. Exploratory factor analysis was conducted with variables predicted to measure the frequency that students use different types of software for each year separately. The variables had correlated communality estimates that ranged from .03 to .21 in 2003-04, .13 to .29 in 2004-05, .15 to .38 in 2005-06, and .17 to .38 in 2006-07. The standardized regression coefficients of the rotated factor patterns and the correlations of the factor structure obtained from the common factor analysis with oblique rotation are depicted in Table C 19. For consistency of interpretability over all four years, the number of factors was specified to be two. Both the original data and the transformed data loaded the same two factors with the same variables: production tool and content delivery. These two factors were used in the multi-level modeling analysis as separate composite variables. The composite was made from the sum of all of the included variables.

Table C 19.

Common Factor Analysis with Oblique Rotation: Frequency Students Use Software

	Rotated Factor Pattern (Standardized Regression Coefficients)				Factor Structure (Correlations)			
Item	Production Tool		Content Delivery		Production Tool		Content Delivery	
2003								
Frequency students use Multimedia	58	*	1		58	*	4	
Frequency students use Tool-based software	49	*	-14		49	*	-11	
Frequency students use Simulation software	39	*	20		40	*	22	
Frequency students use Drill and practice software	-4		36	*	-2		36	*
Frequency students use Integrated Learning Systems	3		30	*	5		30	*
2004								
Frequency students use Multimedia	65	*	0		65	*	23	
Frequency students use Tool-based software	63	*	-4		61	*	18	
Frequency students use Simulation software	38	*	13		43	*	27	
Frequency students use Drill and practice software	-1		49	*	16		49	*
Frequency students use Integrated Learning Systems	5		47	*	21		48	*
2005								
Frequency students use Multimedia	70	*	-2		69	*	30	*
Frequency students use Tool-based software	65	*	1		66	*	31	*
Frequency students use Simulation software	41	*	8		45	*	27	

	Rotated Factor Pattern (Standardized Regression Coefficients)				Factor Structure (Correlations)			
Item	Production Tool		Content Delivery		Production Tool		Content Delivery	
Frequency students use Drill and practice software	2		50	*	24		50	*
Frequency students use Integrated Learning Systems	4		48	*	26		50	*
2006								
Frequency students use Multimedia	71	*	0		71	*	35	*
Frequency students use Tool-based software	67	*	-2		66	*	31	*
Frequency students use Simulation software	37	*	19		46	*	37	*
Frequency students use Drill and practice software	2		52	*	28		53	*
Frequency students use Integrated Learning Systems	3		51	*	28		52	*

Note: Printed values are multiplied by 100 and rounded to the nearest integer. Values greater than 0.3 are flagged by an '*'.

Support for Technology. Exploratory factor analysis was conducted with variables predicted to measure the level of school support for technology for each year separately. The variables had correlated communality estimates that ranged from .03 to .21 in 2003-04, .13 to .29 in 2004-05, .15 to .38 in 2005-06, and .17 to .38 in 2006-07. The standardized regression coefficients of the rotated factor patterns and the correlations of the factor structure obtained from the common factor analysis with oblique rotation are depicted in Table C 20. For consistency of interpretability over all four years, the number of factors was specified to be two. One item was removed from the analysis because its factor loadings were less than .3. Both the original data and the transformed data loaded the same two factors with the same variables: human/ time and hardware/ Internet. These two factors were used in the multi-level modeling analysis as separate composite variables. The composite was made from the sum of all of the included variables.

Table C 20.

Common Factor Analysis with Oblique Rotation: Support for Technology

	Rotated Factor Pattern (Standardized Regression Coefficients)				Factor Structure (Correlations)			
	Human/ Time		Hardware/ Internet		Human/ Time		Hardware/ Internet	
2003								
Level of school-based technical support	65	*	-5		64	*	-1	
Level of school-based instructional technology specialist support	63	*	-1		63	*	3	
Time at your school for a technical issue to be resolved	42	*	10		42	*	12	
Degree of delays when using the Internet	-2		58	*	1		57	*
Level of dependability of the Internet connection	5		57	*	9		58	*
2004								
Level of school-based technical support	71	*	-3		71	*	2	
Level of school-based instructional technology specialist support	64	*	-3		64	*	1	
Time at your school for a technical issue to be resolved	48	*	9		49	*	12	
Level of dependability of the Internet connection	6		53	*	10		54	*
Degree of delays when using the Internet	-4		53	*	0		53	*
2005								
Level of school-based technical support	68	*	-1		68	*	9	
Level of school-based instructional technology specialist support	65	*	-5		64	*	4	
Time at your school for a technical issue to be resolved	36	*	13		38	*	18	
Level of dependability of the Internet connection	4		53	*	11		54	*
Degree of delays when using the Internet	0		51	*	7		51	*
2006								
Level of school-based technical support	67	*	3		66	*	-1	
Level of school-based instructional technology specialist support	60	*	5		60	*	1	

	Rotated Factor Pattern (Standardized Regression Coefficients)				Factor Structure (Correlations)			
	Human/ Time		Hardware/ Internet		Human/ Time		Hardware/ Internet	
Time at your school for a technical issue to be resolved	-43	*	13		-44	*	16	
Level of dependability of the Internet connection	-6		52	*	-10		53	*
Degree of delays when using the Internet	-4		-52	*	0		-52	*

Note: Printed values are multiplied by 100 and rounded to the nearest integer. Values greater than 0.3 are flagged by an '*'.

Descriptive Statistics of Predictor Variables

Table C 21.

Descriptive Statistics of Predictor Variables for FCAT Reading Outcome

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
Percent Students on Free or Reduced Lunch Program									
	All Schools	2285	2003-04	52.06	25.25	1.0	100.0	0.10	-0.94
			2004-05	52.53	24.08	0.9	100.0	0.02	-0.90
			2005-06	52.16	23.89	1.7	100.0	-0.03	-0.97
			2006-07	52.16	23.89	1.7	100.0	-0.03	-0.97
	Elementary	1496	2003-04	56.87	26.13	1.0	100.0	-0.14	-1.01
			2004-05	56.41	24.88	0.9	100.0	-0.20	-0.94
			2005-06	55.99	24.77	1.7	100.0	-0.24	-0.99
			2006-07	55.99	24.77	1.7	100.0	-0.24	-0.99
	High	345	2003-04	35.48	17.18	1.8	93.3	0.46	0.18
			2004-05	38.83	18.05	3.8	100.0	0.58	0.63
			2005-06	38.65	17.21	2.5	93.7	0.17	-0.34
			2006-07	38.65	17.21	2.5	93.7	0.17	-0.34
	Middle	444	2003-04	48.74	21.24	3.7	100.0	0.12	-0.65
			2004-05	50.10	21.09	3.3	100.0	0.05	-0.60
			2005-06	49.76	21.11	3.9	100.0	0.02	-0.79
			2006-07	49.76	21.11	3.9	100.0	0.02	-0.79
Percent Minority Students									
	All Schools	2286	2003-04	50.18	28.20	0.0	100.0	0.31	-1.11
			2004-05	51.35	28.37	0.0	100.0	0.28	-1.14
			2005-06	52.38	28.38	0.0	100.0	0.23	-1.16
			2006-07	52.38	28.38	0.0	100.0	0.23	-1.16
	Elementary	1496	2003-04	51.92	28.97	0.0	100.0	0.21	-1.22
			2004-05	53.06	29.10	0.0	100.0	0.19	-1.23
			2005-06	54.29	28.95	0.0	100.0	0.14	-1.24
			2006-07	54.29	28.95	0.0	100.0	0.14	-1.24
	High	346	2003-04	44.66	26.01	2.6	100.0	0.60	-0.63

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
			2004-05	45.59	26.47	0.7	99.9	0.55	-0.75
			2005-06	45.94	26.99	1.0	99.9	0.50	-0.82
			2006-07	45.94	26.99	1.0	99.9	0.50	-0.82
	Middle	444	2003-04	48.59	26.58	4.8	100.0	0.41	-0.89
			2004-05	50.08	26.62	4.6	99.8	0.36	-0.96
			2005-06	50.97	26.68	5.6	99.9	0.32	-1.00
			2006-07	50.97	26.68	5.6	99.9	0.32	-1.00
Percent LEP students									
	All Schools	2120	2003-04	8.75	10.69	0.0	63.3	1.97	3.96
			2004-05	8.53	10.56	0.0	61.6	2.01	4.18
			2005-06	8.81	10.63	0.0	65.7	1.98	4.12
			2006-07	8.81	10.63	0.0	65.7	1.98	4.12
	Elementary	1374	2003-04	10.83	12.22	0.1	63.3	1.56	1.96
			2004-05	10.52	12.07	0.0	61.6	1.60	2.14
			2005-06	10.83	12.11	0.1	65.7	1.57	2.15
			2006-07	10.83	12.11	0.1	65.7	1.57	2.15
	High	325	2003-04	4.50	4.78	0.0	23.1	1.48	1.75
			2004-05	4.35	4.66	0.0	26.0	1.54	2.11
			2005-06	4.43	4.67	0.0	28.3	1.61	2.75
			2006-07	4.43	4.67	0.0	28.3	1.61	2.75
	Middle	421	2003-04	5.23	5.45	0.1	32.5	1.69	3.50
			2004-05	5.18	5.44	0.1	36.4	1.89	4.87
			2005-06	5.47	5.71	0.1	37.4	2.04	5.74
			2006-07	5.47	5.71	0.1	37.4	2.04	5.74
Percent Students with Disabilities									
	All Schools	2285	2003-04	15.51	5.41	0.5	40.6	0.69	1.44
			2004-05	15.30	5.32	0.4	43.9	0.74	1.99
			2005-06	15.31	5.44	0.3	72.6	1.52	9.77
			2006-07	15.31	5.44	0.3	72.6	1.52	9.77
	Elementary	1496	2003-04	16.04	5.71	1.2	40.6	0.81	1.28
			2004-05	15.81	5.61	1.6	43.9	0.92	1.95
			2005-06	16.04	5.77	1.9	72.6	1.81	10.63
			2006-07	16.04	5.77	1.9	72.6	1.81	10.63
	High	345	2003-04	13.26	4.43	0.7	31.1	0.03	0.96
			2004-05	13.20	4.47	0.4	27.6	-0.16	0.42
			2005-06	13.16	4.48	0.3	30.9	-0.04	0.66
			2006-07	13.16	4.48	0.3	30.9	-0.04	0.66
	Middle	444	2003-04	15.44	4.57	0.5	27.9	-0.13	0.17
			2004-05	15.23	4.48	0.5	28.7	-0.16	0.20
			2005-06	14.51	4.29	0.8	28.7	-0.07	0.26
			2006-07	14.51	4.29	0.8	28.7	-0.07	0.26
Percent Gifted students									
	All Schools	1807	2003-04	4.99	5.77	0.1	52.3	2.91	12.23
			2004-05	5.00	5.87	0.1	54.9	2.96	12.66
			2005-06	4.91	5.80	0.0	57.2	3.03	13.89
			2006-07	4.91	5.80	0.0	57.2	3.03	13.89
	Elementary	1356	2003-04	4.32	5.43	0.1	52.3	3.41	17.27

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
			2004-05	4.28	5.50	0.1	54.9	3.51	18.29
			2005-06	4.20	5.57	0.1	57.2	3.69	20.55
			2006-07	4.20	5.57	0.1	57.2	3.69	20.55
	High	21	2003-04	7.04	10.17	0.4	39.8	2.49	5.99
			2004-05	7.66	10.64	0.7	39.6	2.14	4.13
			2005-06	4.70	5.06	0.0	37.4	2.69	11.04
			2006-07	4.70	5.06	0.0	37.4	2.69	11.04
	Middle	430	2003-04	7.00	6.06	0.1	37.3	2.04	5.18
			2004-05	7.09	6.18	0.1	39.1	2.10	5.59
			2005-06	7.27	6.34	0.1	39.5	2.11	5.84
			2006-07	7.27	6.34	0.1	39.5	2.11	5.84
Positive Learning Environment									
	All Schools	2286	2003-04	363.80	28.47	131.4	398.7	-1.56	3.58
			2004-05	364.16	26.65	220.3	398.1	-1.38	1.92
			2005-06	364.77	26.02	221.3	397.8	-1.38	1.96
			2006-07	364.77	26.02	221.3	397.8	-1.38	1.96
	Elementary	1496	2003-04	377.47	16.69	241.5	398.7	-2.95	13.80
			2004-05	376.95	14.83	272.9	397.9	-2.23	8.48
			2005-06	376.62	15.67	252.8	397.8	-2.34	9.06
			2006-07	376.62	15.67	252.8	397.8	-2.34	9.06
	High	346	2003-04	336.05	26.61	232.4	396.0	-0.53	0.89
			2004-05	338.32	26.55	259.0	397.2	-0.49	0.26
			2005-06	340.26	24.88	261.7	396.6	-0.23	0.12
			2006-07	340.26	24.88	261.7	396.6	-0.23	0.12
	Middle	444	2003-04	339.38	29.33	131.4	394.9	-1.52	6.16
			2004-05	341.22	27.76	220.3	398.1	-0.83	1.21
			2005-06	343.90	28.34	221.3	397.8	-0.94	1.19
			2006-07	343.90	28.34	221.3	397.8	-0.94	1.19
Positive Teacher Qualifications									
	All Schools	2286	2003-04	140.03	16.82	61.3	200.7	-0.66	1.69
			2004-05	139.14	18.06	59.9	194.4	-0.84	1.69
			2005-06	137.42	18.96	40.4	191.6	-0.96	1.72
			2006-07	137.42	18.96	40.4	191.6	-0.96	1.72
	Elementary	1496	2003-04	139.16	17.57	61.3	187.9	-0.69	1.71
			2004-05	137.77	19.14	59.9	192.4	-0.87	1.64
			2005-06	136.28	20.01	40.4	191.6	-0.99	1.60
			2006-07	136.28	20.01	40.4	191.6	-0.99	1.60
	High	346	2003-04	146.30	14.61	79.9	200.7	-0.88	2.85
			2004-05	146.17	14.50	90.2	194.4	-0.62	1.44
			2005-06	143.04	16.28	80.5	191.6	-0.80	1.18
			2006-07	143.04	16.28	80.5	191.6	-0.80	1.18
	Middle	444	2003-04	138.07	14.64	81.8	177.4	-0.26	0.71
			2004-05	138.26	15.39	89.5	173.7	-0.45	0.26
			2005-06	136.87	16.37	61.6	174.3	-0.68	1.45
			2006-07	136.87	16.37	61.6	174.3	-0.68	1.45
Percent of Student Computers with Content Software									
	All Schools	2286	2003-04	50.59	22.63	0.0	87.5	-0.03	-0.90

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
			2004-05	54.23	22.47	0.0	87.5	-0.21	-0.88
			2005-06	52.14	18.86	0.0	87.5	-0.05	-0.57
			2006-07	52.63	18.34	0.0	87.5	-0.07	-0.58
	Elementary	1496	2003-04	53.06	22.32	0.0	87.5	-0.18	-0.81
			2004-05	56.64	22.27	0.0	87.5	-0.36	-0.75
			2005-06	54.31	18.64	0.0	87.5	-0.22	-0.41
			2006-07	55.15	17.58	0.0	87.5	-0.25	-0.38
	High	346	2003-04	43.46	21.59	1.8	87.5	0.42	-0.61
			2004-05	46.86	21.49	5.4	87.5	0.23	-0.96
			2005-06	45.20	18.09	5.4	87.5	0.44	-0.11
			2006-07	44.43	18.17	7.1	87.5	0.43	-0.31
	Middle	444	2003-04	47.82	22.99	0.0	87.5	0.15	-0.91
			2004-05	51.87	22.46	0.0	87.5	-0.09	-0.80
			2005-06	50.22	18.69	7.1	87.5	0.18	-0.68
			2006-07	50.52	18.84	3.6	87.5	0.25	-0.54
Percent of Student Computers with Office/ Production Software									
	All Schools	2286	2003-04	74.90	16.80	0.0	87.5	-1.66	2.68
			2004-05	76.68	15.66	0.0	87.5	-1.78	3.15
			2005-06	78.14	14.96	0.0	87.5	-2.17	5.07
			2006-07	80.04	12.93	0.0	87.5	-2.36	6.95
	Elementary	1496	2003-04	72.23	18.16	0.0	87.5	-1.40	1.66
			2004-05	74.54	16.90	0.0	87.5	-1.48	1.79
			2005-06	75.92	16.68	0.0	87.5	-1.84	3.28
			2006-07	78.19	14.34	0.0	87.5	-2.05	5.10
	High	346	2003-04	80.92	11.55	10.0	87.5	-2.51	8.05
			2004-05	81.51	11.54	0.0	87.5	-3.04	12.83
			2005-06	82.59	10.36	10.0	87.5	-3.50	16.37
			2006-07	83.67	8.43	12.5	87.5	-3.42	17.94
	Middle	444	2003-04	79.20	12.98	10.0	87.5	-2.09	5.25
			2004-05	80.14	12.35	0.0	87.5	-2.42	7.84
			2005-06	82.15	9.15	37.3	87.5	-2.00	4.09
			2006-07	83.46	8.91	27.2	87.5	-2.76	8.71
Percent of Student Computers with Advanced Production Software									
	All Schools	2286	2003-04	22.13	18.29	0.0	87.5	1.15	1.09
			2004-05	21.85	18.63	0.0	87.5	1.15	1.10
			2005-06	25.93	21.19	0.0	87.5	0.87	0.11
			2006-07	28.06	22.92	0.0	87.5	0.68	-0.50
	Elementary	1496	2003-04	21.98	18.48	0.0	87.5	1.07	0.87
			2004-05	21.25	18.84	0.0	87.5	1.08	0.82
			2005-06	25.46	21.21	0.0	87.5	0.79	-0.08
			2006-07	26.98	23.12	0.0	87.5	0.67	-0.58
	High	346	2003-04	22.77	16.92	0.0	87.5	1.43	1.94
			2004-05	22.88	16.80	0.0	87.5	1.43	2.22
			2005-06	27.43	20.48	0.0	87.5	1.15	0.74
			2006-07	31.05	21.67	0.0	87.5	0.87	-0.03
	Middle	444	2003-04	22.12	18.68	0.0	87.5	1.29	1.34
			2004-05	23.08	19.24	0.0	87.5	1.27	1.35

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
			2005-06	26.32	21.65	0.0	87.5	0.99	0.27
			2006-07	29.38	22.97	0.0	87.5	0.67	-0.54
Percent of Teachers Who Regularly Use Technology to Delivery Instruction									
	All Schools	2286	2003-04	20.00	12.14	0.0	87.5	1.10	1.71
			2004-05	22.29	12.65	0.0	87.5	0.97	1.26
			2005-06	23.84	13.74	0.0	87.5	0.82	0.70
			2006-07	27.75	14.16	0.0	87.5	0.58	0.28
	Elementary	1496	2003-04	18.23	11.66	0.0	87.5	1.26	2.50
			2004-05	20.28	12.29	0.0	87.5	1.17	2.16
			2005-06	21.44	13.26	0.0	87.5	1.00	1.23
			2006-07	25.73	14.28	0.0	87.5	0.76	0.59
	High	346	2003-04	24.58	11.45	5.0	68.0	0.76	0.54
			2004-05	26.93	12.32	5.0	68.0	0.86	0.70
			2005-06	28.28	12.72	5.0	67.8	0.52	-0.23
			2006-07	31.92	12.91	0.0	77.4	0.49	0.46
	Middle	444	2003-04	22.41	12.89	2.5	78.1	1.08	1.36
			2004-05	25.43	12.51	0.0	70.0	0.73	0.26
			2005-06	28.50	14.05	2.5	87.5	0.71	0.77
			2006-07	31.30	13.26	5.0	78.1	0.35	0.02
Percent of Teachers Who Regularly Use Technology for Administrative Purposes									
	All Schools	2286	2003-04	61.63	17.04	0.0	87.5	-0.74	0.28
			2004-05	65.75	15.66	5.0	87.5	-0.86	0.55
			2005-06	68.58	14.73	0.0	87.5	-1.07	1.31
			2006-07	72.18	12.69	0.0	87.5	-1.04	1.58
	Elementary	1496	2003-04	59.26	17.40	0.0	87.5	-0.67	0.11
			2004-05	63.47	15.96	5.0	87.5	-0.79	0.38
			2005-06	66.67	15.26	0.0	87.5	-1.06	1.22
			2006-07	70.70	13.06	0.0	87.5	-0.98	1.54
	High	346	2003-04	66.31	15.75	5.0	87.5	-0.91	0.78
			2004-05	69.78	13.97	12.5	87.5	-1.10	1.28
			2005-06	71.77	12.97	27.7	87.5	-0.97	0.72
			2006-07	74.90	11.56	17.5	87.5	-1.26	2.27
	Middle	444	2003-04	65.98	15.12	14.9	87.5	-0.85	0.63
			2004-05	70.31	14.18	12.5	87.5	-0.93	0.80
			2005-06	72.54	12.90	17.4	87.5	-1.01	1.04
			2006-07	75.05	11.39	22.8	87.5	-1.04	1.03
Frequency Students Use Content Delivery Software									
	All Schools	2286	2003-04	5.93	1.62	0.0	8.0	-0.65	0.02
			2004-05	5.12	1.81	0.0	8.0	-0.32	-0.47
			2005-06	5.43	1.95	0.0	8.0	-0.54	-0.37
			2006-07	5.53	2.00	0.0	8.0	-0.66	-0.23
	Elementary	1496	2003-04	6.16	1.59	0.0	8.0	-0.84	0.37
			2004-05	5.43	1.67	0.0	8.0	-0.41	-0.23
			2005-06	5.57	1.87	0.0	8.0	-0.62	-0.14
			2006-07	5.65	1.91	0.0	8.0	-0.70	-0.08
	High	346	2003-04	5.33	1.63	1.0	8.0	-0.33	-0.19
			2004-05	4.61	2.03	0.0	8.0	-0.08	-0.81

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
			2005-06	5.26	2.14	0.0	8.0	-0.47	-0.65
			2006-07	5.37	2.23	0.0	8.0	-0.61	-0.53
	Middle	444	2003-04	5.61	1.56	0.0	8.0	-0.43	-0.07
			2004-05	4.46	1.83	0.0	8.0	0.00	-0.63
			2005-06	5.07	1.99	0.0	8.0	-0.29	-0.73
			2006-07	5.28	2.08	0.0	8.0	-0.51	-0.51
Frequency Students Use Production Tool Software									
	All Schools	2286	2003-04	6.48	2.09	0.0	12.0	-0.17	-0.06
			2004-05	4.52	2.32	0.0	12.0	0.46	-0.02
			2005-06	5.14	2.77	0.0	12.0	0.33	-0.56
			2006-07	5.23	2.81	0.0	12.0	0.31	-0.60
	Elementary	1496	2003-04	6.14	2.14	0.0	12.0	-0.07	-0.09
			2004-05	4.01	2.12	0.0	11.0	0.47	0.05
			2005-06	4.38	2.48	0.0	12.0	0.53	-0.09
			2006-07	4.40	2.52	0.0	12.0	0.53	-0.13
	High	346	2003-04	7.52	1.63	3.0	12.0	-0.04	0.22
			2004-05	6.03	2.34	0.0	12.0	0.17	-0.21
			2005-06	7.32	2.39	1.0	12.0	-0.39	-0.24
			2006-07	7.55	2.42	0.0	12.0	-0.31	-0.18
	Middle	444	2003-04	6.81	1.93	1.0	12.0	-0.09	-0.26
			2004-05	5.05	2.30	0.0	12.0	0.46	-0.03
			2005-06	6.04	2.77	0.0	12.0	0.17	-0.54
			2006-07	6.21	2.70	0.0	12.0	0.09	-0.67
Level of Human Tech Support									
	All Schools	2286	2003-04	6.47	2.77	0.0	12.0	0.06	-0.71
			2004-05	6.59	2.85	0.0	12.0	0.04	-0.91
			2005-06	7.13	2.77	2.0	14.0	0.03	-1.10
			2006-07	7.91	2.59	1.0	13.0	0.00	-0.97
	Elementary	1496	2003-04	6.29	2.71	0.0	12.0	0.09	-0.66
			2004-05	6.26	2.80	0.0	12.0	0.15	-0.86
			2005-06	6.86	2.78	2.0	14.0	0.17	-1.09
			2006-07	7.52	2.54	1.0	13.0	0.15	-0.91
	High	346	2003-04	6.86	2.80	1.0	12.0	0.11	-0.79
			2004-05	7.45	2.83	1.0	12.0	-0.19	-0.84
			2005-06	7.78	2.67	3.0	13.0	-0.22	-0.88
			2006-07	8.70	2.43	4.0	13.0	-0.29	-0.74
	Middle	444	2003-04	6.75	2.92	1.0	12.0	-0.10	-0.78
			2004-05	7.02	2.86	0.0	12.0	-0.14	-0.88
			2005-06	7.55	2.71	2.0	14.0	-0.19	-1.00
			2006-07	8.57	2.62	1.0	13.0	-0.28	-0.86
Level of Hardware/ Internet Dependability									
	All Schools	2286	2003-04	6.01	1.15	0.0	8.0	-1.32	3.19
			2004-05	6.25	1.17	0.0	8.0	-1.43	2.70
			2005-06	6.13	1.47	0.0	8.0	-1.24	1.10
			2006-07	6.36	1.36	0.0	8.0	-1.43	1.94
	Elementary	1496	2003-04	5.98	1.18	0.0	8.0	-1.29	2.99

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
			2004-05	6.21	1.16	0.0	8.0	-1.31	2.14
			2005-06	6.04	1.51	0.0	8.0	-1.16	0.81
			2006-07	6.32	1.40	0.0	8.0	-1.44	1.91
	High	346	2003-04	6.15	0.97	1.0	8.0	-1.16	3.22
			2004-05	6.32	1.17	1.0	8.0	-1.45	2.52
			2005-06	6.27	1.35	1.0	8.0	-1.45	2.08
			2006-07	6.41	1.29	1.0	8.0	-1.28	1.46
	Middle	444	2003-04	6.00	1.17	0.0	8.0	-1.41	3.36
			2004-05	6.32	1.19	0.0	8.0	-1.84	4.89
			2005-06	6.33	1.38	0.0	8.0	-1.36	1.62
			2006-07	6.43	1.28	1.0	8.0	-1.44	2.15

Table C 22.

Descriptive Statistics of Predictor Variables for FCAT Math Outcome

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
Percent Students on Free or Reduced Lunch Program									
	All Years	2300	2003-04	52.21	25.34	1.0	100.0	0.10	-0.94
			2004-05	52.62	24.09	0.9	100.0	0.02	-0.90
			2005-06	52.25	23.90	1.7	100.0	-0.04	-0.97
			2006-07	52.25	23.90	1.7	100.0	-0.04	-0.97
	Elementary	1511	2003-04	57.05	26.21	1.0	100.0	-0.14	-1.01
			2004-05	56.52	24.86	0.9	100.0	-0.21	-0.93
			2005-06	56.09	24.75	1.7	100.0	-0.25	-0.99
			2006-07	56.09	24.75	1.7	100.0	-0.25	-0.99
	High	345	2003-04	35.48	17.18	1.8	93.3	0.46	0.18
			2004-05	38.83	18.05	3.8	100.0	0.58	0.63
			2005-06	38.65	17.21	2.5	93.7	0.17	-0.34
			2006-07	38.65	17.21	2.5	93.7	0.17	-0.34
	Middle	444	2003-04	48.74	21.24	3.7	100.0	0.12	-0.65
			2004-05	50.10	21.09	3.3	100.0	0.05	-0.60
			2005-06	49.76	21.11	3.9	100.0	0.02	-0.79
			2006-07	49.76	21.11	3.9	100.0	0.02	-0.79
Percent Minority Students									
	All Years	2301	2003-04	50.26	28.22	0.0	100.0	0.30	-1.11
			2004-05	51.45	28.39	0.0	100.0	0.27	-1.14
			2005-06	52.48	28.40	0.0	100.0	0.23	-1.17
			2006-07	52.48	28.40	0.0	100.0	0.23	-1.17
	Elementary	1511	2003-04	52.03	28.98	0.0	100.0	0.20	-1.22
			2004-05	53.19	29.13	0.0	100.0	0.18	-1.24
			2005-06	54.42	28.97	0.0	100.0	0.14	-1.25
			2006-07	54.42	28.97	0.0	100.0	0.14	-1.25
	High	346	2003-04	44.66	26.01	2.6	100.0	0.60	-0.63
			2004-05	45.59	26.47	0.7	99.9	0.55	-0.75

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
			2005-06	45.94	26.99	1.0	99.9	0.50	-0.82
			2006-07	45.94	26.99	1.0	99.9	0.50	-0.82
	Middle	444	2003-04	48.59	26.58	4.8	100.0	0.41	-0.89
			2004-05	50.08	26.62	4.6	99.8	0.36	-0.96
			2005-06	50.97	26.68	5.6	99.9	0.32	-1.00
			2006-07	50.97	26.68	5.6	99.9	0.32	-1.00
Percent LEP students									
	All Years	2135	2003-04	8.77	10.71	0.0	63.3	1.96	3.92
			2004-05	8.55	10.57	0.0	61.6	2.01	4.14
			2005-06	8.83	10.65	0.0	65.7	1.97	4.09
			2006-07	8.83	10.65	0.0	65.7	1.97	4.09
	Elementary	1389	2003-04	10.84	12.24	0.1	63.3	1.55	1.94
			2004-05	10.53	12.08	0.0	61.6	1.60	2.12
			2005-06	10.84	12.13	0.1	65.7	1.57	2.14
			2006-07	10.84	12.13	0.1	65.7	1.57	2.14
	High	325	2003-04	4.50	4.78	0.0	23.1	1.48	1.75
			2004-05	4.35	4.66	0.0	26.0	1.54	2.11
			2005-06	4.43	4.67	0.0	28.3	1.61	2.75
			2006-07	4.43	4.67	0.0	28.3	1.61	2.75
	Middle	421	2003-04	5.23	5.45	0.1	32.5	1.69	3.50
			2004-05	5.18	5.44	0.1	36.4	1.89	4.87
			2005-06	5.47	5.71	0.1	37.4	2.04	5.74
			2006-07	5.47	5.71	0.1	37.4	2.04	5.74
Percent Students with Disabilities									
	All Years	2300	2003-04	15.51	5.41	0.5	40.6	0.68	1.42
			2004-05	15.30	5.32	0.4	43.9	0.73	1.99
			2005-06	15.30	5.44	0.3	72.6	1.51	9.72
			2006-07	15.30	5.44	0.3	72.6	1.51	9.72
	Elementary	1511	2003-04	16.05	5.71	1.2	40.6	0.81	1.27
			2004-05	15.80	5.60	1.6	43.9	0.91	1.95
			2005-06	16.03	5.77	1.9	72.6	1.79	10.58
			2006-07	16.03	5.77	1.9	72.6	1.79	10.58
	High	345	2003-04	13.26	4.43	0.7	31.1	0.03	0.96
			2004-05	13.20	4.47	0.4	27.6	-0.16	0.42
			2005-06	13.16	4.48	0.3	30.9	-0.04	0.66
			2006-07	13.16	4.48	0.3	30.9	-0.04	0.66
	Middle	444	2003-04	15.44	4.57	0.5	27.9	-0.13	0.17
			2004-05	15.23	4.48	0.5	28.7	-0.16	0.20
			2005-06	14.51	4.29	0.8	28.7	-0.07	0.26
			2006-07	14.51	4.29	0.8	28.7	-0.07	0.26
Percent Gifted students									
	All Years	1817	2003-04	4.98	5.77	0.1	52.3	2.91	12.23
			2004-05	4.99	5.87	0.1	54.9	2.96	12.64
			2005-06	4.90	5.79	0.0	57.2	3.03	13.87
			2006-07	4.90	5.79	0.0	57.2	3.03	13.87
	Elementary	1366	2003-04	4.31	5.42	0.1	52.3	3.40	17.24

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
			2004-05	4.28	5.49	0.1	54.9	3.50	18.23
			2005-06	4.19	5.56	0.1	57.2	3.69	20.47
			2006-07	4.19	5.56	0.1	57.2	3.69	20.47
	High	21	2003-04	7.04	10.17	0.4	39.8	2.49	5.99
			2004-05	7.66	10.64	0.7	39.6	2.14	4.13
			2005-06	4.70	5.06	0.0	37.4	2.69	11.04
			2006-07	4.70	5.06	0.0	37.4	2.69	11.04
	Middle	430	2003-04	7.00	6.06	0.1	37.3	2.04	5.18
			2004-05	7.09	6.18	0.1	39.1	2.10	5.59
			2005-06	7.27	6.34	0.1	39.5	2.11	5.84
			2006-07	7.27	6.34	0.1	39.5	2.11	5.84
Positive Learning Environment									
	All Years	2301	2003-04	363.90	28.42	131.4	398.7	-1.56	3.61
			2004-05	364.23	26.60	220.3	398.1	-1.39	1.94
			2005-06	364.82	25.98	221.3	397.8	-1.39	1.98
			2006-07	364.82	25.98	221.3	397.8	-1.39	1.98
	Elementary	1511	2003-04	377.49	16.64	241.5	398.7	-2.95	13.86
			2004-05	376.93	14.83	272.9	397.9	-2.22	8.41
			2005-06	376.59	15.67	252.8	397.8	-2.33	8.97
			2006-07	376.59	15.67	252.8	397.8	-2.33	8.97
	High	346	2003-04	336.05	26.61	232.4	396.0	-0.53	0.89
			2004-05	338.32	26.55	259.0	397.2	-0.49	0.26
			2005-06	340.26	24.88	261.7	396.6	-0.23	0.12
			2006-07	340.26	24.88	261.7	396.6	-0.23	0.12
	Middle	444	2003-04	339.38	29.33	131.4	394.9	-1.52	6.16
			2004-05	341.22	27.76	220.3	398.1	-0.83	1.21
			2005-06	343.90	28.34	221.3	397.8	-0.94	1.19
			2006-07	343.90	28.34	221.3	397.8	-0.94	1.19
Positive Teacher Qualifications									
	All Years	2301	2003-04	139.97	16.83	61.3	200.7	-0.66	1.67
			2004-05	139.06	18.12	59.9	194.4	-0.85	1.68
			2005-06	137.38	19.00	40.4	191.6	-0.96	1.71
			2006-07	137.38	19.00	40.4	191.6	-0.96	1.71
	Elementary	1511	2003-04	139.08	17.57	61.3	187.9	-0.68	1.68
			2004-05	137.67	19.21	59.9	192.4	-0.87	1.62
			2005-06	136.23	20.05	40.4	191.6	-0.99	1.58
			2006-07	136.23	20.05	40.4	191.6	-0.99	1.58
	High	346	2003-04	146.30	14.61	79.9	200.7	-0.88	2.85
			2004-05	146.17	14.50	90.2	194.4	-0.62	1.44
			2005-06	143.04	16.28	80.5	191.6	-0.80	1.18
			2006-07	143.04	16.28	80.5	191.6	-0.80	1.18
	Middle	444	2003-04	138.07	14.64	81.8	177.4	-0.26	0.71
			2004-05	138.26	15.39	89.5	173.7	-0.45	0.26
			2005-06	136.87	16.37	61.6	174.3	-0.68	1.45
			2006-07	136.87	16.37	61.6	174.3	-0.68	1.45

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
Percent of Student Computers with Content Software									
	All Years	2301	2003-04	50.58	22.63	0.0	87.5	-0.03	-0.90
			2004-05	54.25	22.48	0.0	87.5	-0.21	-0.89
			2005-06	52.17	18.86	0.0	87.5	-0.05	-0.57
			2006-07	52.71	18.36	0.0	87.5	-0.07	-0.59
	Elementary	1511	2003-04	53.03	22.32	0.0	87.5	-0.18	-0.80
			2004-05	56.65	22.27	0.0	87.5	-0.36	-0.75
			2005-06	54.35	18.65	0.0	87.5	-0.22	-0.41
			2006-07	55.26	17.61	0.0	87.5	-0.26	-0.39
	High	346	2003-04	43.46	21.59	1.8	87.5	0.42	-0.61
			2004-05	46.86	21.49	5.4	87.5	0.23	-0.96
			2005-06	45.20	18.09	5.4	87.5	0.44	-0.11
			2006-07	44.43	18.17	7.1	87.5	0.43	-0.31
	Middle	444	2003-04	47.82	22.99	0.0	87.5	0.15	-0.91
			2004-05	51.87	22.46	0.0	87.5	-0.09	-0.80
			2005-06	50.22	18.69	7.1	87.5	0.18	-0.68
			2006-07	50.52	18.84	3.6	87.5	0.25	-0.54
Percent of Student Computers with Office/ Production Software									
	All Years	2301	2003-04	74.86	16.83	0.0	87.5	-1.65	2.65
			2004-05	76.68	15.66	0.0	87.5	-1.78	3.16
			2005-06	78.11	14.98	0.0	87.5	-2.16	5.00
			2006-07	80.07	12.90	0.0	87.5	-2.36	6.99
	Elementary	1511	2003-04	72.20	18.18	0.0	87.5	-1.40	1.64
			2004-05	74.56	16.88	0.0	87.5	-1.49	1.81
			2005-06	75.90	16.69	0.0	87.5	-1.83	3.24
			2006-07	78.25	14.29	0.0	87.5	-2.06	5.15
	High	346	2003-04	80.92	11.55	10.0	87.5	-2.51	8.05
			2004-05	81.51	11.54	0.0	87.5	-3.04	12.83
			2005-06	82.59	10.36	10.0	87.5	-3.50	16.37
			2006-07	83.67	8.43	12.5	87.5	-3.42	17.94
	Middle	444	2003-04	79.20	12.98	10.0	87.5	-2.09	5.25
			2004-05	80.14	12.35	0.0	87.5	-2.42	7.84
			2005-06	82.15	9.15	37.3	87.5	-2.00	4.09
			2006-07	83.46	8.91	27.2	87.5	-2.76	8.71
Percent of Student Computers with Advanced Production Software									
	All Years	2301	2003-04	22.15	18.30	0.0	87.5	1.15	1.06
			2004-05	21.87	18.68	0.0	87.5	1.14	1.06
			2005-06	25.96	21.26	0.0	87.5	0.87	0.10
			2006-07	28.12	22.95	0.0	87.5	0.67	-0.51
	Elementary	1511	2003-04	22.01	18.50	0.0	87.5	1.06	0.83
			2004-05	21.29	18.90	0.0	87.5	1.07	0.77
			2005-06	25.52	21.31	0.0	87.5	0.78	-0.09
			2006-07	27.07	23.17	0.0	87.5	0.66	-0.60
	High	346	2003-04	22.77	16.92	0.0	87.5	1.43	1.94
			2004-05	22.88	16.80	0.0	87.5	1.43	2.22
			2005-06	27.43	20.48	0.0	87.5	1.15	0.74

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
			2006-07	31.05	21.67	0.0	87.5	0.87	-0.03
	Middle	444	2003-04	22.12	18.68	0.0	87.5	1.29	1.34
			2004-05	23.08	19.24	0.0	87.5	1.27	1.35
			2005-06	26.32	21.65	0.0	87.5	0.99	0.27
			2006-07	29.38	22.97	0.0	87.5	0.67	-0.54
Percent of Teachers Who Regularly Use Technology to Delivery Instruction									
	All Years	2301	2003-04	19.99	12.15	0.0	87.5	1.10	1.70
			2004-05	22.27	12.65	0.0	87.5	0.97	1.25
			2005-06	23.83	13.74	0.0	87.5	0.81	0.69
			2006-07	27.72	14.18	0.0	87.5	0.58	0.27
	Elementary	1511	2003-04	18.23	11.68	0.0	87.5	1.25	2.47
			2004-05	20.27	12.30	0.0	87.5	1.17	2.13
			2005-06	21.44	13.26	0.0	87.5	0.99	1.20
			2006-07	25.71	14.31	0.0	87.5	0.75	0.56
	High	346	2003-04	24.58	11.45	5.0	68.0	0.76	0.54
			2004-05	26.93	12.32	5.0	68.0	0.86	0.70
			2005-06	28.28	12.72	5.0	67.8	0.52	-0.23
			2006-07	31.92	12.91	0.0	77.4	0.49	0.46
	Middle	444	2003-04	22.41	12.89	2.5	78.1	1.08	1.36
			2004-05	25.43	12.51	0.0	70.0	0.73	0.26
			2005-06	28.50	14.05	2.5	87.5	0.71	0.77
			2006-07	31.30	13.26	5.0	78.1	0.35	0.02
Percent of Teachers Who Regularly Use Technology for Administrative Purposes									
	All Years	2301	2003-04	61.60	17.07	0.0	87.5	-0.75	0.28
			2004-05	65.75	15.66	5.0	87.5	-0.86	0.54
			2005-06	68.55	14.73	0.0	87.5	-1.07	1.30
			2006-07	72.17	12.70	0.0	87.5	-1.04	1.59
	Elementary	1511	2003-04	59.24	17.43	0.0	87.5	-0.67	0.12
			2004-05	63.48	15.96	5.0	87.5	-0.79	0.38
			2005-06	66.64	15.25	0.0	87.5	-1.05	1.21
			2006-07	70.69	13.06	0.0	87.5	-0.98	1.54
	High	346	2003-04	66.31	15.75	5.0	87.5	-0.91	0.78
			2004-05	69.78	13.97	12.5	87.5	-1.10	1.28
			2005-06	71.77	12.97	27.7	87.5	-0.97	0.72
			2006-07	74.90	11.56	17.5	87.5	-1.26	2.27
	Middle	444	2003-04	65.98	15.12	14.9	87.5	-0.85	0.63
			2004-05	70.31	14.18	12.5	87.5	-0.93	0.80
			2005-06	72.54	12.90	17.4	87.5	-1.01	1.04
			2006-07	75.05	11.39	22.8	87.5	-1.04	1.03
Frequency Students Use Content Delivery Software									
	All Years	2301	2003-04	5.93	1.62	0.0	8.0	-0.65	0.01
			2004-05	5.12	1.81	0.0	8.0	-0.33	-0.47
			2005-06	5.43	1.95	0.0	8.0	-0.54	-0.37
			2006-07	5.53	2.00	0.0	8.0	-0.66	-0.23
	Elementary	1511	2003-04	6.15	1.59	0.0	8.0	-0.83	0.36

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
			2004-05	5.44	1.67	0.0	8.0	-0.41	-0.22
			2005-06	5.57	1.87	0.0	8.0	-0.62	-0.14
			2006-07	5.65	1.92	0.0	8.0	-0.70	-0.07
	High	346	2003-04	5.33	1.63	1.0	8.0	-0.33	-0.19
			2004-05	4.61	2.03	0.0	8.0	-0.08	-0.81
			2005-06	5.26	2.14	0.0	8.0	-0.47	-0.65
			2006-07	5.37	2.23	0.0	8.0	-0.61	-0.53
	Middle	444	2003-04	5.61	1.56	0.0	8.0	-0.43	-0.07
			2004-05	4.46	1.83	0.0	8.0	0.00	-0.63
			2005-06	5.07	1.99	0.0	8.0	-0.29	-0.73
			2006-07	5.28	2.08	0.0	8.0	-0.51	-0.51
Frequency Students Use Production Tool Software									
	All Years	2301	2003-04	6.47	2.10	0.0	12.0	-0.18	-0.05
			2004-05	4.52	2.32	0.0	12.0	0.46	-0.03
			2005-06	5.13	2.76	0.0	12.0	0.33	-0.56
			2006-07	5.21	2.81	0.0	12.0	0.31	-0.60
	Elementary	1511	2003-04	6.13	2.14	0.0	12.0	-0.09	-0.08
			2004-05	4.01	2.13	0.0	11.0	0.46	0.02
			2005-06	4.37	2.48	0.0	12.0	0.54	-0.09
			2006-07	4.39	2.52	0.0	12.0	0.53	-0.12
	High	346	2003-04	7.52	1.63	3.0	12.0	-0.04	0.22
			2004-05	6.03	2.34	0.0	12.0	0.17	-0.21
			2005-06	7.32	2.39	1.0	12.0	-0.39	-0.24
			2006-07	7.55	2.42	0.0	12.0	-0.31	-0.18
	Middle	444	2003-04	6.81	1.93	1.0	12.0	-0.09	-0.26
			2004-05	5.05	2.30	0.0	12.0	0.46	-0.03
			2005-06	6.04	2.77	0.0	12.0	0.17	-0.54
			2006-07	6.21	2.70	0.0	12.0	0.09	-0.67
Level of Human Tech Support									
	All Years	2301	2003-04	6.45	2.77	0.0	12.0	0.07	-0.71
			2004-05	6.58	2.85	0.0	12.0	0.05	-0.91
			2005-06	7.12	2.77	2.0	14.0	0.04	-1.10
			2006-07	7.90	2.59	1.0	13.0	0.01	-0.97
	Elementary	1511	2003-04	6.27	2.70	0.0	12.0	0.10	-0.66
			2004-05	6.25	2.80	0.0	12.0	0.15	-0.85
			2005-06	6.85	2.77	2.0	14.0	0.17	-1.09
			2006-07	7.51	2.54	1.0	13.0	0.15	-0.91
	High	346	2003-04	6.86	2.80	1.0	12.0	0.11	-0.79
			2004-05	7.45	2.83	1.0	12.0	-0.19	-0.84
			2005-06	7.78	2.67	3.0	13.0	-0.22	-0.88
			2006-07	8.70	2.43	4.0	13.0	-0.29	-0.74
	Middle	444	2003-04	6.75	2.92	1.0	12.0	-0.10	-0.78
			2004-05	7.02	2.86	0.0	12.0	-0.14	-0.88
			2005-06	7.55	2.71	2.0	14.0	-0.19	-1.00
			2006-07	8.57	2.62	1.0	13.0	-0.28	-0.86

Variable	School Level	N	School Year	Mean	STD	Min	Max	Skew	Kurt
Level of Hardware/ Internet Dependability									
	All Years	2301	2003-04	6.01	1.15	0.0	8.0	-1.32	3.17
			2004-05	6.25	1.17	0.0	8.0	-1.43	2.72
			2005-06	6.13	1.47	0.0	8.0	-1.23	1.08
			2006-07	6.36	1.36	0.0	8.0	-1.43	1.92
	Elementary	1511	2003-04	5.99	1.18	0.0	8.0	-1.28	2.96
			2004-05	6.22	1.16	0.0	8.0	-1.31	2.16
			2005-06	6.04	1.51	0.0	8.0	-1.15	0.79
			2006-07	6.32	1.40	0.0	8.0	-1.44	1.88
	High	346	2003-04	6.15	0.97	1.0	8.0	-1.16	3.22
			2004-05	6.32	1.17	1.0	8.0	-1.45	2.52
			2005-06	6.27	1.35	1.0	8.0	-1.45	2.08
			2006-07	6.41	1.29	1.0	8.0	-1.28	1.46
	Middle	444	2003-04	6.00	1.17	0.0	8.0	-1.41	3.36
			2004-05	6.32	1.19	0.0	8.0	-1.84	4.89
			2005-06	6.33	1.38	0.0	8.0	-1.36	1.62
			2006-07	6.43	1.28	1.0	8.0	-1.44	2.15

Table C 23.

Descriptive Statistics of Predictor Variables for FCAT Writing Outcome

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
Percent Students on Free or Reduced Lunch Program									
	2263	All Years	2003-04	52.08	25.34	1.0	100.0	0.11	-0.95
			2004-05	52.54	24.13	0.9	100.0	0.02	-0.91
			2005-06	52.17	23.95	1.7	100.0	-0.03	-0.98
			2006-07	52.17	23.95	1.7	100.0	-0.03	-0.98
	1480	Elementary	2003-04	56.99	26.19	1.0	100.0	-0.14	-1.01
			2004-05	56.51	24.89	0.9	100.0	-0.20	-0.93
			2005-06	56.07	24.79	1.7	100.0	-0.25	-0.99
			2006-07	56.07	24.79	1.7	100.0	-0.25	-0.99
	346	High	2003-04	35.47	17.21	1.8	93.3	0.45	0.16
			2004-05	38.82	18.07	3.8	100.0	0.58	0.61
			2005-06	38.63	17.23	2.5	93.7	0.18	-0.35
			2006-07	38.63	17.23	2.5	93.7	0.18	-0.35
	437	Middle	2003-04	48.58	21.40	3.7	100.0	0.12	-0.69
			2004-05	50.00	21.24	3.3	100.0	0.04	-0.64
			2005-06	49.69	21.28	3.9	100.0	0.02	-0.82
			2006-07	49.69	21.28	3.9	100.0	0.02	-0.82
Percent Minority Students									
	2264	All Years	2003-04	50.53	28.13	1.4	100.0	0.30	-1.11
			2004-05	51.71	28.27	0.7	100.0	0.27	-1.14
			2005-06	52.77	28.29	1.0	100.0	0.22	-1.17
			2006-07	52.77	28.29	1.0	100.0	0.22	-1.17

Appendix C: Data Preparation Procedures (Continued)

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
	1480	Elementary	2003-04	52.40	28.86	1.4	100.0	0.20	-1.22
			2004-05	53.57	28.98	1.6	100.0	0.18	-1.24
			2005-06	54.80	28.82	1.0	100.0	0.13	-1.25
			2006-07	54.80	28.82	1.0	100.0	0.13	-1.25
	347	High	2003-04	44.64	26.06	2.6	100.0	0.59	-0.64
			2004-05	45.56	26.51	0.7	99.9	0.54	-0.76
			2005-06	45.93	27.04	1.0	99.9	0.49	-0.84
			2006-07	45.93	27.04	1.0	99.9	0.49	-0.84
	437	Middle	2003-04	48.89	26.45	4.8	100.0	0.41	-0.89
			2004-05	50.32	26.38	5.6	99.8	0.35	-0.95
			2005-06	51.32	26.51	5.6	99.9	0.32	-0.99
			2006-07	51.32	26.51	5.6	99.9	0.32	-0.99
Percent LEP students									
	2109	All Years	2003-04	8.81	10.71	0.0	63.3	1.96	3.90
			2004-05	8.59	10.58	0.0	61.6	2.00	4.12
			2005-06	8.86	10.65	0.0	65.7	1.97	4.07
			2006-07	8.86	10.65	0.0	65.7	1.97	4.07
	1367	Elementary	2003-04	10.92	12.24	0.1	63.3	1.54	1.92
			2004-05	10.60	12.09	0.0	61.6	1.59	2.10
			2005-06	10.92	12.13	0.1	65.7	1.56	2.12
			2006-07	10.92	12.13	0.1	65.7	1.56	2.12
	326	High	2003-04	4.49	4.78	0.0	23.1	1.47	1.75
			2004-05	4.35	4.66	0.0	26.0	1.53	2.09
			2005-06	4.43	4.67	0.0	28.3	1.60	2.73
			2006-07	4.43	4.67	0.0	28.3	1.60	2.73
	416	Middle	2003-04	5.25	5.46	0.1	32.5	1.70	3.51
			2004-05	5.20	5.45	0.1	36.4	1.89	4.84
			2005-06	5.49	5.72	0.1	37.4	2.04	5.70
			2006-07	5.49	5.72	0.1	37.4	2.04	5.70
Percent Students with Disabilities									
	2263	All Years	2003-04	15.48	5.42	0.5	40.6	0.69	1.44
			2004-05	15.28	5.32	0.4	43.9	0.73	1.99
			2005-06	15.28	5.44	0.3	72.6	1.52	9.84
			2006-07	15.28	5.44	0.3	72.6	1.52	9.84
	1480	Elementary	2003-04	16.02	5.72	1.2	40.6	0.83	1.30
			2004-05	15.78	5.61	1.6	43.9	0.92	1.97
			2005-06	16.02	5.77	1.9	72.6	1.81	10.73
			2006-07	16.02	5.77	1.9	72.6	1.81	10.73
	346	High	2003-04	13.26	4.45	0.7	31.1	0.04	0.91
			2004-05	13.19	4.48	0.4	27.6	-0.15	0.39
			2005-06	13.14	4.47	0.3	30.9	-0.04	0.68
			2006-07	13.14	4.47	0.3	30.9	-0.04	0.68
	437	Middle	2003-04	15.45	4.60	0.5	27.9	-0.14	0.13
			2004-05	15.24	4.50	0.5	28.7	-0.17	0.19
			2005-06	14.51	4.31	0.8	28.7	-0.07	0.25
			2006-07	14.51	4.31	0.8	28.7	-0.07	0.25

Appendix C: Data Preparation Procedures (Continued)

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
Percent Gifted students									
	1790	All Years	2003-04	4.97	5.75	0.1	52.3	2.94	12.51
			2004-05	4.99	5.86	0.1	54.9	2.98	12.88
			2005-06	4.90	5.79	0.0	57.2	3.06	14.12
			2006-07	4.90	5.79	0.0	57.2	3.06	14.12
	1345	Elementary	2003-04	4.29	5.40	0.1	52.3	3.45	17.74
			2004-05	4.27	5.47	0.1	54.9	3.55	18.79
			2005-06	4.18	5.55	0.1	57.2	3.73	20.95
			2006-07	4.18	5.55	0.1	57.2	3.73	20.95
	22	High	2003-04	7.04	9.92	0.4	39.8	2.54	6.35
			2004-05	7.60	10.36	0.7	39.6	2.20	4.50
			2005-06	4.67	4.99	0.0	37.4	2.75	11.70
			2006-07	4.67	4.99	0.0	37.4	2.75	11.70
	423	Middle	2003-04	7.01	6.04	0.1	37.3	2.04	5.26
			2004-05	7.13	6.19	0.1	39.1	2.09	5.58
			2005-06	7.30	6.36	0.1	39.5	2.10	5.77
			2006-07	7.30	6.36	0.1	39.5	2.10	5.77
Positive Learning Environment									
	2264	All Years	2003-04	363.70	28.56	131.4	398.7	-1.55	3.55
			2004-05	364.07	26.68	220.3	398.1	-1.38	1.92
			2005-06	364.70	26.10	221.3	397.8	-1.39	1.99
			2006-07	364.70	26.10	221.3	397.8	-1.39	1.99
	1480	Elementary	2003-04	377.43	16.75	241.5	398.7	-2.94	13.71
			2004-05	376.86	14.85	272.9	397.9	-2.22	8.45
			2005-06	376.57	15.70	252.8	397.8	-2.33	9.01
			2006-07	376.57	15.70	252.8	397.8	-2.33	9.01
	347	High	2003-04	336.01	26.59	232.4	396.0	-0.52	0.88
			2004-05	338.23	26.52	259.0	397.2	-0.48	0.26
			2005-06	340.30	24.93	261.7	396.6	-0.22	0.10
			2006-07	340.30	24.93	261.7	396.6	-0.22	0.10
	437	Middle	2003-04	339.21	29.47	131.4	394.9	-1.52	6.09
			2004-05	341.26	27.93	220.3	398.1	-0.83	1.18
			2005-06	343.86	28.64	221.3	397.8	-0.95	1.15
			2006-07	343.86	28.64	221.3	397.8	-0.95	1.15
Positive Teacher Qualifications									
	2264	All Years	2003-04	140.03	16.85	61.3	200.7	-0.66	1.69
			2004-05	139.13	18.06	59.9	194.4	-0.83	1.62
			2005-06	137.52	18.90	40.4	191.6	-0.97	1.77
			2006-07	137.52	18.90	40.4	191.6	-0.97	1.77
	1480	Elementary	2003-04	139.11	17.60	61.3	187.9	-0.69	1.71
			2004-05	137.75	19.13	59.9	192.4	-0.85	1.57
			2005-06	136.38	19.90	40.4	191.6	-1.00	1.68
			2006-07	136.38	19.90	40.4	191.6	-1.00	1.68
	347	High	2003-04	146.39	14.61	79.9	200.7	-0.89	2.87
			2004-05	146.26	14.44	90.2	194.4	-0.63	1.50

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2005-06	143.20	16.24	80.5	191.6	-0.82	1.23
			2006-07	143.20	16.24	80.5	191.6	-0.82	1.23
	437	Middle	2003-04	138.12	14.66	81.8	177.4	-0.26	0.73
			2004-05	138.15	15.43	89.5	173.7	-0.44	0.25
			2005-06	136.87	16.46	61.6	174.3	-0.68	1.41
			2006-07	136.87	16.46	61.6	174.3	-0.68	1.41
Percent of Student Computers with Content Software									
	2264	All Years	2003-04	50.58	22.67	0.0	87.5	-0.03	-0.91
			2004-05	54.25	22.51	0.0	87.5	-0.21	-0.89
			2005-06	52.16	18.86	0.0	87.5	-0.05	-0.57
			2006-07	52.69	18.39	0.0	87.5	-0.07	-0.59
	1480	Elementary	2003-04	53.02	22.43	0.0	87.5	-0.19	-0.82
			2004-05	56.77	22.33	0.0	87.5	-0.37	-0.75
			2005-06	54.42	18.70	0.0	87.5	-0.23	-0.42
			2006-07	55.26	17.64	0.0	87.5	-0.26	-0.40
	347	High	2003-04	43.63	21.43	3.6	87.5	0.44	-0.63
			2004-05	46.79	21.42	5.4	87.5	0.23	-0.94
			2005-06	45.07	17.99	5.4	87.5	0.45	-0.07
			2006-07	44.53	18.13	7.1	87.5	0.42	-0.30
	437	Middle	2003-04	47.85	23.00	0.0	87.5	0.15	-0.92
			2004-05	51.65	22.39	0.0	87.5	-0.09	-0.79
			2005-06	50.14	18.50	7.1	87.5	0.16	-0.66
			2006-07	50.47	18.92	3.6	87.5	0.24	-0.56
Percent of Student Computers with Office/ Production Software									
	2264	All Years	2003-04	74.91	16.76	0.0	87.5	-1.66	2.70
			2004-05	76.73	15.60	0.0	87.5	-1.79	3.21
			2005-06	78.15	14.89	0.0	87.5	-2.16	5.08
			2006-07	80.06	12.92	0.0	87.5	-2.35	6.88
	1480	Elementary	2003-04	72.25	18.10	0.0	87.5	-1.41	1.69
			2004-05	74.62	16.81	0.0	87.5	-1.49	1.85
			2005-06	75.95	16.59	0.0	87.5	-1.85	3.32
			2006-07	78.24	14.28	0.0	87.5	-2.04	5.09
	347	High	2003-04	80.98	11.52	10.0	87.5	-2.53	8.16
			2004-05	81.52	11.53	0.0	87.5	-3.04	12.87
			2005-06	82.61	10.35	10.0	87.5	-3.51	16.42
			2006-07	83.73	8.39	12.5	87.5	-3.47	18.36
	437	Middle	2003-04	79.09	13.06	10.0	87.5	-2.07	5.12
			2004-05	80.07	12.42	0.0	87.5	-2.41	7.72
			2005-06	82.06	9.24	37.3	87.5	-1.97	3.91
			2006-07	83.32	9.27	27.2	87.5	-2.81	9.04
Percent of Student Computers with Advanced Production Software									
	2264	All Years	2003-04	22.25	18.30	0.0	87.5	1.14	1.06
			2004-05	21.96	18.60	0.0	87.5	1.14	1.07

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2005-06	26.07	21.21	0.0	87.5	0.86	0.08
			2006-07	28.24	22.96	0.0	87.5	0.67	-0.51
	1480	Elementary	2003-04	22.15	18.52	0.0	87.5	1.05	0.83
			2004-05	21.45	18.87	0.0	87.5	1.06	0.78
			2005-06	25.67	21.25	0.0	87.5	0.77	-0.11
			2006-07	27.18	23.17	0.0	87.5	0.65	-0.60
	347	High	2003-04	23.03	17.07	0.0	87.5	1.41	1.82
			2004-05	22.91	16.84	0.0	87.5	1.42	2.16
			2005-06	27.40	20.33	0.0	87.5	1.13	0.68
			2006-07	31.17	21.71	0.0	87.5	0.87	-0.06
	437	Middle	2003-04	22.00	18.51	0.0	87.5	1.29	1.38
			2004-05	22.91	18.99	0.0	87.5	1.28	1.43
			2005-06	26.37	21.75	0.0	87.5	0.99	0.24
			2006-07	29.52	22.98	0.0	87.5	0.66	-0.55
Percent of Teachers Who Regularly Use Technology to Delivery Instruction									
	2264	All Years	2003-04	19.98	12.14	0.0	87.5	1.11	1.75
			2004-05	22.30	12.65	0.0	87.5	0.97	1.24
			2005-06	23.92	13.79	0.0	87.5	0.83	0.75
			2006-07	27.82	14.13	0.0	87.5	0.57	0.27
	1480	Elementary	2003-04	18.22	11.68	0.0	87.5	1.27	2.52
			2004-05	20.30	12.32	0.0	87.5	1.18	2.16
			2005-06	21.51	13.29	0.0	87.5	0.99	1.20
			2006-07	25.76	14.26	0.0	87.5	0.75	0.57
	347	High	2003-04	24.58	11.43	5.0	68.0	0.76	0.55
			2004-05	27.02	12.39	5.0	68.0	0.85	0.63
			2005-06	28.29	12.76	5.0	67.8	0.53	-0.24
			2006-07	31.98	12.90	0.0	77.4	0.48	0.46
	437	Middle	2003-04	22.32	12.85	2.5	78.1	1.10	1.47
			2004-05	25.32	12.41	0.0	70.0	0.71	0.19
			2005-06	28.60	14.20	2.5	87.5	0.77	0.94
			2006-07	31.49	13.13	5.0	78.1	0.35	0.06
Percent of Teachers Who Regularly Use Technology for Administrative Purposes									
	2264	All Years	2003-04	61.56	17.04	0.0	87.5	-0.74	0.29
			2004-05	65.74	15.70	5.0	87.5	-0.86	0.53
			2005-06	68.63	14.69	0.0	87.5	-1.07	1.29
			2006-07	72.23	12.67	0.0	87.5	-1.06	1.66
	1480	Elementary	2003-04	59.25	17.38	0.0	87.5	-0.67	0.14
			2004-05	63.46	16.01	5.0	87.5	-0.79	0.37
			2005-06	66.70	15.25	0.0	87.5	-1.04	1.16
			2006-07	70.73	13.07	0.0	87.5	-1.00	1.59
	347	High	2003-04	66.21	15.76	5.0	87.5	-0.90	0.75
			2004-05	69.84	13.99	12.5	87.5	-1.10	1.27
			2005-06	71.80	12.96	27.7	87.5	-0.97	0.73
			2006-07	74.91	11.56	17.5	87.5	-1.25	2.26

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
	437	Middle	2003-04	65.71	15.25	14.9	87.5	-0.84	0.58
			2004-05	70.22	14.28	12.5	87.5	-0.94	0.78
			2005-06	72.64	12.70	17.4	87.5	-1.02	1.12
			2006-07	75.18	11.22	22.8	87.5	-1.05	1.15
Frequency Students Use Content Delivery Software									
	2264	All Years	2003-04	5.91	1.62	0.0	8.0	-0.64	-0.01
			2004-05	5.12	1.82	0.0	8.0	-0.32	-0.48
			2005-06	5.43	1.95	0.0	8.0	-0.54	-0.39
			2006-07	5.53	2.01	0.0	8.0	-0.66	-0.23
	1480	Elementary	2003-04	6.14	1.60	0.0	8.0	-0.82	0.33
			2004-05	5.43	1.67	0.0	8.0	-0.41	-0.23
			2005-06	5.57	1.87	0.0	8.0	-0.62	-0.16
			2006-07	5.63	1.92	0.0	8.0	-0.69	-0.09
	347	High	2003-04	5.34	1.62	1.0	8.0	-0.32	-0.21
			2004-05	4.62	2.04	0.0	8.0	-0.08	-0.82
			2005-06	5.29	2.13	0.0	8.0	-0.47	-0.67
			2006-07	5.38	2.23	0.0	8.0	-0.62	-0.51
	437	Middle	2003-04	5.60	1.56	0.0	8.0	-0.44	-0.07
			2004-05	4.46	1.84	0.0	8.0	0.00	-0.63
			2005-06	5.07	2.00	0.0	8.0	-0.30	-0.74
			2006-07	5.30	2.08	0.0	8.0	-0.54	-0.48
Frequency Students Use Production Tool Software									
	2264	All Years	2003-04	6.49	2.09	0.0	12.0	-0.18	-0.06
			2004-05	4.54	2.33	0.0	12.0	0.46	-0.02
			2005-06	5.16	2.76	0.0	12.0	0.32	-0.56
			2006-07	5.24	2.82	0.0	12.0	0.31	-0.60
	1480	Elementary	2003-04	6.15	2.14	0.0	12.0	-0.08	-0.08
			2004-05	4.03	2.12	0.0	11.0	0.46	0.03
			2005-06	4.38	2.48	0.0	12.0	0.53	-0.08
			2006-07	4.40	2.52	0.0	12.0	0.53	-0.11
	347	High	2003-04	7.54	1.61	3.0	12.0	-0.04	0.26
			2004-05	6.06	2.37	0.0	12.0	0.18	-0.24
			2005-06	7.35	2.38	1.0	12.0	-0.38	-0.21
			2006-07	7.57	2.41	0.0	12.0	-0.30	-0.19
	437	Middle	2003-04	6.81	1.94	1.0	12.0	-0.09	-0.28
			2004-05	5.06	2.31	0.0	12.0	0.45	-0.04
			2005-06	6.05	2.75	0.0	12.0	0.15	-0.53
			2006-07	6.25	2.69	0.0	12.0	0.08	-0.65
Level of Human Tech Support									
	2264	All Years	2003-04	6.48	2.77	0.0	12.0	0.06	-0.70
			2004-05	6.62	2.84	0.0	12.0	0.04	-0.90
			2005-06	7.14	2.76	2.0	14.0	0.02	-1.10
			2006-07	7.94	2.58	1.0	13.0	-0.01	-0.96
	1480	Elementary	2003-04	6.30	2.70	0.0	12.0	0.09	-0.66
			2004-05	6.29	2.78	0.0	12.0	0.15	-0.85
			2005-06	6.88	2.77	2.0	14.0	0.15	-1.09

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2006-07	7.56	2.53	1.0	13.0	0.14	-0.92
	347	High	2003-04	6.88	2.79	1.0	12.0	0.09	-0.79
			2004-05	7.45	2.82	1.0	12.0	-0.20	-0.83
			2005-06	7.75	2.65	3.0	13.0	-0.22	-0.89
			2006-07	8.71	2.43	4.0	13.0	-0.29	-0.73
	437	Middle	2003-04	6.78	2.90	1.0	12.0	-0.11	-0.74
			2004-05	7.05	2.85	0.0	12.0	-0.17	-0.86
			2005-06	7.57	2.69	2.0	12.0	-0.23	-1.00
			2006-07	8.61	2.60	1.0	13.0	-0.29	-0.84
Level of Hardware/ Internet Dependability									
	2264	All Years	2003-04	6.01	1.15	0.0	8.0	-1.34	3.24
			2004-05	6.25	1.17	0.0	8.0	-1.43	2.70
			2005-06	6.13	1.47	0.0	8.0	-1.23	1.05
			2006-07	6.35	1.37	0.0	8.0	-1.42	1.89
	1480	Elementary	2003-04	5.98	1.18	0.0	8.0	-1.29	2.98
			2004-05	6.21	1.16	0.0	8.0	-1.32	2.17
			2005-06	6.03	1.52	0.0	8.0	-1.14	0.74
			2006-07	6.31	1.41	0.0	8.0	-1.43	1.83
	347	High	2003-04	6.14	1.00	1.0	8.0	-1.39	4.44
			2004-05	6.32	1.18	1.0	8.0	-1.43	2.43
			2005-06	6.29	1.35	1.0	8.0	-1.46	2.15
			2006-07	6.41	1.29	1.0	8.0	-1.28	1.48
	437	Middle	2003-04	6.00	1.18	0.0	8.0	-1.41	3.29
			2004-05	6.32	1.19	0.0	8.0	-1.84	4.84
			2005-06	6.32	1.38	0.0	8.0	-1.36	1.58
			2006-07	6.44	1.28	1.0	8.0	-1.45	2.18

Table C 24.

Descriptive Statistics of Predictor Variables for Absences Outcome

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
Percent Students on Free or Reduced Lunch Program									
	2311	All Schools	2003-04	52.24	25.36	1.0	100.0	0.10	-0.95
			2004-05	52.64	24.10	0.9	100.0	0.01	-0.90
			2005-06	52.23	23.88	1.7	100.0	-0.04	-0.97
	1517	Elementary	2003-04	57.11	26.21	1.0	100.0	-0.14	-1.01
			2004-05	56.57	24.85	0.9	100.0	-0.21	-0.93
			2005-06	56.08	24.70	1.7	100.0	-0.25	-0.98
	348	High	2003-04	35.50	17.17	1.8	93.3	0.45	0.17
			2004-05	38.84	18.02	3.8	100.0	0.58	0.62
			2005-06	38.66	17.19	2.5	93.7	0.17	-0.35
	446	Middle	2003-04	48.75	21.35	3.7	100.0	0.12	-0.66
			2004-05	50.10	21.19	3.3	100.0	0.05	-0.61

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2005-06	49.75	21.20	3.9	100.0	0.02	-0.80
Percent Minority Students									
	2311	All Schools	2003-04	50.28	28.24	0.0	100.0	0.30	-1.12
			2004-05	51.44	28.40	0.0	100.0	0.27	-1.14
			2005-06	52.50	28.43	0.0	100.0	0.23	-1.17
	1516	Elementary	2003-04	52.04	28.99	0.0	100.0	0.20	-1.22
			2004-05	53.19	29.14	0.0	100.0	0.18	-1.24
			2005-06	54.43	28.98	0.0	100.0	0.13	-1.25
	349	High	2003-04	44.74	26.10	2.6	100.0	0.59	-0.65
			2004-05	45.66	26.55	0.7	99.9	0.54	-0.77
			2005-06	46.03	27.08	1.0	99.9	0.49	-0.85
	446	Middle	2003-04	48.65	26.65	4.8	100.0	0.41	-0.89
			2004-05	50.03	26.61	4.6	99.8	0.36	-0.96
			2005-06	51.03	26.74	5.6	99.9	0.32	-1.00
Percent LEP students									
	2145	All Schools	2003-04	8.74	10.69	0.0	63.3	1.97	3.95
			2004-05	8.53	10.55	0.0	61.6	2.01	4.17
			2005-06	8.80	10.64	0.0	65.7	1.98	4.12
	1394	Elementary	2003-04	10.81	12.22	0.1	63.3	1.56	1.96
			2004-05	10.51	12.06	0.0	61.6	1.60	2.13
			2005-06	10.82	12.11	0.1	65.7	1.57	2.16
	328	High	2003-04	4.51	4.77	0.0	23.1	1.47	1.74
			2004-05	4.36	4.65	0.0	26.0	1.53	2.10
			2005-06	4.43	4.66	0.0	28.3	1.60	2.75
	423	Middle	2003-04	5.23	5.44	0.1	32.5	1.70	3.52
			2004-05	5.17	5.43	0.1	36.4	1.89	4.87
			2005-06	5.46	5.70	0.1	37.4	2.04	5.74
Percent Students with Disabilities									
	2311	All Schools	2003-04	15.53	5.43	0.5	40.6	0.68	1.40
			2004-05	15.31	5.33	0.4	43.9	0.73	1.98
			2005-06	15.32	5.45	0.3	72.6	1.50	9.62
	1517	Elementary	2003-04	16.08	5.73	1.2	40.6	0.80	1.24
			2004-05	15.83	5.62	1.6	43.9	0.91	1.94
			2005-06	16.05	5.78	1.9	72.6	1.78	10.45
	348	High	2003-04	13.24	4.45	0.7	31.1	0.04	0.89
			2004-05	13.19	4.48	0.4	27.6	-0.15	0.39
			2005-06	13.15	4.48	0.3	30.9	-0.04	0.64
	446	Middle	2003-04	15.44	4.56	0.5	27.9	-0.13	0.18
			2004-05	15.23	4.47	0.5	28.7	-0.16	0.21
			2005-06	14.51	4.29	0.8	28.7	-0.07	0.26
Percent Gifted students									
	1824	All Schools	2003-04	4.97	5.76	0.1	52.3	2.91	12.23
			2004-05	4.99	5.87	0.1	54.9	2.95	12.63
			2005-06	4.90	5.79	0.0	57.2	3.03	13.85
	1370	Elementary	2003-04	4.30	5.42	0.1	52.3	3.41	17.27

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2004-05	4.27	5.49	0.1	54.9	3.50	18.25
			2005-06	4.19	5.56	0.1	57.2	3.69	20.51
	22	High	2003-04	7.04	9.92	0.4	39.8	2.54	6.35
			2004-05	7.60	10.36	0.7	39.6	2.20	4.50
			2005-06	4.71	5.03	0.0	37.4	2.70	11.15
	432	Middle	2003-04	7.00	6.05	0.1	37.3	2.04	5.18
			2004-05	7.10	6.18	0.1	39.1	2.09	5.55
			2005-06	7.28	6.34	0.1	39.5	2.10	5.76
Positive Learning Environment									
	2312	All Schools	2003-04	272.20	24.75	62.7	300	-1.64	4.03
			2004-05	273.46	22.89	131.2	299.4	-1.46	2.23
			2005-06	274.15	22.11	156.8	299.5	-1.53	2.55
	1517	Elementary	2003-04	283.77	15.28	158.9	300	-3.42	17.44
			2004-05	284.45	13.12	184.9	299.4	-2.90	12.88
			2005-06	284.07	13.64	163.9	299.5	-2.97	13.42
	349	High	2003-04	249.96	22.76	165.9	296.8	-0.61	0.58
			2004-05	252.40	22.10	183.6	297.2	-0.59	0.30
			2005-06	255.55	20.32	188.2	297.7	-0.32	0.03
	446	Middle	2003-04	250.25	25.56	62.7	296.7	-1.56	6.69
			2004-05	252.58	23.59	131.2	298.1	-0.95	1.79
			2005-06	254.93	24.61	156.8	297.8	-1.02	1.39
Positive Teacher Qualifications									
	2312	All Schools	2003-04	140.00	16.81	61.3	200.7	-0.66	1.67
			2004-05	139.09	18.11	59.9	194.4	-0.85	1.69
			2005-06	137.42	18.99	40.4	191.6	-0.96	1.71
	1517	Elementary	2003-04	139.08	17.55	61.3	187.9	-0.68	1.69
			2004-05	137.68	19.20	59.9	192.4	-0.87	1.62
			2005-06	136.27	20.05	40.4	191.6	-0.98	1.59
	349	High	2003-04	146.37	14.58	79.9	200.7	-0.89	2.87
			2004-05	146.21	14.46	90.2	194.4	-0.63	1.47
			2005-06	143.11	16.23	80.5	191.6	-0.81	1.20
	446	Middle	2003-04	138.12	14.63	81.8	177.4	-0.26	0.71
			2004-05	138.28	15.37	89.5	173.7	-0.45	0.27
			2005-06	136.91	16.36	61.6	174.3	-0.68	1.45
Percent of Student Computers with Content Software									
	2312	All Schools	2003-04	50.60	22.63	0.0	87.5	-0.03	-0.90
			2004-05	54.25	22.46	0.0	87.5	-0.21	-0.88
			2005-06	52.13	18.84	0.0	87.5	-0.04	-0.57
	1517	Elementary	2003-04	53.03	22.32	0.0	87.5	-0.18	-0.80
			2004-05	56.61	22.27	0.0	87.5	-0.36	-0.76
			2005-06	54.29	18.65	0.0	87.5	-0.21	-0.42
	349	High	2003-04	43.39	21.61	1.8	87.5	0.42	-0.62
			2004-05	46.89	21.40	5.4	87.5	0.22	-0.94
			2005-06	45.19	18.02	5.4	87.5	0.44	-0.09
	446	Middle	2003-04	47.95	23.03	0.0	87.5	0.14	-0.92
			2004-05	51.95	22.47	0.0	87.5	-0.09	-0.80

Appendix C: Data Preparation Procedures (Continued)

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2005-06	50.20	18.65	7.1	87.5	0.18	-0.67
Percent of Student Computers with Office/ Production Software									
	2312	All Schools	2003-04	74.89	16.80	0.0	87.5	-1.66	2.68
			2004-05	76.71	15.63	0.0	87.5	-1.79	3.19
			2005-06	78.13	14.96	0.0	87.5	-2.16	5.03
	1517	Elementary	2003-04	72.22	18.16	0.0	87.5	-1.40	1.66
			2004-05	74.59	16.86	0.0	87.5	-1.49	1.83
			2005-06	75.93	16.66	0.0	87.5	-1.84	3.26
	349	High	2003-04	80.97	11.51	10.0	87.5	-2.52	8.14
			2004-05	81.56	11.50	0.0	87.5	-3.05	12.94
			2005-06	82.63	10.32	10.0	87.5	-3.52	16.52
	446	Middle	2003-04	79.21	12.96	10.0	87.5	-2.09	5.27
			2004-05	80.14	12.34	0.0	87.5	-2.42	7.86
			2005-06	82.12	9.18	37.3	87.5	-1.98	3.99
Percent of Student Computers with Advanced Production Software									
	2312	All Schools	2003-04	22.21	18.36	0.0	87.5	1.14	1.05
			2004-05	21.89	18.68	0.0	87.5	1.14	1.04
			2005-06	26.00	21.28	0.0	87.5	0.87	0.08
	1517	Elementary	2003-04	22.05	18.56	0.0	87.5	1.06	0.84
			2004-05	21.29	18.92	0.0	87.5	1.06	0.75
			2005-06	25.54	21.33	0.0	87.5	0.78	-0.11
	349	High	2003-04	22.99	17.07	0.0	87.5	1.40	1.81
			2004-05	22.99	16.84	0.0	87.5	1.41	2.12
			2005-06	27.63	20.56	0.0	87.5	1.13	0.66
	446	Middle	2003-04	22.14	18.68	0.0	87.5	1.29	1.32
			2004-05	23.05	19.20	0.0	87.5	1.27	1.37
			2005-06	26.26	21.62	0.0	87.5	0.99	0.28
Percent of Teachers Who Regularly Use Technology to Delivery Instruction									
	2312	All Schools	2003-04	20.01	12.18	0.0	87.5	1.11	1.76
			2004-05	22.30	12.72	0.0	87.5	1.01	1.44
			2005-06	23.90	13.84	0.0	87.5	0.85	0.86
	1517	Elementary	2003-04	18.26	11.74	0.0	87.5	1.28	2.59
			2004-05	20.29	12.40	0.0	87.5	1.23	2.50
			2005-06	21.49	13.36	0.0	87.5	1.04	1.44
	349	High	2003-04	24.56	11.40	5.0	68.0	0.77	0.57
			2004-05	27.02	12.36	5.0	68.0	0.85	0.65
			2005-06	28.32	12.74	5.0	67.8	0.52	-0.24
	446	Middle	2003-04	22.40	12.90	2.5	78.1	1.07	1.34
			2004-05	25.40	12.50	0.0	70.0	0.73	0.26
			2005-06	28.62	14.21	2.5	87.5	0.76	0.89
Percent of Teachers Who Regularly Use Technology for Administrative Purposes									
	2312	All Schools	2003-04	65.76	15.66	5.0	87.5	-0.86	0.54
			2004-05	68.57	14.72	0.0	87.5	-1.07	1.30
			2005-06	61.59	17.08	0.0	87.5	-0.74	0.27
	1517	Elementary	2003-04	63.50	15.96	5.0	87.5	-0.78	0.37

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2004-05	66.67	15.24	0.0	87.5	-1.05	1.21
			2005-06	59.24	17.43	0.0	87.5	-0.67	0.12
	349	High	2003-04	66.28	15.75	5.0	87.5	-0.90	0.76
			2004-05	69.84	13.95	12.5	87.5	-1.10	1.30
			2005-06	71.77	12.95	27.7	87.5	-0.97	0.71
	446	Middle	2003-04	65.91	15.20	14.9	87.5	-0.86	0.62
			2004-05	70.25	14.24	12.5	87.5	-0.93	0.77
			2005-06	72.53	12.90	17.4	87.5	-1.01	1.03
Frequency Students Use Content Delivery Software									
	2312	All Schools	2003-04	5.12	1.81	0.0	8.0	-0.32	-0.48
			2004-05	5.43	1.95	0.0	8.0	-0.53	-0.38
			2005-06	5.92	1.62	0.0	8.0	-0.65	0.01
	1517	Elementary	2003-04	5.43	1.67	0.0	8.0	-0.41	-0.23
			2004-05	5.57	1.87	0.0	8.0	-0.61	-0.16
			2005-06	6.15	1.59	0.0	8.0	-0.83	0.35
	349	High	2003-04	5.32	1.63	1.0	8.0	-0.33	-0.20
			2004-05	4.62	2.04	0.0	8.0	-0.07	-0.81
			2005-06	5.28	2.14	0.0	8.0	-0.47	-0.65
	446	Middle	2003-04	5.60	1.56	0.0	8.0	-0.43	-0.06
			2004-05	4.46	1.83	0.0	8.0	0.01	-0.63
			2005-06	5.08	2.00	0.0	8.0	-0.29	-0.74
Frequency Students Use Production Tool Software									
	2312	All Schools	2003-04	4.52	2.33	0.0	12.0	0.46	-0.02
			2004-05	5.13	2.77	0.0	12.0	0.34	-0.56
			2005-06	6.47	2.10	0.0	12.0	-0.18	-0.04
	1517	Elementary	2003-04	4.01	2.13	0.0	11.0	0.46	0.01
			2004-05	4.36	2.48	0.0	12.0	0.54	-0.08
			2005-06	6.12	2.14	0.0	12.0	-0.09	-0.08
	349	High	2003-04	7.52	1.63	3.0	12.0	-0.05	0.23
			2004-05	6.06	2.36	0.0	12.0	0.18	-0.22
			2005-06	7.34	2.39	1.0	12.0	-0.39	-0.22
	446	Middle	2003-04	6.82	1.93	1.0	12.0	-0.09	-0.26
			2004-05	5.05	2.30	0.0	12.0	0.46	-0.03
			2005-06	6.04	2.77	0.0	12.0	0.17	-0.54
Level of Human Tech Support									
	2312	All Schools	2003-04	6.57	2.85	0.0	12.0	0.05	-0.91
			2004-05	7.12	2.77	2.0	14.0	0.04	-1.10
			2005-06	6.46	2.77	0.0	12.0	0.07	-0.71
	1517	Elementary	2003-04	6.24	2.79	0.0	12.0	0.16	-0.85
			2004-05	6.84	2.78	2.0	14.0	0.17	-1.09
			2005-06	6.27	2.70	0.0	12.0	0.10	-0.66
	349	High	2003-04	6.87	2.79	1.0	12.0	0.10	-0.79
			2004-05	7.46	2.82	1.0	12.0	-0.21	-0.83
			2005-06	7.78	2.66	3.0	13.0	-0.22	-0.88
	446	Middle	2003-04	6.75	2.92	1.0	12.0	-0.10	-0.78
			2004-05	7.01	2.85	0.0	12.0	-0.14	-0.88

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2005-06	7.56	2.71	2.0	14.0	-0.20	-1.00
Level of Hardware/ Internet Dependability									
	2312	All Schools	2003-04	6.25	1.16	0.0	8.0	-1.43	2.72
			2004-05	6.13	1.47	0.0	8.0	-1.23	1.07
			2005-06	6.01	1.15	0.0	8.0	-1.33	3.22
	1517	Elementary	2003-04	6.22	1.15	0.0	8.0	-1.31	2.18
			2004-05	6.04	1.52	0.0	8.0	-1.15	0.77
			2005-06	5.99	1.18	0.0	8.0	-1.28	2.97
	349	High	2003-04	6.14	1.00	1.0	8.0	-1.38	4.30
			2004-05	6.32	1.18	1.0	8.0	-1.44	2.45
			2005-06	6.29	1.35	1.0	8.0	-1.45	2.09
	446	Middle	2003-04	6.01	1.17	0.0	8.0	-1.40	3.33
			2004-05	6.33	1.18	0.0	8.0	-1.85	4.92
			2005-06	6.33	1.38	0.0	8.0	-1.36	1.62

Table C 25.

Descriptive Statistics of Predictor Variables for Student Conduct Outcome

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
Percent Students on Free or Reduced Lunch Program									
	2311	All Schools	2003-04	52.24	25.36	1.0	100.0	0.10	-0.95
			2004-05	52.64	24.10	0.9	100.0	0.01	-0.90
			2005-06	52.23	23.88	1.7	100.0	-0.04	-0.97
	1517	Elementary	2003-04	57.11	26.21	1.0	100.0	-0.14	-1.01
			2004-05	56.57	24.85	0.9	100.0	-0.21	-0.93
			2005-06	56.08	24.70	1.7	100.0	-0.25	-0.98
	348	High	2003-04	35.50	17.17	1.8	93.3	0.45	0.17
			2004-05	38.84	18.02	3.8	100.0	0.58	0.62
			2005-06	38.66	17.19	2.5	93.7	0.17	-0.35
	446	Middle	2003-04	48.75	21.35	3.7	100.0	0.12	-0.66
			2004-05	50.10	21.19	3.3	100.0	0.05	-0.61
			2005-06	49.75	21.20	3.9	100.0	0.02	-0.80
Percent Minority Students									
	2311	All Schools	2003-04	50.28	28.24	0.0	100.0	0.30	-1.12
			2004-05	51.44	28.40	0.0	100.0	0.27	-1.14
			2005-06	52.50	28.43	0.0	100.0	0.23	-1.17
	1516	Elementary	2003-04	52.04	28.99	0.0	100.0	0.20	-1.22
			2004-05	53.19	29.14	0.0	100.0	0.18	-1.24
			2005-06	54.43	28.98	0.0	100.0	0.13	-1.25
	349	High	2003-04	44.74	26.10	2.6	100.0	0.59	-0.65
			2004-05	45.66	26.55	0.7	99.9	0.54	-0.77
			2005-06	46.03	27.08	1.0	99.9	0.49	-0.85
	446	Middle	2003-04	48.65	26.65	4.8	100.0	0.41	-0.89
			2004-05	50.03	26.61	4.6	99.8	0.36	-0.96

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2005-06	51.03	26.74	5.6	99.9	0.32	-1.00
Percent LEP students									
	2145	All Schools	2003-04	8.74	10.69	0.0	63.3	1.97	3.95
			2004-05	8.53	10.55	0.0	61.6	2.01	4.17
			2005-06	8.80	10.64	0.0	65.7	1.98	4.12
	1394	Elementary	2003-04	10.81	12.22	0.1	63.3	1.56	1.96
			2004-05	10.51	12.06	0.0	61.6	1.60	2.13
			2005-06	10.82	12.11	0.1	65.7	1.57	2.16
	328	High	2003-04	4.51	4.77	0.0	23.1	1.47	1.74
			2004-05	4.36	4.65	0.0	26.0	1.53	2.10
			2005-06	4.43	4.66	0.0	28.3	1.60	2.75
	423	Middle	2003-04	5.23	5.44	0.1	32.5	1.70	3.52
			2004-05	5.17	5.43	0.1	36.4	1.89	4.87
			2005-06	5.46	5.70	0.1	37.4	2.04	5.74
Percent Students with Disabilities									
	2311	All Schools	2003-04	15.53	5.43	0.5	40.6	0.68	1.40
			2004-05	15.31	5.33	0.4	43.9	0.73	1.98
			2005-06	15.32	5.45	0.3	72.6	1.50	9.62
	1517	Elementary	2003-04	16.08	5.73	1.2	40.6	0.80	1.24
			2004-05	15.83	5.62	1.6	43.9	0.91	1.94
			2005-06	16.05	5.78	1.9	72.6	1.78	10.45
	348	High	2003-04	13.24	4.45	0.7	31.1	0.04	0.89
			2004-05	13.19	4.48	0.4	27.6	-0.15	0.39
			2005-06	13.15	4.48	0.3	30.9	-0.04	0.64
	446	Middle	2003-04	15.44	4.56	0.5	27.9	-0.13	0.18
			2004-05	15.23	4.47	0.5	28.7	-0.16	0.21
			2005-06	14.51	4.29	0.8	28.7	-0.07	0.26
Percent Gifted students									
	1824	All Schools	2003-04	4.97	5.76	0.1	52.3	2.91	12.23
			2004-05	4.99	5.87	0.1	54.9	2.95	12.63
			2005-06	4.90	5.79	0.0	57.2	3.03	13.85
	1370	Elementary	2003-04	4.30	5.42	0.1	52.3	3.41	17.27
			2004-05	4.27	5.49	0.1	54.9	3.50	18.25
			2005-06	4.19	5.56	0.1	57.2	3.69	20.51
	22	High	2003-04	7.04	9.92	0.4	39.8	2.54	6.35
			2004-05	7.60	10.36	0.7	39.6	2.20	4.50
			2005-06	4.71	5.03	0.0	37.4	2.70	11.15
	432	Middle	2003-04	7.00	6.05	0.1	37.3	2.04	5.18
			2004-05	7.10	6.18	0.1	39.1	2.09	5.55
			2005-06	7.28	6.34	0.1	39.5	2.10	5.76
Positive Learning Environment									
	2312	All Schools	2003-04	185.39	7.06	147.3	199.2	-1.20	2.49
			2004-05	183.81	8.24	80.9	198.5	-1.83	11.75
			2005-06	183.61	8.23	134.6	199	-1.10	1.94
	1517	Elementary	2003-04	187.66	4.90	162.6	199.2	-0.59	0.68

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2004-05	185.80	6.79	80.9	197.9	-3.19	38.18
			2005-06	185.72	6.67	134.6	197.9	-1.29	3.65
	349	High	2003-04	178.65	8.94	151.2	198.4	-0.44	0.20
			2004-05	177.55	9.73	150.8	198.4	-0.41	-0.01
			2005-06	176.59	9.95	137.7	198.5	-0.40	0.54
	446	Middle	2003-04	182.95	7.47	147.3	198.2	-0.92	2.31
			2004-05	181.91	8.58	144.8	198.5	-0.94	1.85
			2005-06	181.94	8.10	147.7	199	-0.63	0.71
Positive Teacher Qualifications									
	2312	All Schools	2003-04	140.00	16.81	61.3	200.7	-0.66	1.67
			2004-05	139.09	18.11	59.9	194.4	-0.85	1.69
			2005-06	137.42	18.99	40.4	191.6	-0.96	1.71
	1517	Elementary	2003-04	139.08	17.55	61.3	187.9	-0.68	1.69
			2004-05	137.68	19.20	59.9	192.4	-0.87	1.62
			2005-06	136.27	20.05	40.4	191.6	-0.98	1.59
	349	High	2003-04	146.37	14.58	79.9	200.7	-0.89	2.87
			2004-05	146.21	14.46	90.2	194.4	-0.63	1.47
			2005-06	143.11	16.23	80.5	191.6	-0.81	1.20
	446	Middle	2003-04	138.12	14.63	81.8	177.4	-0.26	0.71
			2004-05	138.28	15.37	89.5	173.7	-0.45	0.27
			2005-06	136.91	16.36	61.6	174.3	-0.68	1.45
Percent of Student Computers with Content Software									
	2312	All Schools	2003-04	50.60	22.63	0.0	87.5	-0.03	-0.90
			2004-05	54.25	22.46	0.0	87.5	-0.21	-0.88
			2005-06	52.13	18.84	0.0	87.5	-0.04	-0.57
	1517	Elementary	2003-04	53.03	22.32	0.0	87.5	-0.18	-0.80
			2004-05	56.61	22.27	0.0	87.5	-0.36	-0.76
			2005-06	54.29	18.65	0.0	87.5	-0.21	-0.42
	349	High	2003-04	43.39	21.61	1.8	87.5	0.42	-0.62
			2004-05	46.89	21.40	5.4	87.5	0.22	-0.94
			2005-06	45.19	18.02	5.4	87.5	0.44	-0.09
	446	Middle	2003-04	47.95	23.03	0.0	87.5	0.14	-0.92
			2004-05	51.95	22.47	0.0	87.5	-0.09	-0.80
			2005-06	50.20	18.65	7.1	87.5	0.18	-0.67
Percent of Student Computers with Office/ Production Software									
	2312	All Schools	2003-04	74.89	16.80	0.0	87.5	-1.66	2.68
			2004-05	76.71	15.63	0.0	87.5	-1.79	3.19
			2005-06	78.13	14.96	0.0	87.5	-2.16	5.03
	1517	Elementary	2003-04	72.22	18.16	0.0	87.5	-1.40	1.66
			2004-05	74.59	16.86	0.0	87.5	-1.49	1.83
			2005-06	75.93	16.66	0.0	87.5	-1.84	3.26
	349	High	2003-04	80.97	11.51	10.0	87.5	-2.52	8.14
			2004-05	81.56	11.50	0.0	87.5	-3.05	12.94
			2005-06	82.63	10.32	10.0	87.5	-3.52	16.52
	446	Middle	2003-04	79.21	12.96	10.0	87.5	-2.09	5.27
			2004-05	80.14	12.34	0.0	87.5	-2.42	7.86

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2005-06	82.12	9.18	37.3	87.5	-1.98	3.99
Percent of Student Computers with Advanced Production Software									
	2312	All Schools	2003-04	22.21	18.36	0.0	87.5	1.14	1.05
			2004-05	21.89	18.68	0.0	87.5	1.14	1.04
			2005-06	26.00	21.28	0.0	87.5	0.87	0.08
	1517	Elementary	2003-04	22.05	18.56	0.0	87.5	1.06	0.84
			2004-05	21.29	18.92	0.0	87.5	1.06	0.75
			2005-06	25.54	21.33	0.0	87.5	0.78	-0.11
	349	High	2003-04	22.99	17.07	0.0	87.5	1.40	1.81
			2004-05	22.99	16.84	0.0	87.5	1.41	2.12
			2005-06	27.63	20.56	0.0	87.5	1.13	0.66
	446	Middle	2003-04	22.14	18.68	0.0	87.5	1.29	1.32
			2004-05	23.05	19.20	0.0	87.5	1.27	1.37
			2005-06	26.26	21.62	0.0	87.5	0.99	0.28
Percent of Teachers Who Regularly Use Technology to Delivery Instruction									
	2312	All Schools	2003-04	20.01	12.18	0.0	87.5	1.11	1.76
			2004-05	22.30	12.72	0.0	87.5	1.01	1.44
			2005-06	23.90	13.84	0.0	87.5	0.85	0.86
	1517	Elementary	2003-04	18.26	11.74	0.0	87.5	1.28	2.59
			2004-05	20.29	12.40	0.0	87.5	1.23	2.50
			2005-06	21.49	13.36	0.0	87.5	1.04	1.44
	349	High	2003-04	24.56	11.40	5.0	68.0	0.77	0.57
			2004-05	27.02	12.36	5.0	68.0	0.85	0.65
			2005-06	28.32	12.74	5.0	67.8	0.52	-0.24
	446	Middle	2003-04	22.40	12.90	2.5	78.1	1.07	1.34
			2004-05	25.40	12.50	0.0	70.0	0.73	0.26
			2005-06	28.62	14.21	2.5	87.5	0.76	0.89
Percent of Teachers Who Regularly Use Technology for Administrative Purposes									
	2312	All Schools	2003-04	61.59	17.08	0.0	87.5	-0.74	0.27
			2004-05	65.76	15.66	5.0	87.5	-0.86	0.54
			2005-06	68.57	14.72	0.0	87.5	-1.07	1.30
	1517	Elementary	2003-04	59.24	17.43	0.0	87.5	-0.67	0.12
			2004-05	63.50	15.96	5.0	87.5	-0.78	0.37
			2005-06	66.67	15.24	0.0	87.5	-1.05	1.21
	349	High	2003-04	66.28	15.75	5.0	87.5	-0.90	0.76
			2004-05	69.84	13.95	12.5	87.5	-1.10	1.30
			2005-06	71.77	12.95	27.7	87.5	-0.97	0.71
	446	Middle	2003-04	65.91	15.20	14.9	87.5	-0.86	0.62
			2004-05	70.25	14.24	12.5	87.5	-0.93	0.77
			2005-06	72.53	12.90	17.4	87.5	-1.01	1.03
Frequency Students Use Content Delivery Software									
	2312	All Schools	2003-04	5.92	1.62	0.0	8.0	-0.65	0.01
			2004-05	5.12	1.81	0.0	8.0	-0.32	-0.48
			2005-06	5.43	1.95	0.0	8.0	-0.53	-0.38
	1517	Elementary	2003-04	6.15	1.59	0.0	8.0	-0.83	0.35

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2004-05	5.43	1.67	0.0	8.0	-0.41	-0.23
			2005-06	5.57	1.87	0.0	8.0	-0.61	-0.16
	349	High	2003-04	5.32	1.63	1.0	8.0	-0.33	-0.20
			2004-05	4.62	2.04	0.0	8.0	-0.07	-0.81
			2005-06	5.28	2.14	0.0	8.0	-0.47	-0.65
	446	Middle	2003-04	5.60	1.56	0.0	8.0	-0.43	-0.06
			2004-05	4.46	1.83	0.0	8.0	0.01	-0.63
			2005-06	5.08	2.00	0.0	8.0	-0.29	-0.74
Frequency Students Use Production Tool Software									
	2312	All Schools	2003-04	6.47	2.10	0.0	12.0	-0.18	-0.04
			2004-05	4.52	2.33	0.0	12.0	0.46	-0.02
			2005-06	5.13	2.77	0.0	12.0	0.34	-0.56
	1517	Elementary	2003-04	6.12	2.14	0.0	12.0	-0.09	-0.08
			2004-05	4.01	2.13	0.0	11.0	0.46	0.01
			2005-06	4.36	2.48	0.0	12.0	0.54	-0.08
	349	High	2003-04	7.52	1.63	3.0	12.0	-0.05	0.23
			2004-05	6.06	2.36	0.0	12.0	0.18	-0.22
			2005-06	7.34	2.39	1.0	12.0	-0.39	-0.22
	446	Middle	2003-04	6.82	1.93	1.0	12.0	-0.09	-0.26
			2004-05	5.05	2.30	0.0	12.0	0.46	-0.03
			2005-06	6.04	2.77	0.0	12.0	0.17	-0.54
Level of Human Tech Support									
	2312	All Schools	2003-04	6.46	2.77	0.0	12.0	0.07	-0.71
			2004-05	6.57	2.85	0.0	12.0	0.05	-0.91
			2005-06	7.12	2.77	2.0	14.0	0.04	-1.10
	1517	Elementary	2003-04	6.27	2.70	0.0	12.0	0.10	-0.66
			2004-05	6.24	2.79	0.0	12.0	0.16	-0.85
			2005-06	6.84	2.78	2.0	14.0	0.17	-1.09
	349	High	2003-04	6.87	2.79	1.0	12.0	0.10	-0.79
			2004-05	7.46	2.82	1.0	12.0	-0.21	-0.83
			2005-06	7.78	2.66	3.0	13.0	-0.22	-0.88
	446	Middle	2003-04	6.75	2.92	1.0	12.0	-0.10	-0.78
			2004-05	7.01	2.85	0.0	12.0	-0.14	-0.88
			2005-06	7.56	2.71	2.0	14.0	-0.20	-1.00
Level of Hardware/ Internet Dependability									
	2312	All Schools	2003-04	6.01	1.15	0.0	8.0	-1.33	3.22
			2004-05	6.25	1.16	0.0	8.0	-1.43	2.72
			2005-06	6.13	1.47	0.0	8.0	-1.23	1.07
	1517	Elementary	2003-04	5.99	1.18	0.0	8.0	-1.28	2.97
			2004-05	6.22	1.15	0.0	8.0	-1.31	2.18
			2005-06	6.04	1.52	0.0	8.0	-1.15	0.77
	349	High	2003-04	6.14	1.00	1.0	8.0	-1.38	4.30
			2004-05	6.32	1.18	1.0	8.0	-1.44	2.45

Variable	N	School Level	School Year	Mean	STD	Min	Max	Skew	Kurt
			2005-06	6.29	1.35	1.0	8.0	-1.45	2.09
	446	Middle	2003-04	6.01	1.17	0.0	8.0	-1.40	3.33
			2004-05	6.33	1.18	0.0	8.0	-1.85	4.92
			2005-06	6.33	1.38	0.0	8.0	-1.36	1.62

Correlations of Technology Indicators with Predictor Variables

Table C 26.

Correlations and P-values of Predictor Variables for Learning Environment and Technology Indicators for FCAT Reading Outcome

	Variable	1	2	3	4	5	6	7	8	9	10
1	Positive Learning Environment										
2	Positive Teacher Qualifications	0.10 <.0001									
3	Percent of Student Computers with Content Software	0.13 <.0001	0.04 <.0001								
4	Percent of Student Computers with Office/ Production Software	-0.05 <.0001	-0.02 0.0329	0.20 <.0001							
5	Percent of Student Computers with Advanced Production Software	0.08 <.0001	0.11 <.0001	0.31 <.0001	0.32 <.0001						
6	Percent of Teachers Who Regularly Use Technology to Deliver Instruction	-0.02 0.0581	0.07 <.0001	0.27 <.0001	0.24 <.0001	0.35 <.0001					
7	Percent of Teachers Who Regularly Use Technology for Administrative Purposes	0.04 <.0001	0.04 0.0005	0.26 <.0001	0.33 <.0001	0.27 <.0001	0.56 <.0001				
8	Frequency Students Use Content Delivery Software	0.04 0.0006	0.01 0.2158	0.30 <.0001	0.02 0.0427	0.06 <.0001	0.08 <.0001	0.10 <.0001			
9	Frequency Students Use Production Tool Software	-0.11 <.0001	0.13 <.0001	0.13 <.0001	0.22 <.0001	0.26 <.0001	0.35 <.0001	0.27 <.0001	0.25 <.0001		
10	Level of Human Tech Support	-0.08 <.0001	0.10 <.0001	0.11 <.0001	0.11 <.0001	0.14 <.0001	0.20 <.0001	0.19 <.0001	0.10 <.0001	0.12 <.0001	
11	Level of Hardware/ Internet Dependability	-0.05 <.0001	0.01 0.5997	0.06 <.0001	0.08 <.0001	0.03 0.0014	0.05 <.0001	0.08 <.0001	0.03 0.0128	0.01 0.2939	0.08 <.0001

Table C 27.

Correlations and P-values of Predictor Variables for Learning Environment and Technology Indicators for FCAT Math Outcome

	Variable	1	2	3	4	5	6	7	8	9	10
1	Positive Learning Environment										
2	Positive Teacher Qualifications	0.10									
		<.0001									
3	Percent of Student Computers with Content Software	0.13	0.04								
		<.0001	<.0001								
4	Percent of Student Computers with Office/ Production Software	-0.05	-0.02	0.20							
		<.0001	0.0235	<.0001							
5	Percent of Student Computers with Advanced Production Software	0.09	0.11	0.31	0.32						
		<.0001	<.0001	<.0001	<.0001						
6	Percent of Teachers Who Regularly Use Technology to Deliver Instruction	-0.02	0.07	0.27	0.24	0.35					
		0.0602	<.0001	<.0001	<.0001	<.0001					
7	Percent of Teachers Who Regularly Use Technology for Administrative Purposes	0.04	0.04	0.26	0.33	0.27	0.56				
		0.0001	0.0003	<.0001	<.0001	<.0001	<.0001				
8	Frequency Students Use Content Delivery Software	0.04	0.01	0.29	0.02	0.05	0.08	0.10			
		0.0006	0.238	<.0001	0.0574	<.0001	<.0001	<.0001			
9	Frequency Students Use Production Tool Software	-0.11	0.13	0.13	0.22	0.26	0.35	0.27	0.24		
		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		
10	Level of Human Tech Support	-0.08	0.10	0.11	0.11	0.14	0.20	0.19	0.10	0.13	
		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	
11	Level of Hardware/ Internet Dependability	-0.05	0.00	0.06	0.08	0.03	0.05	0.08	0.03	0.01	0.08
		<.0001	0.7154	<.0001	<.0001	0.001	<.0001	<.0001	0.0067	0.3345	<.0001

Table C 28.

Correlations and P-values of Predictor Variables for Learning Environment and Technology Indicators for FCAT Writing Outcome

	Variable	1	2	3	4	5	6	7	8	9	10
1	Positive Learning Environment										
2	Positive Teacher Qualifications	0.11									
		<.0001									
3	Percent of Student Computers with Content Software	0.14	0.04								
		<.0001	<.0001								
4	Percent of Student Computers with Office/ Production Software	-0.05	-0.02	0.20							
		<.0001	0.0407	<.0001							
5	Percent of Student Computers with Advanced Production Software	0.09	0.12	0.31	0.32						
		<.0001	<.0001	<.0001	<.0001						
6	Percent of Teachers Who Regularly Use Technology to Deliver Instruction	-0.02	0.07	0.27	0.24	0.35					
		0.0731	<.0001	<.0001	<.0001	<.0001					
7	Percent of Teachers Who Regularly Use Technology for Administrative Purposes	0.04	0.04	0.26	0.33	0.26	0.56				
		<.0001	0.0002	<.0001	<.0001	<.0001	<.0001				
8	Frequency Students Use Content Delivery Software	0.03	0.01	0.30	0.02	0.06	0.08	0.11			
		0.0016	0.1941	<.0001	0.0237	<.0001	<.0001	<.0001			
9	Frequency Students Use Production Tool Software	-0.11	0.13	0.13	0.22	0.26	0.35	0.27	0.25		
		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		
10	Level of Human Tech Support	-0.08	0.10	0.10	0.11	0.13	0.20	0.19	0.10	0.12	
		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	
11	Level of Hardware/ Internet Dependability	-0.05	0.01	0.06	0.08	0.03	0.06	0.08	0.03	0.01	0.08
		<.0001	0.5539	<.0001	<.0001	0.0012	<.0001	<.0001	0.0112	0.2295	<.0001

Table C 29.

Correlations and P-values of Predictor Variables for Learning Environment and Technology Indicators for Absences Outcome

	Variable	1	2	3	4	5	6	7	8	9	10
1	Positive Learning Environment										
2	Positive Teacher Qualifications	0.09 <.0001									
3	Percent of Student Computers with Content Software	0.12 <.0001	0.03 0.0298								
4	Percent of Student Computers with Office/ Production Software	-0.05 <.0001	-0.03 0.0202	0.19 <.0001							
5	Percent of Student Computers with Advanced Production Software	0.10 <.0001	0.09 <.0001	0.31 <.0001	0.33 <.0001						
6	Percent of Teachers Who Regularly Use Technology to Deliver Instruction	-0.02 0.1122	0.07 <.0001	0.28 <.0001	0.25 <.0001	0.35 <.0001					
7	Percent of Teachers Who Regularly Use Technology for Administrative Purposes	0.04 0.0003	0.04 0.0005	0.27 <.0001	0.34 <.0001	0.28 <.0001	0.56 <.0001				
8	Frequency Students Use Content Delivery Software	0.06 <.0001	0.00 0.7296	0.29 <.0001	0.00 0.8327	0.05 <.0001	0.06 <.0001	0.09 <.0001			
9	Frequency Students Use Production Tool Software	-0.10 <.0001	0.12 <.0001	0.13 <.0001	0.22 <.0001	0.27 <.0001	0.33 <.0001	0.27 <.0001	0.22 <.0001		
10	Level of Human Tech Support	-0.06 <.0001	0.09 <.0001	0.11 <.0001	0.09 <.0001	0.12 <.0001	0.17 <.0001	0.16 <.0001	0.09 <.0001	0.11 <.0001	
11	Level of Hardware/ Internet Dependability	-0.07 <.0001	-0.01 0.3145	0.04 2E-04	0.07 <.0001	0.03 0.0154	0.05 <.0001	0.06 <.0001	0.02 0.0794	0.01 0.5377	0.07 <.0001

Table C 30.

Correlations and P-values of Predictor Variables for Learning Environment and Technology Indicators for Conduct Outcome

	Variable	1	2	3	4	5	6	7	8	9	10
1	Positive Learning Environment										
2	Positive Teacher Qualifications	0.12									
		<.0001									
3	Percent of Student Computers with Content Software	0.07	0.03								
		<.0001	0.0298								
4	Percent of Student Computers with Office/ Production Software	-0.01	-0.03	0.19							
		0.3578	0.0202	<.0001							
5	Percent of Student Computers with Advanced Production Software	0.05	0.09	0.31	0.33						
		<.0001	<.0001	<.0001	<.0001						
6	Percent of Teachers Who Regularly Use Technology to Deliver Instruction	0.02	0.07	0.28	0.25	0.35					
		0.2091	<.0001	<.0001	<.0001	<.0001					
7	Percent of Teachers Who Regularly Use Technology for Administrative Purposes	0.07	0.04	0.27	0.34	0.28	0.56				
		<.0001	0.0005	<.0001	<.0001	<.0001	<.0001				
8	Frequency Students Use Content Delivery Software	0.01	0.00	0.29	0.00	0.05	0.06	0.09			
		0.2925	0.7296	<.0001	0.8327	<.0001	<.0001	<.0001			
9	Frequency Students Use Production Tool Software	0.00	0.12	0.13	0.22	0.27	0.33	0.27	0.22		
		0.7315	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		
10	Level of Human Tech Support	-0.04	0.09	0.11	0.09	0.12	0.17	0.16	0.09	0.11	
		0.0002	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	
11	Level of Hardware/ Internet Dependability	-0.02	-0.01	0.04	0.07	0.03	0.05	0.06	0.02	0.01	0.07
		0.0605	0.3145	0.0002	<.0001	0.0154	<.0001	<.0001	0.0794	0.5377	<.0001

Appendix D: Permissions

Appendix D: Permissions

From: Robert E. Slavin [rslavin@SuccessForAll.org]
Sent: Monday, November 19, 2007 8:45 AM
To: Tina Hohlfeld
Subject: RE: Permission to use diagram

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Dr. Hohlfeld:

Please feel free to use the diagram.

Robert Slavin

From: Tina Hohlfeld [mailto:thohlfeld@coedu.usf.edu]
Sent: Sunday, November 18, 2007 10:15 PM
To: Robert E. Slavin
Cc: Barron, Ann
Subject: Permission to use diagram

Dear Dr. Slavin,

May I have permission to publish the following diagram in my dissertation, The Relationship between Technology Integration and Achievement Using Multi-level Modeling, to fulfill the requirements of the Ph.D. in Instructional Technology from the University of South Florida? May I also have permission to use this diagram in journal articles that I may publish about the findings from this research study?

This diagram was originally published in the following journal articles:
Slavin, R.E. (1987). A theory of school and classroom organization. *Educational Psychologist, 22*, 89-108.
Slavin, R.E. (1994). Quality, appropriateness, incentive, and time: A model of instructional effectiveness. *International Journal of Educational Research, 21*, 141-157.

Thank you for your guidance for understanding the factors that impact student achievement, and for your permission to use this chart to support my explanations about the factors that impact student achievement.

Sincerely,
Tina Hohlfeld

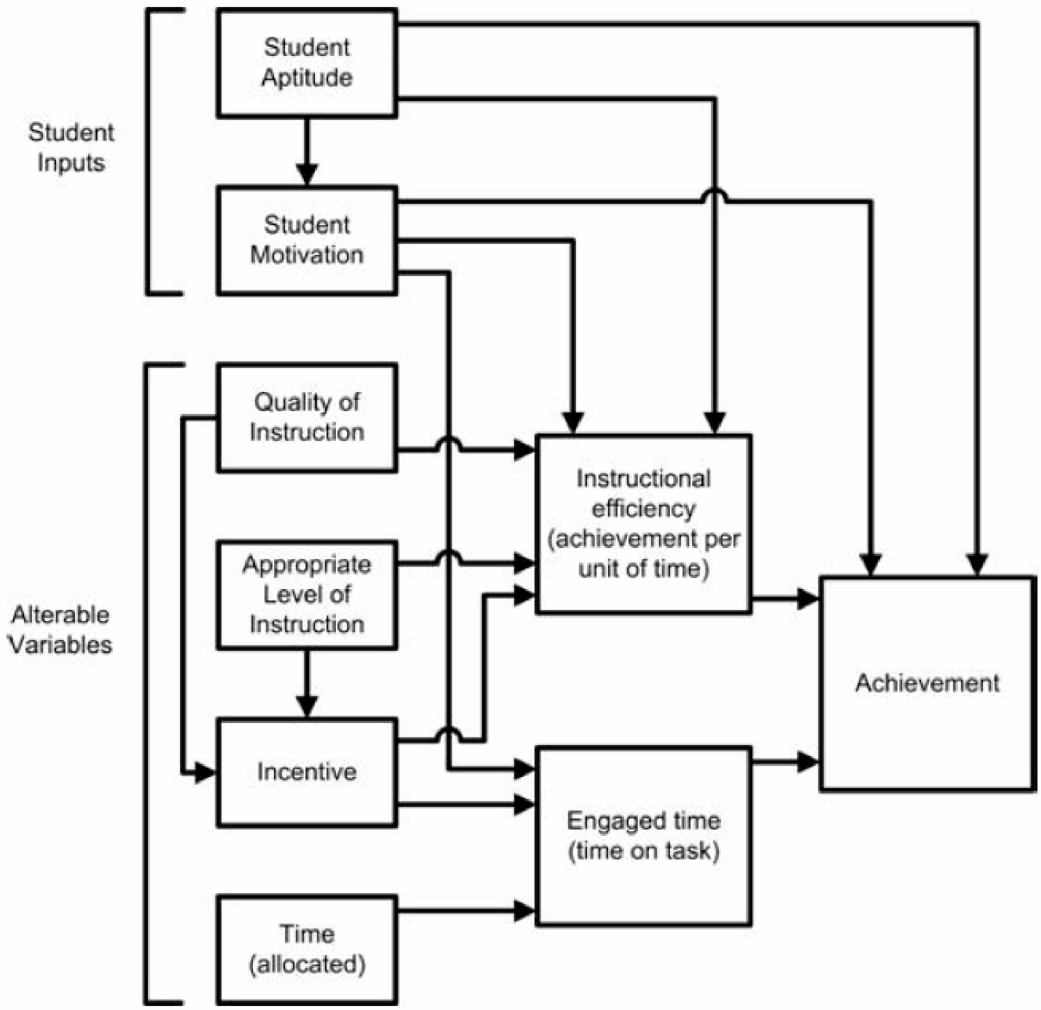

Figure 4. *Quality, Appropriateness, Incentive, and Time (QAIT) Model of instructional effectiveness relating alterable elements of instruction to student achievement (Slavin, 1987).*

About the Author

Tina Newstein Hohlfeld has devoted her career to the empowerment of all children. In this capacity, she has worked as a regular education and special education teacher in early childhood, elementary, middle school, and high school settings. Also, she has supported the education of young children, parents, and teachers as a childcare director, an administrator in an early intervention center, an adjunct professor, and a consultant supporting the implementation of quality child care programs. Through out all of these experiences the integration of technology has been crucial to success of the project or program and children. In her latest career spiral at the University of South Florida, she has learned how to conduct research about how technology integration supports student achievement. Ms. Hohlfeld earned a Bachelors of Science degree in Humanities and Technology at Drexel University and a Masters of Education degree in Elementary and Special Education at Lehigh University.