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Leadership Behavior And Technology Activities:the Relationship Between Principals And Technology Use In Schools

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LEADERSHIP BEHAVIOR AND TECHNOLOGY ACTIVITIES: THE RELATIONSHIP BETWEEN PRINCIPALS AND TECHNOLOGY USE IN SCHOOLS

by

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ABSTRACT

The purpose of study was to investigate the use of technology in schools and the influence of the principal on technology use. The technology activities of principals along with the school technology outcomes perceived by their faculty were described and analyzed to discover if there was a relationship between and among them. This study investigated technology related leadership behavior exhibited by principals in terms of NETS-A technology standards for administrators, and how their leadership behavior affected or predicted the multiple ways that technology was used throughout a school.The population for this study was composed of principals and instructional faculty from public schools in Collier County, Florida. Principals completed the Principal Technology Leadership Assessment Survey to establish leadership behavior according to the NETS-A standards; faculty completed the School Technology Outcomes survey to identify technology use in schools. The numerous uses of technology were structured into three levels: administrative and management tasks (organizational technology outcomes), planning and delivery of instruction (instructional technology outcomes), and use by students for completing assignments (educational technology outcomes). Survey results revealed strong technology leadership behaviors and extensive and variety use of technology in schools. Analysis of the survey results supported the null hypothesis that there was no relationship between the technology behavior of educational leaders and the use of technology by faculty members in their schools.

This dissertation is dedicated to my parents, Shirley and Lionel Read QC.
Their love, support, and encouragement made this study possible.

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CHAPTER 1 INTRODUCTION

Effective use of technology across all functions of a school system has been the subject of numerous studies on systemic reform (Anderson & Dexter, 2005; Baylor & Ritchie, 2002; Bozeman & Spuck, 1991). There is also a wealth of evidence in the literature that shows how facilitating change in schools, and especially maintaining that change, depends heavily on capable leadership (Leithwood, 2005). This research study explores the technology outcomes that can be expected in learning, teaching, and school operations through successful implementation of technology achieved with the assistance of superior technology leadership from principals.

In order to keep up with the rapid pace of technology, schools have to continually change and grow in order to offer new technologies to their students. In this way, technology is responsible for changing the face of leadership. Certain character traits, charismatic personalities, or specialized skills once attributed to great leadership have been superseded by a principal's ability to cope with complex change and build organizations with a culture of continuous learning (Anderson & Dexter, 2005). There seems little doubt from the literature that technology influences teaching and learning, but there is a lack of research explaining how or why this occurs (Achacoso, 2003).

Statement of the Problem

The following question guided this investigation: To what extent, if any, does the leadership behavior and the technology activity of the principal affect the use of technology in schools?

Purpose of Study

This study sought to investigate the influence of the principal on technology use in schools. The technology activities of principals along with the school technology outcomes perceived by their faculty were described and analyzed to discover if there was a relationship between and among them. This study also investigated the kind of technology related leadership behavior exhibited by principals, how their leadership behavior affected, and whether it predicted, the multiple ways that technology was used throughout a school.

Research Questions and Hypotheses

1. What is the technology leadership behavior of principals in terms of NETS-A standards?
2. How is technology used in schools for organizational, instructional, and educational purposes?
3. What is the relationship between the technology leadership behavior of principals and the use of technology for organizational, instructional, and educational purposes in schools?

Null: Hypothesis: There is no relationship between the technology leadership behavior of principals and the use of technology for organizational, instructional, and educational purposes in schools.

Definition of Terms

Technology

Descriptors for technology used in the classroom included, but were not limited to information and communication technology (ICT), technology-mediated learning, computer aided instruction (CAI), distance education, distance learning, educational technology, computer-based education, instructional technology (IT), multimedia, communication systems, Web-based learning, e-learning, educational multimedia application, and computer-mediated communication (Achacoso, 2003). More specifically, technology may be composed of the hardware and software normally associated with personal computers, and attachments or peripherals such as scanners, document cameras, digital cameras, video-conferencing, VCR, DVD's, CD's and tape recordings, robotics, presentation and demonstration equipment, simulation systems, expert systems, databases, local area networks, wide area networks, and the Internet.

Principal Leadership Behavior

A description of leadership behavior formed from responses by principals and teachers to the questions contained in the surveys used in this research study.

Technology Leadership Activities

Specific behaviors, actions, and practices used by principals associated with each of the six NETS-A standards developed by the International Society for Technology Education (2002).

NETS-A Technology Standards

A set of standards created as a result of a national consensus building process among educational stakeholders, to identify knowledge and skills that constitute the core of what every K–12 administrator needs regardless of specific job role. These standards are indicators of effective leadership and appropriate use of technology in schools. They define neither the minimum nor maximum level of knowledge and skills required of a leader, and are neither a comprehensive list nor a guaranteed recipe for effective technology leadership (ISTE, 2002).

Organizational Level Technology Outcomes

The results yielded directly or indirectly from the use of technology by the administrators, teachers, staff, and students for organizational purposes (non-instructional, non-educational). Examples included, but were not limited to data warehousing,

Email, online courses for professional development, shared network directory access, and web sites for posting information for students and parents.

Instructional Level Technology Outcomes

The results yielded directly or indirectly from the use of technology by teachers for instructional purposes. Examples included, but were not limited to Microsoft Office software, multimedia presentations, web design and editing software, online text books, Internet search engines, computer labs, wireless laptops, and DVD players.

Educational Level Technology Outcomes

The results yielded directly or indirectly from the use of technology by students engaged in the learning process. Examples included, but were not limited to web pages, multimedia presentations, digital imaging, and desktop publishing.

Population and Sample

The population for this study was composed of principals and instructional faculty from K-12 public schools in Collier County, Florida. Principals from 44 of the 51 schools in the county were selected to participate in this study. The faculty from the schools whose principals agreed to participate in the study were also included in sample. Faculty from K-12 schools whose principals did not choose to participate were not included in the sample and were excluded from the study. A total of 44 principals and 1258 faculty were included in the sample.

Study Design

This study investigated the technology leadership behaviors and activities of principals and their effect on teachers' perceptions of technology proficiency and technology use. It was descriptive in design, primarily qualitative with quantitative components. The main indicators used in the analysis were technology leadership behaviors and technology outcomes. The independent variables were the technology behaviors reported by principals and the dependent variables were the technology outcomes reported by their faculty.

The study followed a mediated–effects model, which hypothesized that leaders achieve their effect on school outcomes through indirect paths, rather than having a direct relationship between specific outcomes (Hallinger & Heck, 1998). The technology outcomes identified in this study were separated into groups to demonstrate how the leadership behavior of principals impacted multiple levels of operations in education that co-exist and function simultaneously in a cooperative rather than independent process. Descriptive and correlational analyses were conducted to discover if there was a relationship between leadership behavior and technology use in Collier County schools.

Assumptions

The following assumptions are made for this study:

1. Principals and faculty have access to, and use electronic mail through the GroupWise software used for communication at their schools.
2. Principals and faculty will complete the online surveys.
3. Principals and faculty will complete the online surveys diligently and honestly.

Instrumentation

Two surveys were used in this study; one to identify principal technology leadership behaviors, and a second administered to their faculty to show how technology is used in schools. For ease of identification, the two surveys were referred to as the Principal Technology Leadership Assessment (PTLA) survey and the School Technology Outcomes (STO) survey respectively.

The PTLA survey identified the independent variables; principal leader behaviors and their technology activities. The survey was designed and tested by the UCEA Center for the Advanced Study of Technology Leadership in Education at the University of Minnesota, USA. The questions were based on the six National Educational Technology Standards for Administrators and their corresponding 27 performance indicators known as NETS-A (ISTE, 2002). This instrument was specifically designed to assess principals' technology leadership inclinations and activities over the course of the last school year (UCEA, 2005). These standards, listed below, were formulated to assist administrators with the process of implementing technology in their schools.

1. Leadership and Vision
2. Learning and Teaching
3. Productivity and Personal Practice
4. Support, Management, and Operations
5. Assessment and Evaluation
6. Social, Legal, and Ethical Issues

The survey contained a total 35 questions, in six sections, with between five and seven questions in each section relating to each of the six standards listed above. This survey was administered online at the web site www.questionpro.com to every principal included in the sample. The six constructs in this questionnaire represent each of the NETS-A standards. Each construct contained an average of 6 questionnaire items and was scored using a 5-point Likert-type frequency response scale ranging from *Not at all* to *Fully*. High scale scores for a construct indicates that the respondent implemented the corresponding standard frequently. Low scales scores for a construct indicates that the respondent implemented the corresponding standard minimally.

The second survey used in this study was administered to the faculty of schools whose principals completed the PTLA Survey. The School Technology Outcomes Survey (STO) was created by the researcher to measure the dependent variable, technology outcomes in schools. The survey was designed to identify technology outcomes at the organizational, instructional, and educational levels. The survey contained a total of 57 Questions in two parts with two different scales. Part I used a Likert scale with four possible responses that ranged from *Strongly Agree* to *Strongly Disagree*. Part II used a frequency scale with four response options that range from *Never* to *Almost Always*. High scale scores indicated a high level of agreement and high frequency use of technology. Low scale scores indicated a low level of agreement and low frequency use of technology. The survey contained four sections. The first section ascertained the faculty's overall perception of the value, proficiency and use of technology by their principal, their school as an organization, their students and themselves. Sections two and three established what type of hardware and software was used by faculty for administrative and management tasks and planning and delivery of instruction respectively. The fourth section contained questions about faculty perception of their student's use of technology for completing assignments. This survey was also administered online at the web site www.questionpro.com to the faculty of each school whose principals agreed to participate in the study. Copies of the surveys are included in Appendixes A and B.

Significance of Study

The results of this study reported how principals in Collier County, Florida participated as leaders in the planning, funding, training, modeling, use, and implementation of technology in schools. This study also described teacher perceptions of how technology is used in schools for organizational, instructional, and educational purposes. The results of this study provided further research findings on types of technology related leadership behaviors exhibited by K-12 principals and the organizational, instructional and educational technology outcomes that occur in their buildings. These findings contribute to the ever-changing and increasingly dynamic variety of technology outcomes, and their possible relationship with administrative technology related behavior and activities. The results of this study may provide teacher trainers, staff development programs, and leadership programs with greater insight into the extent of technology diffusion within the district and how new technology is being used in different ways in different parts of the school, and how principals promote the use of technology through modeling and application. The survey responses from principals and faculty who participated in the study provide district level technology departments with more information about how their district-wide technology plan has being implemented. The results will show how technology has impacted educational organizations, and the learning and teaching processes that they facilitate.

Limitations and Delimitations of Study

The following limitations apply to this study:

1. This study was restricted to principals and faculty in the schools selected for the sample population in Collier County only.
2. Some recommendations for educational leaders made in the NETS-A Standards were not addressed in the PTLA survey and therefore were not measured in this study.
3. Faculty who participated in this survey were limited to the schools whose principals chose to participate.
4. Surveys submitted by principals and faculty who have held a position in the school building for less than one year have a limited relationship to the technology outcomes at that school.
5. The surveys used in this survey were only available online through the use of technology. The absence of hard copy alternatives may have discouraged educational leaders and faculty who were less comfortable using technology from participating.
6. The sample size limited the extent that the results can be generalized to the target population.
7. Technology outcomes were limited to teacher perceptions.

8. First year teachers and newly-hired teachers have a limited knowledge of technology outcomes and their principal's technology activities.

CHAPTER 2 REVIEW OF THE LITERATURE

Technology and Educational Reform

Technology has played an integral role in the changes that have taken place throughout the course of history. Milestones such as the invention of the light bulb, radio, television, the first man in space, personal computing, the invention of the floppy disc, DVD's, and the Internet have caused technology to become so deeply entrenched in modern society that it is now a significant factor that guides the direction and fuels the process of social change. The rate of advances in science and technology has dramatically increased since the advent of the radio, which took 38 years before 50 million people tuned in. Television took 13 years to attract the same amount of viewers, and the personal computer took nearly 16 years to reach this level of use. The Internet however, was in 50 million homes in less than 4 years, and some have predicted that there will be a billion users by the end of the next decade (U.S. Department of Education, 2000).

Information communications technology has opened the lines of communication and enhanced networking between nations, states, local governments, businesses, and individuals. International economic and political climates responsible for shaping global social order continue to use new technologies as vehicles for achieving their goals. Information communication technology has revolutionized world trade and has been identified as the reason for an intensified global market, the rise of globalization, and greater competition between countries. The product of the relationship between international market forces and political interest is public policy that includes technology as a key component in strategies for reform. Public institutions that fail to implement these policies prompt legislation that demands imminent action. During the mid 1990s policy reports began to present education technology as a driver of school reform, rather than as a class of tools and resources that could be used to assist with educational challenges (McMillan Culp, Honey, & Mandinach, 2003). In this way, technology may be viewed as responsible for the change that has occurred in the past, and the source for innovation in the future.

National leaders often call upon education to solve economic issues, especially in the international trade arena. In an increasingly competitive world trade scenario, political figures have blamed fiscal declines in trade and industry on inadequate preparation of the nation's workforce, steering public policy towards educational reform as a means for economic improvement (National Commission for Excellence in Education, 1983). The Task Force on Education for Economic Growth (1983) stated that technological change and global competition demanded that public education extend beyond the basics. In order to become productive participants in a society that depends heavily on technology students will need more than just minimum competencies in the academic disciplines, critical thinking and computer skills have become basic essential for entering the job market. In this way education is held responsible for social inadequacies and initiating reform. Society is not a static entity and is in a continual state of flux, and therefore an effective educational system is expected to be responsive and adaptable enough to mirror social change in a timely fashion.

Twenty years after the Nation At Risk report (National Commission for Excellence in Education, 1983) that called for immediate change, there remains substantial evidence to support the case that America's current state of education is still inadequate. There is a deficit in the pace of reform in education to match technological innovation, schools have been slow to adopt technological change (Todd, 1999) and there is a considerable body of research to show that this gap is widening at an increasing rate every year (Ching, Basham, & Jang, 2005). Overall residential use of the World Wide Web has increased threefold from 20% to 60% since 1997. However, online access is far more prevalent in households where at least one member has attained graduate-level education. Less than one in five households that do not hold a high school diploma have Internet access (Carvin, 2006). This disparity underlines the reality that the Internet is still a text-based medium, and until streaming video and multi-media become more prevalent it will remain less valuable to those who lack literacy skills. Educational access to online services has increased nationwide since the federal e-rate program was implemented. This program was initiated as part of the Telecommunications Act (1996), allowing schools and libraries across the nation to receive discounted telecommunications and establish the infrastructure necessary to connect to the Internet and boost the speed of their connectivity through increased bandwidth. The digital divide extends far beyond the USA, it is a global problem with a solution that lies in the hands of policy makers and international leaders.

Rapid technological change over the last two decades has left people who are not using it regularly feeling obsolete (Daggett, 2005). One way to keep abreast of trends and changes in the marketplace is by forging relationships between the business world and the educational establishments that provide the training necessary for young people to find employment as they enter the adulthood. Legislation in the form of the No Child Left Behind Act (2001) is part of a compounded initiative by political and business leaders throughout the country to raise standards across the nation for all students and prepare them for a global world. European nations echo these concerns, and with diminishing recruitment to courses and careers in the disciplines of mathematics, science and technology they also believe that scientific and technological advancement is fundamental for the continued development of a competitive knowledge society (Dow, 2006).

The National Educational Technology plan (U.S. Department of Education, 2004) mandated by the NCLB Act (2001) outlines a need for innovation for the United States to succeed in a time of rapidly increasing global competition. This need for change is driven by forces in the field such as the digital marketplace, virtual schools available online, and a new generation of students who have been brought up with technology and demand the use of technology to meet their educational needs and career goals. The results of a survey about the nation's youth included in this technology plan showed that 49% were more than a little interested in pursuing a career in technology, 90% of children between ages of five and seventeen use computers and 94% of teens with Internet access use it for school-related research. Teens spend more time online using the Internet than watching television (Horatio Alger Association, 2004). Other research quoted in this report clearly demonstrates student demand for more technology in the schools, regularly updated software, more computers with less restricted access, better trained teachers, and more opportunities to use technology to learn about the subjects they study in the classroom. The challenge for educators and administrators is to meet this demand and align teaching to the new ways that students are learning (Vail, 2006).

The systemic change that is taking place in education is necessary to prepare students for the demands of a global society in the 21st Century. New technologies have changed the way that the marketplace operates and have enhanced communications to overcome and reach beyond traditional geographical boundaries. This new system of globalization has become a driving world force, and the effective use of technology in schools is necessary to ensure that all students are prepared to meet the challenges that it will bring. There is a growing concern that American jobs are at risk because intellectual work can be digitized, delivered, distributed and shipped around the planet, allowing American companies to outsource and save money on salaries by finding better skilled, more productive, and often more ambitions people overseas (Hershberg, 2005). Business leaders have addressed their concerns about the deficit in human capital development in the U.S by privately funding educational reform. Examples include The Bill and Melinda Gates Foundation which aims to to expand educational opportunities and access to information technology. Social change fueled by market activity and encouraged by international trade organizations such as NAFTA and information technology, has demanded a new order of productive competition. The heightened role of information has shifted the economic focus from material production to information processing where the old factors of production such as land, labor and capital have been replaced by knowlede as the key resource of the next centrury (Davies & Guppy, 1997). The prevalence of automation and outsourcing in the business world has led to a greater demand for intellectual capital from the nation's work force, and educational institutions must provide graduates that are superior, or at least equally skilled to those in competing countries.

The United States had fallen behind internationally in high school completion, and lies in tenth place behind such nations as South Korea, Norway, the Czech Republic, and Japan (Barton, 2005). The numbers of high school dropouts in America has been described as a silent epidemic afflicting the nation's schools. Research has identified a graduation rate between 68-71%, leaving almost one third of public high school students failing to graduate (Bridgeland, Dilulio, & Morison, 2006). This rate drops to approximately 50% for minority students; Florida was at the bottom of the scale for graduating only 61% of white students, and between 75-77% for Asians. In the ten year period between 1990 and 2000 the national high school completion rate has declined by 2.4%, the rate for Florida is very close to the national average with a decline of 2.5% (Barton, 2005). Students expressed that the main reason for dropping out was that classes were not interesting, 69% of students also stated that they were not inspired or motivated to work hard in school. The most popular solution to prevent future dropouts was to make the curriculum more relevant to student's lives with better teachers, more one-to-one instruction, involvement and immediate feedback. 81% of respondents said that if schools provided opportunities for real-world learning it would have improved their changes of graduating form high school.

The National Education Technology plan (U.S. Department of Education, 2004) offers seven major action steps and recommendations to enact the technology changes needed to compliment the No Child Left Behind Legislation (2001). The first is to strengthen leadership and develop tech-savvy leaders by investing leadership development and administrator education programs that provide training in technology decision making and organizational change. The other six are innovative budgeting, improved teacher training, supporting e-learning and virtual schools, increased broadband access, more digital content, and integrated data systems.

The Influence of the Principal on Technology Use in Schools

There is evidence to show that principals influence what goes on in schools and their behavior has been successfully measured to yield significant results (Hallinger & Heck, 1998). An empirical investigation of prevalence and effect of leadership on school technology (Anderson & Dexter, 2005) used data from a national survey involving over 800 schools to draw conclusions about the influence of the principal on technology outcomes (Anderson & Dexter, 2000). Their findings support the proposition that principals influence technology outcomes in their schools through their leadership behavior in the six critical areas defined by the NETS-A technology standards for administrators: Leadership and vision, learning and teaching; productivity and professional practice; support, management and operations; assessment and evaluation; and social, legal and ethical issues.

Although the principal's influence extends in multiple directions, their role in shaping the school's direction through vision, mission, and goals has been shown to be significant (Krüger, Witziers, & Sleegers, 2007; Mulford, 2003). One of the key elements in many professional development programs for administrators is to help them establish a vision in their educational organization (Peterson, 2002). This vision has been shown to exert considerable influence on technology outcomes (Anderson & Dexter 2000; Anderson & Dexter, 2005; Ertmer, Bai, Dong, Khalial, Park, & Wang, 2002). The principal's participation in the design process of technology planning is essential for defining a clear vision coupled with a practical mission and attainable goals (Anderson, 2001; Kowch, 2005; Porter, 2003).

Technology leaders are responsible for understanding how educational technology can support teaching and learning in classrooms (Anderson & Dexter, 2005; Bozeman & Spuck, 1991). In their review of the research on principals' contribution to school effectiveness, Hallinger and Heck (1998) found that the general pattern of results supported their belief that principals exercise a measurable, though indirect, effect on school effectiveness and student achievement. The studies that they reviewed contained an array of theoretical frameworks; simple models that focused on the direct effects of principals' actions were reviewed with more complex models which examined the indirect or mediated effects of the principals' activities. The results produced by the more complex models led the authors to conclude that the influence of the principal in schools is mediated by the effect of all the other action that takes place at different levels throughout the organization. Other research, such as the Leadership for Organizational Learning and Student Outcomes Study (LOLSO) project (Mulford, 2003) has confirmed that leadership makes a difference in administrative and teacher outcomes, but is only indirectly related to student outcomes. An investigation of the methods and strategies utilized by secondary school principals (Burhans, 2003) showed no significant correlation between principals participation in technology implementation and student achievement.

Principals with the most influence on their faculty lead by example and use technology as part of their professional daily practice (Gosmire & Grady, 2007). No matter how much training teachers undergo to prepare them for technology integration, most will not successfully employ that training without the leadership of the principal, and therefore training for principals as well as teachers should be a priority (Holland, 2000). Some technological innovations fail to be successfully implemented in the school improvement process because of flawed management or insufficient support from school administrators (Crandall & Loucks, 1982) who lack both knowledge and skills necessary to assist with the implementation. Dawson & Rakes (2003) found a statistically significant relationship between the levels of technology integration in the school curricula, and the amount and type of technology training received by K-12 school principals. This study confirmed that leadership in a school determines the extent of technology integration that takes place in the classroom, and supported their hypothesis that administrators were not able to fully or effectively support technology if they did not understand it. In general, the literature suggest that principals need general knowledge about hardware capabilities and how software applications can be applied to instruction (Gosmire & Gady, 2007; Scott, 2005), they should also know the capacities and limitations of technology so that they may plan, budget, purchase, install, maintain, schedule, distribute, and replace the technology best suited for their needs (Mecklenberger, 1989; Owens, 2003).

The majority of the literature on leadership and technology acknowledges that school leaders should provide administrative oversight for technology by ensuring that the systems in place support technology use and that technology also supports the management of these systems. Principals are expected to provide access to equipment for staff and establish a continuing source of funding for purchasing, maintaining and upgrading technology (Anderson & Dexter, 2005); generate funding as an ongoing process rather than a one time expenditure (Gosmire & Grady, 2007); and coordinate and plan the process of implementing and sustaining technology with a committee that represents the organization's stakeholders (Czubaj, 2002; Owens, 2003).

Evaluation and assessment have been identified as a critical role for responsive leaders that are committed to being accountable to the needs of the student, the community and society (Todd, 1999). This provides the basis for an ongoing renewal process where obsolete technology is discarded and older technology is maintained or upgraded to meet organizational goals and educational needs. School districts showing improvement in instruction and achievement had superintendents that supported and encouraged school leaders to use student performance and stakeholder satisfaction data for identifying needs, setting goals and planning and tracking improvements (Leithwood, 2005).

Ensuring equity of access for all to technology is just one of the social and ethical issues that educational leaders need to pay close attention to. For over a decade, public policy, legislation (NCLB, 2001), and government funding initiatives such as E-Rate, have been specifically targeted at reducing the gap between those who have access to technology and those who have not, the most recent major federal study shows that disparities in access still exist between the minority groups (Carvin, 2006). Administrators who are sensitive to laws that govern equal opportunities to students with special needs and the provisions of Title One are more likely to ensure that everyone is offered the same opportunities afforded by the technology in their educational organization. The extensive set of state and national educational policies that have come into effect since the No Child Left Behind Act (2001) have demanded the attention of all educational administrators. It has been shown that those principals who are informed about the technology policy making process at district, state, and national levels are more likely to be involved with technology at the building level (Nance, 2003). This study also found that middle and high school principals were more involved in technology policy making than their elementary school counterparts.

Even though technology is justifiably one of the key elements in a successful school, few principals claim to be technology experts (Gosmire & Grady, 2007). Lack of professional preparedness to manage technology is a logical explanation for this shortfall (Kearsley & Lynch, 1992). Principals have been shown to have a measurable influence on overall school effectiveness (Hallinger & Heck, 1998), but their contribution towards the implementation and integration of technology in schools depends on their level of professional development (Dawson & Rakes, 2003), the extent of their knowledge and technology skills (Crandall & Loucks, 1982), and the vision and goals they establish for use of technology in their school (Anderson & Dexter, 2000). The influence of leadership is diffused through the multiple layers that coalesce inside an educational system; the extent of the influence is evident in the wide variety of technology used by all stakeholders in the educational institution.

Measuring Leadership Behavior and Technology Activities of Principals

Too often, organizational leaders with limited background in technology are responsible for directing large investments to diffuse technology in their organization with incomplete, and in some cases no understanding of the strategic implications of their actions (Kowch, 2005). Principals play a vital role in setting the direction for successful schools, and technology leadership will become increasingly more critical as public policy and industry focus on educational quality and accountability in their discussions regarding global, national, state, and institutional issues. In order to meet the demands of public policy calling for higher standards in K-12 schools and technology literate students (NCLB, 2001); universities and colleges of higher education need to prepare educational technologists to be accountable for long and short term strategic decision-making. Educational leadership programs need to provide future administrators with a strong core of technology proficiency, so that they are able to participate in the design of technology planning and then lead it through to completion. A review of the research on developing successful principals shows that successful school leaders influence student achievement through the support and development of effective teachers and the implementation of effective organizational processes (Davis, Darling-Hammond, LaPointe, & Meyerson, 2005).

Leadership behavior has been the subject of numerous studies involving a wide variety of measurement instruments designed to identify which leadership factors contribute the most to selected outcomes in an array of different contexts. In the 1940s, Ralph Stogdill and a team of faculty members at Ohio State University developed a leadership scale known as the Leadership Behavioral Description Questionnaire, which was originally administered to Air Force commanders. Two main factors emerged from a factorial analysis of 1800 questions; they were initiating structure and consideration. Initiating structure refers to the leader's behavior involving the group members and themselves. Examples of initiating structure included patterns of organization, channels of communication, and methods of procedure. Consideration referred to friendship, trust, respect, and warmth (Stogdill, 1963).

The dichotomy between task versus, people that emerged from these studies has developed into two very distinct styles of leadership which later became the focus of

Rensis Likert's (1961) studies of effective leaders. Likert found that supervisors with the best records of performance focused their primary attention on the human aspects of their employee's problems and on endeavoring to build effective work groups with high performance goals. Effective communication of these goals and freedom to do the job were identified as employee-centered or participative managers. In contrast, job centered managers focused on production and the tasks and processes that needed to be accomplished. Likert identified two more types of managers that lay between these two extremes, benevolent authorities and consultative managers with more task based goals, or employee based goals respectively.

These two dimensions of leadership provided the foundation for a new type of leadership in organizations that learn and grow together. First conceptualized by James MacGregor Burns (1978), the success of this style of leadership, known as transformational leadership, is evident in the extent to which they seek out potential motives in their followers, satisfy higher needs, and engage their whole identity. Transformational leadership results in a relationship of mutual stimulation and elevation that converts followers into leaders in a way that confirms their emotional commitment. Research on the success of transformational and transactional leadership has shown that a combination of both can provide successful long term results (Bass, 2003). Transactional leadership was shown to assist in establishing a basic level of standards and expectations, and transformational leadership behaviors built on this to provide cohesion, potency, persistence, energy, and performance. In this way follower performance has been successfully linked to both transactional and transformational leadership behavior.

The full range leadership theory (FRTL) proposed by Avolio and Bass (1991) included another addition to the transactional and transformational behaviors known as laissez-faire leadership. This third component represented the absence of transaction, where leaders avoided making decisions, abdicated responsibility and did not use their authority. This kind of leadership involved an active choice by the leader to avoid taking action. The most widely used survey instrument to assess the three types of leadership in the FRTL was the Multifactor Leadership Questionnaire, or MLQ. This survey identified nine factors that represented transformational, transactional, and laissez-faire leadership behavior (Antonakis, Avolio, & Sivsubramaniam, 2003). A meta-analysis conducted by Lowe, Kroeck, and Sivasubramaniam (1996) found the leadership scales in the MLQ to be a reliable and significant predictor of effectiveness across the set of studies included in the analysis, regardless of organizational setting or level of the leader. Military, private, and public organizations dominated this meta-analysis, but one K-12 study was included that linked exceptional performance with transformational leadership (Kirby, King, & Paradise, 1991).

The Leadership Practices Inventory (LPI) was another popular instrument used in leadership development contexts. This categorized leadership into five dimensions: Challenging the process, inspiring a shared vision, enabling others to act, modeling the way and encouraging the heart. Although this instrument was not designed to measure either transactional or transformational leadership the contents of the scales contain one or the other of both elements. Fields and Herold (1997) concluded that it was possible to infer leadership behavior in terms of transactional or transformational dimensions using a measurement instrument, such as the LPI which was not specifically designed for the task.

The technology activities of principals have been the focus of fewer studies, and there is a need for more research that targets the way that principals use technology in their everyday practices (Seay, 2004). Baylor and Ritchie (2002) examined school technology plans, professional development programs, curriculum alignment processes, technology use, and openness to change. Anderson and Dexter (1998) constructed a school technology leadership index composed of eight organizational policies which included technology committees, budgets, planning, email, district support, grants, staff development, and intellectual property. They measured the percentage of schools in their sample that possessed any or all of these eight characteristics. Teacher perceptions have also been used to examine the effect of principal's technology style on technology use (Anderson & Dexter, 2005).

The Technology Competencies for School-Based Administrators: Self-Assessment Instrument, based on the Technology Standards for School Administrators (TSSA), was adopted by the International Society for Technology in Education as the National Educational Technology Standards for Administrators (NETS-A). This instrument was found to be a reliable indicator of technology leadership (Scanga, 2004). The American Institutes for Research (AIR) and the UCEA Center for the Advanced Study of Technology Leadership in Education (CASTLE) used the National Educational Technology Standards for Administrators, or NETS-A (ISTE, 2002), to develop another survey specifically designed for measuring the technology activities of principals known as the Principals Technology Leadership Assessment or PTLA (UCEA, 2005). The

NETS-A standards that formed the foundations of this measurement instrument were developed from a body of related literature and a nation-wide consensus of opinion regarding the knowledge and skills necessary for K-12 administrators regardless of specific job role. These standards are indicators of effective leadership and appropriate use of technology in schools which comprehensively operationalize technology leadership (Anderson & Dexter, 2005).

Ensuring ethical and appropriate use, online safety, security, and privacy of school technology is often overlooked as an important aspect of technology leadership. A recent study conducted by scholastic Inc. showed that 58% of juveniles did not consider hacking to be a crime, and the majority of young people who were unlikely to commit a serious crime such as robbery, burglary, or assault may not think twice about committing a cyber crime (Newman, 2004). Internet plagiarism is prevalent in K-12 education, evident in the dramatic increase of websites that provide students with access to term papers which students can download for free. In March of 2003 around 35 of these sites existed, by the end of 2005 there were over 250. In a study conducted by the University of San Francisco, over 25% of respondents claimed that they had cut and pasted from online sources without a citation (Baum, 2005). It is up to educational leaders to include all of these elements in a school wide acceptable use police (AUP) to ensure that technology is used for educational purposes and develop an appropriate use standard through guidelines and expectations. Future measurement instruments that assess the technology activity of principals should include technology ethics, privacy, and security as additional factors defining technology leadership.

Key practices in technology leadership include: having a technology committee made up of parents, teachers, students, and technology staff members that guide the acquisition and implementation of technology; creating a technology plan and conducting internal audits to identify what is happening in the school and external audits to provide an outside look at how the school matches up to other schools (Gosmire & Grady, 2007).

The Use of Technology in Educational Organizations

The impact of school organization on general educational outcomes is often overlooked, but has been shown to equal outcomes generated by more obvious school features, such as curriculum or leadership (Lay, 2007). Leadership is sometimes referred to as a quality of an organization, or a systemic characteristic (Glatter, 2006). In the same way, technology is also a factor, characteristic, component, or quality of an educational organization. There is very little research on how educational objectives and outcomes connect with leadership and organization (Lay, 2007), but there is evidence that reveals the role of technology in numerous reform processes that are currently being implemented by educational organizations in the United States and other countries around the world. Small learning communities, organizational planning, acquisition and development of intellectual capital, organizational learning, and data driven decision making are all examples of how organizational initiatives that involve extensive use of technology are shaping a new culture of learning in schools.

High dropout rates across the nation, dominated in many states by minorities, have prompted a transformation in large comprehensive high schools to smaller learning communities with greater access to technology. Technology is considered such a powerful motivator for students to stay in school that the National Dropout Prevention Center has included the expansion of education technology as one of its strategies for the past decade (Vail, 2006). Educational technology has helped alleviate learning barriers for students at risk of dropping out, and computers have been used to improve student mastery of content, provide individualized instruction, improve students' attitudes towards learning, and prepare students for the workforce. Technology has provided at-risk students with an opportunity to be successful by building self-esteem, changing reluctant learners to motivated learners, empowering students by providing multiple and flexible learning opportunities in a psychologically safe learning environment (Smink & Schargel, 1999).

Some of the goals of high school reform include relevance to students, challenging and rigorous academic offerings, and opportunities to learn skills that will help student function in a global economy and society. The modern workplace is dominated by technology, which requires an increasingly higher level of skills for employees. Consequently, employers need high school graduates with a diverse set of adaptable and enduring skills that have prepared them to enter the workforce. In response to these demands, high school career and technical education programs have become an integral part of the high school reform movement. High school enrollment has increased by 57% from 9.6 million students in 1999 to 15.1 million in 2004 (Vail, 2007). This rise is due in part to the growth of career academies, which are small schools within schools that focus on career paths or themes. Modern day career and technical education programs contain rigorous curricula with high academic standards that are far superior to traditional vocational courses for students who chose not to attend college. High standards for all students, and exposure to career education for all students is now considered an essential part the high school experience. These academies are part of a nationwide effort to make school more rigorous and relevant to young people (Daggett, 2005).

Schools with small learning communities have experienced improved feelings of affiliation and belonging, less incidences of boredom, improved safety and order with less in-school suspensions and discipline issues, improved attendance and graduation rates, improved teacher collaboration, curriculum integration, and alignment and increases in overall student achievement (Patterson, Beltyukova, Berman, & Francis, 2007). This reform movement has been funded by federal grants, and private funding such as the Bill and Melinda Gates Foundation. However, educational reformers are cautioned by the author of a recent study of small learning communities that used data from the National Household Education Survey (1999) and concluded that smaller is not necessarily better (Lay, 2007). The findings showed limited support for smaller schools, even for those groups who are believed to benefit most significantly from small schools, such as racial minorities, low-income students, and underachievers.

The role of technology as an active agent of organizational change was addressed in a research study involving case studies of 94 successful school reforms where information and computer technologies were heavily used. One of the hypotheses tested in this study was whether information communication technology (ICT) acted as a catalyst for school reform. The findings showed that ICT rarely acts as a catalyst by itself, but proved to be a powerful lever for implementing planned educational innovation (Venezky, 2004). The main difference between a catalyst and a lever is that a catalyst acts as an agent whose presence causes a reaction to proceed or speed up without affecting the properties of the subject it is acting upon; and a lever is a tool that is applied intentionally to produce a desired change. If ICT were a true catalyst for change, its presence in schools would initiate and accelerate innovative instructional techniques used in the classroom, instead this study concluded that technology helped teachers reach sub-goals required for educational change which led to changes occurring but was not responsible for the change itself. For technology to be an effective agent for change it had to be applied intentionally to produce a desired change, it could not be added to a situation without a specific vision or application.

The adoption and integration of new technology in educational organizations takes time, and the benefits that it yields are not necessarily immediately identifiable. This process is also referred to as diffusion. Gardener, Lepak, & Bartol (2003) identified three stages of use: automation, information, and transformation. In the automation stage, technology was primarily used to automate manual systems and reduce the need of personnel to perform routine activities. This reduction in routine work provided more opportunities for individual to think and use their full cognitive capacities to analyze the information made available to them through the automated systems. This in turn led to a transformation of roles from gathering information to interpreting information. In this way technology could be described as a catalyst, modifying professionals' job role focus. Educator's use of technology was linked to better organizational performance, allowing administrators to devote more time to strategic issues that foster a horizontal, self-learning organizational environment. Automation freed up more time for administrators and educators to spend on strategic operations and practices, and broader and transformational issues in their organizations and classrooms respectively.

Much of the research on the diffusion of computers in schools has generally focused on the effects of the access to functional reliable software, institutional factors such as scheduling and leadership, or pedagogical characteristics such as ability and openness to change (Frank, Zhao, & Borman, 2004). A popular model used to describe the process of diffusion begins with a small group of innovators that are the first 2.5% to adopt the item, which in this case is new technology. This is followed by a larger group of early adopters that amount to approximately 13.5%, a larger group of early majority account for the next 34% followed by the late majority, which make up the next 34%. Finally a group of laggards complete the process with the final 16% (Vensky, 2004). The degree of technology diffusion that has occurred in that organization must affect the amount of technology integration that takes place at various levels in an organization. There is a need for more research on how technology diffusion occurs in K-12 educational organizations and the outcomes that are generated during different stages in the diffusion process.

Technology planning has been described as a means of stoking the catalysts of change (Porter, 2003) and an essential way of confronting the major decisions facing an educational organization (Kowch, 2005). Organizational planning is key to successful diffusion and implementation of new technology because it is a collective effort, rather than a leadership activity. Without the active participation of all stakeholders in the planning process, there is just a vision, or mission that is yet to be realized by the group. Technology innovations require institutional involvement because the resources and knowledge required for using any modern computing technology often lie beyond an individual's immediate reach. Without careful planning and collaboration the separate entities within an organization, such as human infrastructure, technological infrastructure, and networking infrastructure can be the cause of frustration to all. For example, if the servers are down without prior notice, or access filters block access to information, lack of human communication and coordination through planning renders technological innovation as a source of frustration for the teachers trying to implement it in the classroom (Zhao et al., 2002). Planning recommendations for organizations include assessing the districts level of diffusion in readiness, learning, system capacity and technology deployment, focusing goals specifically on student learning rather than technology acquisition, the purpose needs to extend all the way to the student outcomes (Porter, 1999).

Educational organizations committed to reform movements which promote student-centered learning have been shown to invest in technology to help reach their long term goal of developing the country's intellectual capital (Churchill, 2006). Briefly defined as the sum of all knowledge and knowing capabilities in an organization, intellectual capital is utilized to give a company competitive advantage. An institution that successfully integrates educational technology is becomingly increasingly important as a generator of social intellectual capital. This is confirmed in an empirical research study that involved approximately 200 American public organizations with more than one hundred employees. Results showed that human resources and information technology investments appeared to influence intellectual capital development more than research and development investments (Youndt, Subramaniam, & Snell, 2004). These findings suggest that internal organizational knowledge is considered more valuable than external learning and research. Youndt, et al., also found that organizations with high levels of information technology investment exhibited high levels of social capital suggesting that investment in technology assists in building social knowledge webs in which knowledge transfer and diffusion occur.

The extensive research conducted on urban teacher talent by the Gallup Organization (Gordon, 1999) and the methodologies used to aid in successful recruitment of NBA and WNBA coaches, players, and office personnel (Macaleer, Shannon, & Haviland, 2002) demonstrate that hiring for talent is a far preferable alternative to training for expertise. A study on the technology skills perceived as essential for newly hired teachers showed that most principals, regardless of their own level of technology expertise preferred teachers who were talented in the uses of technology (Cullum, 2000). Online surveys have been used to discover potential and existing employees major strengths to assist educational organizations with talent identification and management (Liesveld & Miller, 2005). For organizations with high level technology needs, such as new school sites (Venszky, 2004) this translates into hiring educational personnel with technology talents wherever possible and using as many forms of technology as possible to attract those talented individuals. Performance appraisals should also consider the intellectual capital of administrators and educators in terms of organizational knowledge. There are endless possibilities for the use of technology for capturing and using these assets; examples include digital portfolios and duplicable technology lesson plans such as Web quests and distance learning courses.

Information communication technology has facilitated greater communication between parties previously separated and limited by geographical distances. New tools, also known as shared spaces, have emerged that assist in the process of collaborative engineering. Some examples include websites, instant messaging, chat rooms, message boards, video conferencing and shared databases. These environments foster cooperative processes such as knowledge management and organizational learning. A case study conducted in an industrial vehicle company showed how language and annotation was used in an informal collaboration of software users to improve a computer assisted design (CAD) program (Boujut, 2003).

Management experts and business leaders claim that organization learning, knowledge management, and intellectual capital are more important to today's organizations than traditional assets such as natural resources and skilled labor (Rowland, 2004). Implications for educational organizations involve shaping a climate of continuous learning and providing as many opportunities as possible to develop technology competancies through professional development, collaboration, and practice. Educational professionals in administrative and instructional roles have a growing responsibility to provide intelligent data to drive the process of decision-making. By collecting data about level of district technology diffusion, individual educational organizations can adopt and plan with a time frame that suits the greater context in which the organization is embedded. Data about instructional perceptions and satisfaction with technology can be presented to the school board for funding or support of staff development or similar programs in the technology plan. Inventory statistics can reveal areas of critical need, obsolescence, and redundancy which provide the foundation for purchasing, replacement and budgeting. Data is also a valuable source of charting the historical course for reflection and forecasting for the future (Porter, 1999). Technology is a means through which data is stored and analyzed for a multitude of different purposes by all levels in an organization, but it should also be the subject of the data gathering exercise to remain current and functional for its use in data-driven decision making by stakeholders. The accuracy of reports generated through data analysis is often questionable and educators and administrators are warned to look closely at the processes and criteria used to gather, record, compile, and report data (Jones, 2006). Data cannot accurately describe social phenomena where qualitative human characteristics are the most pervasive influence in a social environment. Attempts to quantify social situations often fail to recognize the importance of the human element, which is often irrational, illogical, unpredictable, unscientific, and not compatible with quantitative analysis. Data however, does provide educational organizations with a means of assimilating a group of highly complex and interrelated process that occur independently and simultaneously. Data allows organizations to monitor and develop an understanding of their existence and is a valuable tool that assists in planning for the future.

Masino and Zamarin (2003) examined the relationship between use of technology and organizational change. This study showed how information technology becomes embedded in the organizational mass through the people that use it, and the rules they use to utilize it. Technology was shown to be an integral part of the organizational process rather than an external element that could be separated from the organizational entity. Computers have become an essential form of assistance or artificial intelligence that help educational establishments to become learning organizations that attract, develop, and retain intellectual capital through the process of knowledge management. The future of education needs to be an evolving entity, where educational institutions are not just vehicles for delivering information; they are actively growing and learning systems that are responsible for engineering and forging new pathways and avenues for their students (Senge, 2000).

The Use of Technology in Pedagogical Practice

Reviews of the literature on information and communication technology (ICT), attainment, and pedagogy studies showed a strong relationship between technology use and attainment outcomes across the educational spectrum (Cox & Abbot, 2004; Cox & Webb, 2004). There are many examples of effective use of technology across the curriculum in a variety of educational settings from early childhood education to higher education. According to Webb (2005), technology has provided educators and students with affordances to support cognitive development, formative assessment, and new curricula that were mutually beneficial to all stakeholders. Technology has been the reason for much of the restructuring and redesigning that has taken place in the classroom to create an environment that promotes and encourages the development of higher order thinking skills and their evaluation (Hopson, Simms, & Knezek, 2002). Technological innovations have caused a paradigm shift in pedagogical practice away from direct instruction or teacher centered classrooms, where students rely heavily on their teacher for knowledge acquisition, information is passively absorbed through listening and viewing, and technology is used to reinforce skills through drill and practice. These traditional learning and teaching practices are being replaced with more student centered learning environments, where technology is used in a constructivist way, as a tool that facilitates student interaction through active engagement with the curricular content. Higher order thinking skills, problem solving, and critical thinking are used to achieve learning objectives that students have set for themselves. In student centered classrooms the teacher's role is more of a facilitator, coach, or guide and technology is used to help students become more independent as they learn take more responsibility for their own learning.

Public education has invested vast amounts of money to ensure equity and access to technology in schools throughout the nation, however, it remains that highly educated teachers with technology skills still fail to integrate technology on a consistent basis as both a teaching and learning tool (Bauer & Kenton, 2005). The reform of pedagogical practice is an active choice by teachers to adopt new instructional strategies to teach curricular content. Technology may play a role as a catalyst by encouraging teachers to try new approaches, in this way it may be seen as a motivator, or a tool to help teachers break away from traditional teaching practices. In order to effect some of the necessary changes it may be necessary for educators to transform aspects of their current private theories about education which may prevent them from successfully integrating technology (Churchill, 2006). Teacher openness to change has been identified as a predictor of successful technology use in the classroom, facilitating greater content acquisition and impact on higher order thinking skills (Baylor & Ritchie, 2002). Research conducted in science classrooms in the United Kingdom showed that teachers were moving away from the more traditional forms of experiments in their classrooms and were exploring the use of technologies to engage in inquiry based, exploratory learning.

With the assistance of technology, the outcomes of experiments conducted in virtual environments, such as simulations could be immediately accessed, allowing students to receive immediate feedback in the classroom (Hennesssy et al. , 2007).

The introduction of new technology in the classroom has been shown to accommodate student centered teaching practices more than direct instruction. Handheld wireless computers (HWC's) or PDA's can transform classrooms into a learning environment in which problem solving, collaborative learning, student involvement and participation are possible (Moallem, Kermani, & Chen, 2005). Digital video has been shown to increase learning skills such as problem solving, negotiating, reasoning, risk-taking, team work, and critical thinking as well as increase overall student engagement. Interactive whiteboards have been used to support a range of learning styles, empowering learners through greater interaction with the process of learning (Cuthell, 2006). These kinds of innovations in the classroom are, however, only effective if they are used to improve the process of learning generated by good teaching practices where students are actively involved and using technology in the learning process rather than a listening to the teacher lecture with, or demonstrate technology use (Moallem, Kermani, & Chen, 2005).

E-learning has extended learning beyond the classroom and afforded educators with the opportunity of providing managed learning environments (MLEs) for their students. By using the educational systems in place along with technology tools and resources, students can seek educational alternatives to suit their individual circumstances (McAvinia & Oliver, 2004). In the United Kingdom, students required to travel overseas during critical educational periods have been able to continue with assignments by emailing them to instructors to meet deadlines and contribute to discussions and debates using message boards. Video-conferencing and e-mail has linked classrooms around the world together, allowing students to learn languages by communicating with each other in English, French, German and Spanish (Cuthell, 2006). Remote rural areas that have difficulty attracting highly qualified teachers have developed an online school house program that employs content expert teacher from anywhere in the United States to provide distance education instruction. A certified teacher with strong pedagogical skills who is not highly qualified in the required content area, supports the online instruction (Brownell, Bishop, & Sindelar, 2005).

Virtual schools are becoming increasingly popular as an alternative means for educators to reach out to students who have become disconnected from schools and conventional learning. A report published by The Peak Group predicted that enrollment would increase five-fold from 85,500 to 520,000 in the following school year. Virtual schools are currently better suited to high school, when students are old enough to possess the maturity and motivation necessary to complete studies alone. The enrollment figures are evidence of the popularity virtual schools, but the effectiveness of these alternative methods of schooling are relatively untested (Angelo, 2002).

The growth in K-12 distance education has followed in the footsteps of higher educational institutions, who have been implementing distance learning for a longer period of time. The introduction of e-learning at this level has been accomplished with a limited research base, where most studies were conducted in adult distance learning communities. In her review of the literature, Rice (2006) noted that high levels of student-teacher interaction, including feedback and summaries were an essential part of a virtual classroom. Teacher quality played a significant role in educational outcomes, and a popular reason for enrolling in distance learning courses with greater access to highly qualified teachers. Distance education using computer-based learning has created a shift in pedagogical practice to a more student-centered model. In many cases, teachers have employed more constructivist instructional strategies such as reflective thinking, provision of social support for dialogue, interaction and extension of ides and feedback from peers and mentors on curricular and related learning issues. In order to overcome some of the social drawbacks and solitude of distance learning, successful distance educators help build learning communities by combining asynchronous communication tools such as emails and threaded discussions boards, with synchronous communication tools such as instant messaging, chat rooms and real-time audio or video. Asynchronous learning tools have also been linked to the development of higher order thinking skills (Meyer, 2003). Enhanced computer mediated communication tools such as these cannot substitute well-designed instruction and opportunities to engage in purposeful interactive learning activities (Rice, 2006).

One-to-one computing has been the focus of a stateside initiative coordinated by the Michigan Department of Education. This program used laptops with wireless capabilities in conjunction with inquiry project-based teaching practices and ongoing staff development to increase cooperative and experiential learning and computer activities involving critical thinking. Over half the students involved in this program reported that they were more interested in learning, felt that they learned more, and believed that their increased efforts would lead to getting better jobs in the future (McHale, 2007). Funding the cost of upgrades and continuing staff development remains a challenge for state funded programs like this that are initiated by state and then handed to individual districts to sustain the funding.

In authentic learning environments technology is used as cognitive tool by students to engage in meaningful learning (Jonassen, 2000). Characterized by real life learning situations that integrate technology, authentic learning environments involve activities and assignments that mimic real world situations, using expert modeling of professional practices, collaborative learning, coaching and integrated assessment with learning (Herrington & Kervin, 2007). These are all examples of student-centered instructional practices, where teachers become a guide or facilitator, upon which students become less dependent as their knowledge, skills, confidence, and independence grows.

Pedagogical practices that foster critical thinking and higher order thinking skills provide a perfect partner for computers and technology in the classroom. Learning by doing, project-based assignments, and problem based learning are all types of constructivist approaches that encourage participants to work collaboratively to solve authentic problems. Intelligent use of technology in the classroom, according to Kehler, Mishra and Yahya (2005) requires the development of a complex transactional knowledge of the multi-faceted relationships between content, pedagogy and technology (TPCK). The best way to develop teachers professionally for integrating technology is to move away from skills based in services by immersing teachers in the entire design process. In this way they are integrally involved in curricular and learning context in which technology is being developed.

Many school districts still continue to categorize technology education as one of the related arts, but there is a growing consensus among educational leaders that technology should be considered a core subject along with math, science, social studies and language arts (Gilberti, 1999). The importance of technology in the future of human development should be imparted to the next generation, and schools should prepare students with knowledge and understanding so that they can participate fully in a technological society. As future decision makers, they should be able to participate in a society where public policies contain technology issues; examples include genetic engineering, extracting natural resources, energy generation, pollution, managing, planning and developing technological infrastructures.

Claims made over a decade ago by researchers that technology will act as a catalyst for a change in pedagogy remain questionable (Webb, 2005). Technology is often described simply as another resource for educators to use in their classrooms, and despite the dramatic growth in access to computer technology, computer usage in the classroom remains disappointingly low (Cuban, 1993; Zhao, Pugh, Sheldon, & Byers, 2002). Educators merely use computers to teach the same things in the same way and wrongly expect improved learning outcomes (Achacoso, 2003). Technology is often under utilized, and student computers sit in the classroom unused due to classroom management issues or teachers that prefer to use technology to present their lessons instead of encouraging students to use technology to complete assignments. Many teachers use computers primarily to teach low-level skills instead of using technology to deepen student learning (Burns, 2006). Art teachers have reported that they used technology for assessment or grading purposes, they use the Internet for lesson preparation, or for handouts, and prefer to use computers for graphic imaging rather than instructional development and delivery (Delacruz, 2004).

Based on the premise that the activities that take place in the classroom are a reflection of a teacher's training it would be reasonable to assume that many educators are ill-prepared to integrate technology in the classroom because their professional preparation for a teaching position lacked an effective technology component. Too many teacher trainings focus on computer skills rather than how to best use technology in instructional practice to enhance student learning (Burns, 2006). In-service trainings often contain motivational introductions about the possibilities that technology holds for the future, followed by software training and application. Little, and in some cases, no time is spent building pedagogical or curricular connections to the software. Staff development trainings should spend more time developing the social and organizational aspects of the school technology environment (Zhao, Pugh, Sheldon & Byers, 2002).

Some other obstacles that inhibit the use of technology in pedagogical practice include old, slow hardware that is not properly networked, lack of printers, insufficient time, student technology skill level, and keyboarding ability (Bauer & Kenton, 2005). The level of diffusion of technology within a school is also related to the types of pedagogical practices that involve technology. Older schools, with outdated or limited availability and access to software and hardware present barriers that prevent teachers from successfully implementing technology in their classrooms, on the other hand, recently constructed schools are often organized as high-intensity ICT sites with cutting edge technology. Often administrators hiring in new school sites adopt criteria for staff selection that is based on technology interests and abilities. Different expectations for teachers to implement technology will also affect technology outcomes at different levels. Some schools required teachers to develop web-based teaching resources, others use technology primarily for communication. These kinds of variables in expectations affect the amount of value placed on teacher competencies in relation to infrastructure reliability and technical support. There is also evidence to suggest that strong ICT support compensates for low teacher competency (Venesky, 2004).

Teacher resistance to change presents another hurdle for successful integration of technology in the classroom. In the past, this has been blamed on an aging population of teachers. Educators who were born before the computer age often find technology intimidating or frustrating, and they often harbor an inherent fear of feeling left behind or being obsolete. Technology has been such a predominant influence in schools over the last two decades that as older educators retire they can no longer be held responsible for the continued reluctance of some teachers to use technology (Dow, 2006). One area that is often overlooked is the underlying assumptions which teachers hold about the nature of effective teaching and learning. These theories or beliefs often remain unarticulated but they have been shown to have a substantial influence on pedagogical practice (Churchill, 2006; Dow). From a practitioner's perspective it is important to consider whether teachers believe that reform initiatives are worth their time and effort, and whether they believe that they are actually feasible to implement in a given teaching situation (Delacruz, 2004). The emphasis on assessment and accountability through standardized testing as a priority for educators and administrators is another factor that takes precedence over technology and integration.

Teacher's comments and research on change and resistance to integrating technology in instruction suggests that more investigation is needed on how experienced teachers can be encouraged and motivated to feel confident and comfortable using technology in the classroom. Some suggestions include finding out: how teachers can obtain educational software products that they feel have educational value; how to develop a focus on technology and computer use that will not waste teachers' time; how to establish a support system for teachers beginning to integrate technology; what kind of personality traits foster resistance towards change that technology accompanies (McNierney, 2004). Other guidelines for reaching out to reluctant teachers involve minimizing risk and surprise, avoiding technology jargon and unnecessary technical terminology, providing rewards and incentives, emphasizing teams where teachers work in small groups of mixed abilities and styles and finding out what they are passionate about and creating a pathway between technology and that personal motivation (McKenzie, 1999).

The Use of Technology in Student Learning

Despite a plethora of articles relating to technology in the classroom there is little convincing empirical evidence to support a solid relationship between technology and student achievement. In Bell and Bell's (2003) bibliography of over 50 articles written between 1994 and 2003 relating to technology use in K-12 science teaching, only a handful provided any support regarding its positive effect on student achievement. Computers have been shown to enhance student motivation, assist individual and collective cognitive processes and support meaningful learning. Databases, semantic webs, expert systems, and simulations are all examples of how computers can be used as mind tools to support critical thinking, problem solving, and higher order thinking skills. E-learning and virtual schools are examples of new ways that students learn with the assistance of technology. The Internet and World Wide Web have provided students with instant access to grades, coursework, homework, and educational resources in school, at home, or elsewhere. Although the relationship between technology and student achievement may be too complex to show a correlation, evidence does exist to show that teachers are changing their instruction, and students are more engaged and have a more positive attitude towards learning when technology is present in the classroom (Gosmire & Grady, 2007).

There are a number of studies that suggest that students' internal processes such as motivation, interest and memory were greatly enhanced with the use of technology (Shavinia & Loarer, 1999). Such processes prove difficult to measure in terms of gains using traditional instruments. The field of cognitive psychology offers alternative means of identifying active learning and calls for greater attention to the learner's affect and behaviors (Young, 2002). There is a need for greater understanding of the underlying psychological processes that govern learning and how the brain operates with the assistance of technology (Achacoso, 2003).

Research exploring the role of computers as a cognitive artifact or tools that aid cognition, or the process of knowing, exposes the array of roles that computers play in facilitating cognition in a variety of situations. Two opposing views have emerged which view computers as personal tools and part of a system. In the system view, the system involves the person the task and the artifact, or computer, where the artifact enhances the performance of the system. In the personal view, the computer aids individual mental cognition and changes the nature of the task the person is facing, but not the person itself. The research studies in this area illustrate how computers are used as cognitive artifacts to achieve different goals, in different ways, for different purposes. An overwhelming majority of the results support a systems approach where computational artifacts, intentionally or otherwise, have become part of a greater cognitive system, where social interaction, collective learning and other sub-systems play important roles.

From a systems perspective, research cannot be limited to the study of the cognitive artifacts themselves and must include the systems and sub-systems into which they are configured. Research should include design that is managed as a distributed activity among the individuals who are active participants in the professional use of artifacts and the instrumentation process. According to Giere (2003), the cognitive capacities of humans have not changed much since before the scientific revolution, but we know so much more because we have constructed physical and symbolic artifacts that have made mankind part of a distributed cognitive system with overall cognitive capacities far greater than our natural individual capacity. A scientific cognitive system is a hybrid of systems that include both artifacts and humans, where the roles have become interchangeable, machines can accomplish human tasks and visa versa. When collective cognition is combined with computational cognition it forms distributed cognition. Classical cognitive science and artificial intelligence once assumed that all representational and processes were localized in someone's head (or in a computer). By using computers to achieve tasks that are executed by computers, what remains is in the head are only pieces of something that is much larger that can only be assimilated through collective cognition with a powerful pattern recognition device such as the brain, or a computer. The majority of cognitive processing takes place in interactions with the environment, particularly with artifacts such as larger detectors designed for specific purposes.

The use of computers as cognitive tools to support meaningful learning (Jonassen, 2000) involves using selected computer applications as mind tools to engage learners in critical thinking. Learners use technology to represent what they know. Rather than learn from computers in an assisted drill and practice environment, or tutorial, a constructivist approach involves using computers to support knowledge construction, exploration, application, collaboration, and reflection. Some examples of mind tools include databases, semantic networks, spreadsheets, expert systems, systems modeling tools, microwrolds, intentional information search engines, visualization tools, multimedia publishing tools, live conversation environments, and computer conferences. Technological applications such as simulations and expert systems can provide safe experiential learning that is simply not possible in the real world and cannot be attained by reading a two-dimensional book.

Semantic networks, or concept maps, combined with expert systems, which are artificial intelligence programs that simulate expert decision making, can support learning and serve as mind tools for critical thinking. Semantic networks represent an intermediate type of knowledge known as structural knowledge which connects declarative and procedural knowledge. This level of knowledge demonstrates an awareness of an individual's consciousness of relationships and connections between ideas within a given subject area. The ability to describe these relationships is considered essential for higher order thinking (Jonassen, 2000). Semantic networks and expert systems can be used as cognitive reflection tools that help learners build a representation of their knowledge. A study on the effect of building semantic networks on the coherence and utility of expert systems subsequently constructed showed that expert systems built with the information provided by semantic networks contained significantly more rules and rule types than the control group, and reported increased knowledge synthesis in their domains (Marra & Jonassen, 2002).

A Finnish study examined the occurrence of cognitive conflict solving, cooperation and explicit planning in a problem solving activity conducted by 5th grade students in a complex, technology-rich environment (Soumala & Alajaaski, 2002). The children built a LEGO robot and instructed it to follow a certain path from point A to point B using the programming language LOGO. The cognitive processes assisted by computers in this study are evidenced by the specific behaviors of the students carrying out the activity, rather than an examination of the end product.

A research study by Pedersen and Liu (2002), examined the relationships between problem based learning (PBL), expert tools, computer technology, and cognitive strategies. The effects of modeling expert cognitive strategies were measured as students completed a problem based learning activity involving a hypermedia based expert tool called *Alien Rescue*. The expert tool was an interactive video of an expert modeling his cognitive processes as he performed tasks relating to the ultimate solution of the PBL unit. The solutions that the students produced showed evidence of the cognitive strategies that had been modeled by the expert video tool; which in turn, significantly improved the quality of the rationales students wrote for their solutions.

A research study conducted over a period of four years involving a software product called Computer Tutor for Writers (CTW) confirmed that the use of well-designed expert tool could successfully provide cognitive support even in complex cognitive processes such as writing; and produce reliable gains in student writing achievement over traditional methods. Writing classes that utilized the CTW expert tool software showed writing achievement gains of up to one letter grade above the control groups. Teachers and student reported that using CTW improved both the ability of students to follow a complete writing process, and their ability to achieve related learning objectives (Rowley & Meyer, 2003).

The design and use of three different types of computers tools for interactive math activities (TIMA) were studied over a period of three years (Steffe & Olive, 2002). Computer tools were developed that used toys, sticks and bears to provide children with contexts in which they could enact mathematical operations such as unitizing, uniting, measuring, fragmenting, segmenting and partitioning. This software aimed to depart from the prevailing towards trend drill and practice software to mirror Papert's self-contained microworld (1980) as an alternative use of technology where children learn to transfer habits of exploration from their personal lives to the formal domain of scientific construction. Their goal was for children to use TIMA to transform cognitive play activity into mathematical play through teacher intervention. The case studies described how children built their own mathematical symbol systems and used TIMA to execute mathematical operations when engaged in a play environment with other children.

One of the programs used in the interactive math activities to teach math to children through cognitive play was LOGO. The evidence regarding cognitive benefits of manipulating the LOGO turtle is mixed. The reason for the mixed findings on research about this software may be due to the fact that it group experiments that use LOGO as a treatment cannot effectively factor in the diversity of learning patterns in the children. However LOGO has been found to show significant gains in divergent thinking, reflection, metacognitive ability, and the ability to describe directions. It seems unlikely that young children develop problem solving skills using this program, and there are some doubts about whether it builds on mathematical skills and concepts (Yelland, 1995).

The explosion of computer-based multimedia applications in education inspired an investigation into the cognitive processes of students learning physics in a computer supported multimedia format (Gerlic & Jausovec, 2001). The electrical activity of each student's brain was recorded using electroencephalography (EEG). Alpha power measures, inversely related to mental effort as well were recorded as well as coherence measures that provide information about the cooperation between brain areas. The results of the alpha powers showed that the respondents learning with the computer showed more brain activity than the control group in the visual and temporal areas of the brain that process images and sounds. The coherence measures showed more cooperation between brain areas when students were engaged in learning by text, rather than learning by computer. The overall results suggest that multimedia learning is more demanding but stimulated less transfer of information between brain areas and there were no significant differences in the amount of material learned relating to multimedia or text presentation styles.

A review of the recent research on the effectiveness of simulations and games in the classroom found that they were consistently more interesting than traditional forms of classroom instruction, and that students retained information from simulations for a longer period of time. Results regarding the impact of simulations on student achievement still fail to confirm their effectiveness. Out of a total of 68 studies that involved simulations over half (56%) found that their was no difference between simulations and conventional instruction on student performance (32%) found differences favoring simulations and games and only 5% found differences favoring conventional instruction (Randel, Morris, Wetzel, & Whitehill, 1992).

Virtual Reality (VR) has become an increasingly popular form of technology used for medical, educational and recreational purposes. Three-dimensional VR differs from two-dimensional computer programs and simulations by employing integrated computer components in the form of head-mounted displays and gloves that afford the user to experience a first hand sense of being present or immersed in a computer-generated environment. 3-D Virtual realities have been shown to be a viable medium for measuring learning and memory (Matheis, Scholthies, Tiesky, Deluca, Millis, & Rizzon, 2007). Multi-user Virtual Environments (MUVEs) developed by Harvard Professor Chris Dede provide simulations for students to move through a virtual simulated experiences as a team or individually. Advocates of Howard Gardner's multiple intelligences attest to the fact that these kinds of learning experiences can furnish students with a profound and meaningful understanding of concepts and phenomena as yet unparalleled by other mediums (Joyce, Weil, & Calhoun, 2004).

A review of the literature evaluating technology and instruction (Alanis, 2004) described how technology has enabled students to utilize higher order thinking skills and attain synthesis and evaluation levels according to Bloom's taxonomy. Students using technology to complete projects evidenced higher order thinking skills, risk taking, innovation, transfer of knowledge between students, joint development of ideas, development of computer programs through trial and error, independence, and rapid transitions from one solution to the next (Barak, 2005).

The teacher has been shown to affect the use of technology in student learning in numerous ways. Technology integration, impact of technology on content acquisition and higher order thinking skills have been related to teacher openness to change, constructivist use of technology, and percentage of technology use with others (Baylor & Ritchie, 2002). Self-directed learning is one of the long-standing goals behind establishing computers in education (Cuban, 1993). Teachers that introduce new technology into the classroom as a means to achieve greater autonomy can be greeted with considerable resistance (Åkerlind & Trevitt, 1999). Taking greater responsibility for their learning is just the first step in a much larger educational paradigm shift in how students conceive and approach their learning. In this case, the traditional conception of education as a passive process is being superseded with a new interactive and transactional role where learners are empowered to dictate their own path to knowledge acquisition and rely less on the teacher as their levels of knowledge increase.

There is increasing evidence to support the argument that the most commonly used software applications are of the show-and-tell genre, such as the Microsoft office products Word, PowerPoint, and Publisher. Although the ability to synthesize information using a combination of text and visuals is in important skill, it can preclude some of the more rigorous kinds of learning (Burns, 2006). Data gathered from 247 observations of classroom technology use from 1999 to 2003 in 10 low-income middle and high schools by the SouthCentral Regional Technology in Education Consortium showed that classrooms were rarely found to use spreadsheets or databases which are conceptually and technically more complex and require higher order types of thinking skills. Online collaboration or content-oriented simulations that encourage critical thinking and problem solving were also scarce in the classrooms observed in this study. The Internet was used by many as an alternative to a textbook, without a means of evaluating or questioning the validity of the information. There is a growing trend among students to simply copy and paste huge chunks of information (Gibson, 2005) without actually digesting the meaning or understanding the copyright violations that they are breaching in the process. The reason for the predominant use of lower order technology tools at the expense of higher order ones may be because they are simply harder to use, less visually appealing, more time-intensive, requiring longer hours mastering, planning and integrating into an already bursting curriculum and school day.

There are studies that suggest that the quality, rather than the quantity of technology use is imperative to its effect on student learning, and that when the quality of technology use is not ensured, more time on computers may cause more harm than benefit (Lei & Zhao, 2005). This study also found that some technology uses that were shown to have the most impact on student achievement were less popular and were the least frequently used. Other reasons for the failure of technology to live up to the expectations of improved student performance and higher standards may include insufficient opportunities for long term professional development, lack of hardware, software, on site technical support, or instructional leadership to help teachers understand how they can use computers to extend and deepen student learning. Some technology training programs for educators teach skills instead of showing teachers how to utilize computers in instructional practice to enhance learning and achieve curricular goals (Burns, 2006).

Distance learning has become increasingly popular as an alternative to traditional classroom environment. A national survey of school districts conducted by the U.S Department of Education estimated that 328,000 public school students are enrolled in online or video-based distance education courses. Virtual learning opportunities are available for PreK-12 students, both nationally and internationally (Gosmire & Grady, 2007). The No Child Left Behind Act (US Department of Education, 2001) identified virtual schools as a legitimate option for school choice. The limited amount of research that has been conducted on virtual schools for K-12 show that some students succeed in the virtual education environment and some fail in the same way that they failed in traditional classroom environments. There is a high dropout rate to contend with as much as 50% in some cases. The relationships and connection with the instructor and fellow students has been shown to reduce the likelihood of dropouts. K-12 distance learning programs have been shown to foster a feeling of empowerment and freedom in the direction of learning in students. Although there is little conclusive evidence to show whether virtual schools increase student achievement, research shows that e-learning supports learner autonomy, convenience, flexibility in scheduling, accelerated learning opportunities, conflict avoidance, and the opportunity to take courses that are not offered locally (Rice, 2006).

Measuring Technology Outcomes

Technology has commanded a great deal of attention and public funding over the last two decades, but too often research fails to provide any empirical evidence to tie technology to student achievement (Alanis, 2004; Bell & Bell, 2003; Cuban, 1993; Gosmire & Grady, 2007; Lei & Zhao, 2005). In this age of accountability, measurement has played an important role in evaluating and assessing the performance of educational organizations, instructional practice, and student learning. The data generated by computer technology has helped in this measurement process, but ironically the empirical benefits of technology outcomes generated by students, , and educational organizations remain illusive and continue to present a challenge to researchers attempting to identify which variables best facilitate the use of technology in schools.

There are a number of explanations for the inconclusive results in technology studies in the field of education. Achacoso (2003), pointed out that rapid pace of technology evolution limits the life of summative studies, many of which become outdated by the time they are completed and published. Other reasons include the types of assessment used to measure the effect of technology, the sources of data collected in research studies, and the differing methodologies used to collect them. Too often administrators falsely assume that when technology is integrated into the classroom achievement scores will increase. Standardized tests measure learning objectives identified in state standards and they cannot provide valid insight into the role of technology in their achievement. Many research studies use quantitative data sources such as exam scores, standardized test scores, course grades, and course assignments to measure outcomes. These kind of performance scores yield little information regarding the internal or cognitive processes that operate to facilitate intellectual function. Research methods that include journaling, interviews, surveys, and self-reporting could reveal more of the interior processes stimulated through the use of technology in active learning. One of the most obvious reasons for the lack of technology-specific learning outcomes is that technology remains subservient to the learning objectives dictated by the curriculum. In most cases, technology is integrated into the curriculum to facilitate the curricula goals, and these are the focus of the measurement process rather than the technology that used to achieve them (Alanis, 2004). It is reasonable to assume therefore, that if technology is integrated into the curriculum, that the outcomes in terms of skills and knowledge of curriculum would also be integrated with skills and knowledge of technology.

The list of technology outcomes that follows illustrates how outcomes been organized by researchers in a variety of ways to suit the purposes of the research study. Technology covers such a broad spectrum of equipment, hardware or software that may, or may not be computer based with limitless academic, business, domestic, and industrial applications. Technology outcomes are consistently grouped in the most meaningful way that the researcher sees fit for the study.

Some examples of organizational educational technology outcomes include standards based student test results (Brown & Capp, 2003); software annotations (Boujut, 2003), technology planning, technology leadership, curriculum alignment, and provision of professional development (Baylor & Ritchie, 2002); administrative and institutional support factors (Zhou, Pugh, Sheldon, & Byers, 2002) inventory descriptions of the type and number of technology components; objectives or standards based evaluation that establish whether a given set of criteria have been met; comparing one institution with another; formative gathering of information for evaluation; identifying outcomes, and program justification (Gustafson, 2003).

Some examples of pedagogical technology outcomes used in research studies and discussed in scholarly articles are: the number of occasions that teachers use computers for various educational goals and activities (Frank, Zhao, & Borman, 2004); technology competency, technology integration (Anderson & Dexter, 2005; Baylor & Ritchie, 2002; Gustafson, 2003); how often technology was used for preparing for, or during classroom instruction, teacher non-school computer use (Baylor & Ritchie); private theories and beliefs about technology integration (Churchill, 2006; Dow, 2006); teacher morale (Baylor & Ritchie); perceived value of technology and personal technology experience (Hiatt, 1998); perceived success of technology use (Baylor & Ritchie); classroom documents and memos (Rice, 2006) observations and interviews (Bauer & Kenton, 2005; Rice; Delacruz, 2004); surveys or questionnaires (Bauer & Kenton; Rice); discourse analysis of field notes to establish technological pedagogical content knowledge (Koehler, Mishra, & Yahya, 2005); net use (Anderson & Dexter, 2005); formative descriptions of technology use, technology integration and technology impact (Gustafson).

Examples of student technology outcomes include satisfaction surveys (Petrides, 2006); electrical brain activity recorded using electroencephalography (EEG) (Gerlic & Jausovec, 2001); virtual reality performance data (Matheis et al., 2007); online notebooks, design drawings and design statements (Pedrson & Lui, 2002); learning effects and educational effectiveness of computer games and simulations (Randel et al., 1992); the writing process and ability to achieve related learning objectives (Rowley & Meyer, 2003); projects and assignments created using software applications (Charnitski et al., 1999; Steffe & Olive, 2002); constructing and programming robots (Suomala & Alajaaski, 2002; Wright, 1998); the percentage of constructivists use of technology (Baylor & Ritchie, 2002); building and testing models, predicting and comparing results of experiments and simulations, deciding and explaining how principles relate to real life (Webb, 2005); the impact of technology on higher order thinking skills and content acquisition, (Baylor & Ritchie); net use (Anderson & Dexter, 2005); student tool net use (Anderson & Dexter, 2005), and the percentage of time technology was used alone and with other students (Baylor & Ritchie).

Data are collected from an extensive array of sources for the purpose of evaluating learning and technology. They include, and are not limited to exam scores, standardized tests scores, course grades, course assignments, student behaviors, student attitudes, student perceptions, student retention, instructor behaviors, instructor attitudes, instructor perceptions, and costs. Methods for collecting data include testing, journals, surveys, interviews, observations, activity measures, and any combination of these. The measurements of technology outcomes remain specific to the types of technology being used within the organization, and the multitude of purposes for which it is used. Achacoso (2003) identified the lack of research studies that utilize assessment tools suited to specifically measuring the skills used with learning technologies. She called for the development of new kinds of measurement approaches and methodologies that are compatible with technological innovations. There is a need for longitudinal studies to examine changes over time, with methodologies incorporating observations and self-report data in a combination of quantitative and qualitative approaches. There seems little doubt from the literature that technology influences learning, but there is a lack of research explaining how or why this occurs. Quantitative studies have difficulty explaining why something happened and qualitative studies often have difficulty establishing valid and reliable results, so ideally a combination of the two would yield the most insightful outcomes.

CHAPTER 3 METHODOLOGY

This chapter describes the methodology used to conduct the research. The statement of the problem and a description and explanation of how the population was chosen are provided. Descriptions of the instruments that were used, the procedures that were used to collect and organize the data and an account of how the data were analyzed are also presented in this section.

Statement of the Problem

This study sought to investigate the relationship between the leadership behavior and technology activities of principals and the use of technology in their schools. A review of the literature showed that technology continues to dominate educational reform policies as a necessity for preparing all students for higher education and future employment.

Government funding has sought to create an infrastructure to support Internet connectivity and bring modern hardware and software to all public school classrooms. It has been shown that the technology knowledge and proficiency of principals affects educational technology use, although specific outcomes are often mediated through other school activities. However, there is little research to show how technology is used in educational organizations, pedagogical practice student learning and how leadership behavior may influence technology outcomes in different levels of the educational institution. This study focused on specific technology-related leadership behavior and the use of technology by teachers for organizational and instructional purposes and teachers' perceptions of technology use by their students.

Population and Sample

The accessible population for this study was composed of principals and instructional faculty in Collier County, Florida, K-12 schools. In May of 2007, when this research was conducted, the Collier County Public School District, located in Southwest Florida, had a total of 51 schools composed of one early learning center (Pre-K), 29 elementary schools, of which two were separated into primary and intermediate elementary schools, 11 middle schools, 9 high schools, and one alternative school. In this county, the number of elementary schools far surpassed the number of middle and high schools because the size of student enrollment increased considerably in middle and high grades. In terms of school size this translated into a greater number of small elementary schools and fewer middle schools with a larger student body. Three of these schools, two elementary and one middle school, had principals assigned to them but had no student body or faculty because they were under construction and preparing to open in the fall of 2007.

The principals and schools were not randomly selected. From the 51 schools in the county, 44 were used in the target sample for this study. The principal and faculty at the early learning center were excluded because this study was intended primarily for K-12 schools only. The alternative school was excluded from the sample because of the unique organizational structure and instructional programs offered at this school designed specifically to meet the special needs of the student body. The faculties of the three schools under construction were also excluded from the sampling frame because they had not yet been identified. The two elementary schools separated into primary and intermediate buildings were combined to form two elementary schools because in both cases, although the buildings were separate, there was one principal and a single faculty for both buildings. Therefore, total of 7 schools were excluded from the target sample.

Forty-four principals were contacted by email letter through the district Groupwise email requesting their participation in the survey. The letter also contained a link to the survey intended for principals to complete (See Appendix C). Twenty-five principals completed the survey and agreed to allow their faculties to participate in the study, of these 25, 14 were elementary schools, 7 were middle schools and 4 were high schools. Over 56% of the schools in Collier County participated in the survey. The table below shows the percentage of Collier County schools that participated in the study.

Table 1
Percentage of Schools From the Target Sample that Participated in the Study

Type of School	No. in target sample	No. that participated in the study	% of target sample
Elementary	27	14	51.85
Middle	9	7	77.7
High	8	4	50
Total	44	25	56.82

The members of the faculty from each school were identified using faculty lists posted on the school web page for each participating school. A total of 1248 faculty were sent emails requesting their participation in the study. This was composed of 616 elementary faculty, 388 middle school faculty, and 244 high school faculty. Each letter contained a link to the faculty survey. The letter to the faculty and the link to the survey are included in Appendix D. The final target sample for faculty was n=1248 and principals n=44.

The non-random selection of schools in the sample presented a major source of bias and therefore the results of this study could not be extended to represent any population outside Collier County K-12 schools. The demographic composition of this county is not typical of any other county in the state of Florida, and therefore it would be impractical and misleading to suggest that the results of this study could represent any other school districts in the state of Florida or elsewhere in the United States.

The University of Central Florida Institutional Review Board (IRB) and Collier County Research Oversight Committee reviewed and approved the research proposal for this study. The researcher completed the required coursework in order to meet the UCF IRB eligibility requirements for submission of a research proposal for review. Letters of approval from these institutions are in Appendix C.

Sample Size

An appropriate sample size for this study was estimated using Chebyshev's mathematical formula (Fishman, 1971). A minimum sample size was calculated using the total population and an estimated variance based on the number of items in the instrument at a given level of confidence. The population variance was estimated using a 99% level of confidence for the 35 item survey administered to the principals in the sample. A 99.9% level of confidence was used to estimate the population variance for the 57 item survey administered to the faculty in the sample. In fall of 2005, the total population for school principals in the state of Florida was 3,038 and the total number of instructional staff was 182,879 (Florida Department of Education, 2006). Using these populations and Chebyshev's theorem, the estimated sample size for the PTLA was n = 21, and n = 290 for the STO. These sample sizes served as a minimum sample requirement for this study. The number of principals (n=44) and faculty (n= 1248) in the sample exceeds the minimum sample required according to Chebyshev's theorem.

The principal sample (n=44) shown in Table 2, accounted for 89.7% of the 49 Collier County Public School principals (Florida Department of Education, 2007). The 7 principals excluded from the sample included alternative schools, and schools still under construction.

Table 2

Collier County Public School Principals in the Population and Sample

Type of School	Population	Sample	Percentage
Elementary	29	27	55.1
Middle	10	9	18.3
High	8	8	16.3
Other (PreK-12)	2	0	
Total	49	44	89.7

The faculty sample (n=1248) shown in Table 3, accounted for 43% of the population of Collier County K-12 instructional faculty which totaled 2,612 (Florida Department of Education, 2007).

Table 3

Percentage of Total Population of Faculty Represented in the Sample

Type of School	Population	Sample	% of Total Population
Elementary	1225	616	24
Secondary & Other	1390	632	24
Total	2615	1248	48

Fifty percent of the elementary teachers in the population were represented in the sample. Middle and high school faculty in the sample were combined to represent 45% of secondary instructional faculty in the population. Approximately 5% more instructional faculty were represented in the sample of elementary schools than secondary schools. This difference may be explained the inclusion of unidentified instructional personnel in the secondary school category of the population data reported by the Florida Department of Education (2007).

Instrumentation

Two surveys were used in this study; one was administered to the principals in the sample, and a second was administered to the faculty in the sample. A survey designed to determine leadership technology behaviors was administered to the principals to identify the independent variables of the study, which were principal leader behaviors and their technology activities. This survey, known as the Principal Technology Leadership Assessment (PTLA) was administered online at the web site www.questionpro.com to the principal of each school included in the sample (n = 44).

A second survey was created by the researcher for the purpose of identifying the multiple level school technology outcomes which was the dependent variable in the study. This survey, known as the School Technology Outcomes survey (STO) was designed to measure the use of technology for organizational, instructional, and educational purposes as reported by the faculty in Collier County schools. This survey was also administered online at the web site www.questionpro.com to the faculty of each participating school in the sample (n=1248).

The Principal Technology Leadership Activities (PTLA) Survey

Technology-related behaviors exhibited by principals were measured using the Principals Technology Leadership Assessment (PTLA). This survey was designed by the University Council for Educational Administration at the Center for Advanced Study of Technology in Education, Minneapolis, Minnesota, to assess principals' technology leadership inclinations and activities over the course of the last school year (UCEA, 2005). This survey was based on the National Educational Technology Standards for Administrators known as NETS-A (ISTE, 2002). These standards were created to assist administrators with the process of implementing technology in their schools.

1. Leadership and Vision
2. Learning and Teaching
3. Productivity and Personal Practice
4. Support, Management and Operations
5. Assessment and Evaluation
6. Social Legal and Ethical Issues

The survey was prefaced with two questions added by the researcher to discover if the respondent had been the principal at that school for longer than one year. If they had been principal at their current school for less than one year they were asked to identify the number of months they had been principal. A second question asked respondents to provide the grade levels at the school. The survey was in 6 sections, one for each of the standards listed above. Each section contained between 5 and 7 questions on each standard with a total of 35 standards-based questions and 37 including the two opening questions. The scale was a 5 point Likert-style frequency scale that included the following range of responses: *Not At All*, *Minimally, Somewhat, Significantly*, *Fully*. It was estimated to take approximately 15 minutes to complete.

Survey Development and Methodology

The Principals Technology Leadership Assessment (PTLA) was created for the purpose of providing a short, multiple-choice assessment to measure the school technology leadership of an individual principal or school administrator. The assessment was designed to align with the existing National Education Technology Standards for Administrators (NETS-A). Development of the instrument began with a review of NETS-A where specific behaviors, activities, and practices associated with each of the standards were identified. The development team then reviewed both the core NETS-A, as well as the more detailed set of standards outlined for school principals (ISTE, 2002). The team referenced a wide range of resources on school technology leadership to help gather additional detail on the standards and assessment items. Their review included existing surveys and assessments, relevant literature, the advice of researchers, best practices in leadership assessment, self-assessment, and item development (UCEA, 2005).

Survey Reliability and Validity

Draft items were reviewed by individuals on the development team to assess general validity and alignment with the six dimensions of NETS-A. In order to check that each one of the proposed items was aligned to each of the NETS-A Standards, such as Leadership and Vision, or Learning and Teaching, the reviewers checked each item until a unanimous agreement was reached. If the reviewers assigned an item to different a different NETS-A standard, the item was revised until the reviewers agreed that it was aligned with the same, specific NETS-A dimension. The survey was also reviewed multiple times against NETS-A to ensure that each of the major themes of the standards were addressed. These processes led to a draft instrument of approximately 35 items with four to six items per NETS-A dimension. The draft instrument was then reviewed and revised by content experts in the field of education technology and school leadership. Many of the revisions were minor language clarifications to address relatively low item quality ratings. Two items were deleted, and four new items were added.

PTLA Pilot and Internal Reliability Testing

The pilot survey was conducted by UCEA (2005). Data were collected from 74 school principals in schools from seven states and provinces: Alberta (Canada), Arizona, Illinois, Minnesota, New York, Ohio, and Texas. The development team used the pilot data to test the instrument's reliability. An analysis of internal consistency, or reliability, was conducted in STATA on the test as a whole and on each of the six factors. The reliability of the test as a whole was relatively high: Cronbach's alpha (α) = 0.95.

Overall, the PTLA instrument has been shown to be highly reliable, therefore the addition or removal of items to further increase reliability was not necessary. According to the overall analysis, no items appeared to function poorly or needed to be removed or revised. The PTLA instrument was deemed an appropriate measure of the desired construct of school technology leadership.

Although this instrument has already been extensively tested for reliability, a pilot survey was originally planned for use in this study in Collier County, Florida. The results for all items would undergo a factor analysis to check for internal consistency and item reliability in the specific context and circumstances for this research study. However the principals at the three schools selected for the pilot study failed to complete the survey within the time frame allotted for the pilot factor analysis to occur, and therefore the PTLA survey did not undergo further reliability testing before the data were collected from the principals in the target sample.

The School Technology Outcomes (STO) Survey

This survey was created by the researcher to measure the dependent variable of technology outcomes at three levels: organizational technology outcomes, instructional technology outcomes and educational technology outcomes. Survey items were designed to identify the faculty's perceived use of technology by their principal, their organization, their students, and themselves. It was administered to the faculty of each school included in the research study. The survey was prefaced with questions to identify the grade level(s) associated with the respondent, and whether they have been teaching in the building for more than a year. Respondents who had been at the school for less than one year were asked to identify the number of months they had been teaching at the school. The survey contained two parts with two different scales.

Part I consisted of 23 questions and was designed to elicit a scaled agreement score using a 4 point Likert scale with the following responses: *Strongly Agree, Agree, Disagree, Strongly Disagree*. Questions in this section asked for the faculty's perception of their principal's technology behavior and activities, followed by their perception of a variety of organizational, instructional, and educational technology activities that take place in their school.

Part II contained a total of 34 items was separated into three sections. The first section contained 5 items devoted to organizational outcomes where respondents were asked how often they used a variety of software and hardware for administrative and management purposes. The second section contained 14 questions about instructional outcomes where respondents were asked how often they used a variety of hardware and software for planning and instructional purposes. The third section contained 15 questions about student outcomes, which asked teachers to identify how often their students used specific software and hardware for completing assignments. Constructs in Part II were measured using a 4 point Likert frequency scale with the following options: *Never, Occasionally, Frequently, Almost Always*. The range of scale scores for each construct is listed in Table 8.

The survey contained a total of 57 items, and two additional preface questions which asked if the faculty had been present at the school for more than one year and what grade level(s) they taught. Respondents who indicated that they had been at the school for less than a year were asked to identity the number of months they had been at the school. Neutral responses were not available for respondents in order to reduce the possibility of inconclusive findings under the circumstances of a small target sample, and the possibility of a low response rate. The survey was intended to obtain faculty perceptions of their principal's use of technology, their organization's use of technology, their student's use of technology and their own use of technology for administrative and management tasks as well as planning and delivery of instruction. Low scale scores indicated a low level of agreement with technology statements and low frequency use of technology. High scale scores indicated a high level of agreement with technology statements and high frequency use of technology. This survey was available online at www.questionpro.com for respondents to complete. A copy of this survey is included in Appendix B.

School Technology Outcome Constructs

Construct 1- Student Technology Outcomes

This construct was assessed using scaled scores obtained from 15 items, involving questions 43-57 in section 4 of the STO survey. The items shown in Table 4 were designed to represent teachers' perception of their students' use of technology in the learning process and the related educational outcomes and issues discussed in the review of the literature.

Table 4

STO Survey Items for Construct 1

Section & Item No.	Question
Section 4.	**How often do <u>your students</u> use the following technology items for <u>completing assignments?</u>**
43.	Microsoft products for word processing and presentation.
44.	Spreadsheet software; e.g., Microsoft Excel
45.	Concept mapping software; e.g., Inspiration/Kidspiration
46.	Image or video editing software; e.g., Paint, Adobe Photoshop, Macromedia Fireworks, Microsoft Moviemaker, Visual Communicator
47.	Html editing/web page or desktop publishing software; e.g., Macromedia Dreamweaver, Microsoft Front Page, Microsoft Publisher
48.	Animation software; e.g., Macromedia Flash, Poser
49.	Design and engineering software; e.g., Autocad, Cadkey
50.	Internet search engines or online encyclopedias; e.g., Google, Yahoo Worldbook, Wikipedia
51.	Web based skill development software; e.g., FCAT Explorer, Riverdeep
52.	Online Text books
53.	Image capture devices; e.g., digital cameras & scanners
54.	Student response systems/classroom clickers
55.	Portable wireless laptop computers
56.	School computer lab
57.	Classroom computers

Construct 2- Instructional Technology Use

This construct was assessed using scaled scores obtained from 14 items, involving questions 29-42 in section 3 of the STO survey. The questions shown in Table 5 were designed to represent the use of technology in pedagogical practice and related outcomes and issues discussed in the review of the literature.

Table 5

STO Survey Items for Construct 2

Item No.	Question
Section 3	**How often do you use the following technology items for planning and delivery of instruction?**
29.	Microsoft products for word processing and presentation (Word & PowerPoint)
30.	Spreadsheet software; e.g., Microsoft Excel
31.	Concept mapping software; e.g., Inspiration!
32.	Image or video editing software; e.g., Paint, Adobe Photoshop, Macromedia Fireworks, Microrosft Moviemaker, Visual Communicator
33.	HTML editing/web page or desktop publishing software; e.g., Macromedia Dreamweaver, Microsoft Front Page, Microsoft Publisher
34.	Internet search engines or online encylopedias; e.g., Google, Yahoo, Worldbook. Wikipedia
35.	Web based skill development software; e.g., FCAT Explorer, Riverdeep
36.	Online Text books
37.	Databases for student information; e.g., Datawarehouse, Esembler
38.	Image capture devices; e.g., digital camera, scanner
39	File copying and transportation devices; e.g., CD burner, portable flash drive
40.	Presentation devices; e.g., video projector, sound enhancement, interactive whiteboard
41.	Portable wireless laptop computer or tablet
42.	DVD player

Construct 3 - Principal and Organizational Technology Use.

This construct was assessed using scaled scores from 9 items, involving questions 1-6, and 8-10 in section 1 of the STO survey. The questions shown in Table 6 were designed to discover teachers' perception of their principal's use of technology and their school's organizational use of technology.

Table 6

STO Survey Items for Construct 3

Section & Item No.	Question
Section 1.	**Do you agree or disagree with the following statements?**
1.	Technology is important to the principal
2.	The principal is proficient at using technology
3.	The principal has discussed the school technology plan with the faculty
4.	The school's technology goals are readily available to the faculty
5.	The principal supports funding for new technology
6.	The principal supports training for new technology
8.	Technology helps our school achieve AYP (Adequate Yearly Progress)
9.	Technology has helped our organization communicate more effectively
10.	Our educational organization is proficient at using technology

These items were related to the NETS-A constructs in the PTLA survey as well as technology activities and leader behaviors identified in the review of the literature. The items in this construct also confirmed or refuted the self-reported behavior of principals in the PTLA survey. The items were paired with the following PTLA constructs Leadership & Vision (items 1, 3, and 4), Learning & Teaching (item 6), Productivity & Professional Practice (item 2), Support Management & Operations (item 5), as well as a selection of the organizational technology outcomes discussed in the review of the literature

Construct 4 - Administrative and Management Technology Use

This construct was assessed using scaled scores obtained from 6 items, involving question 7 in section 1 and questions 24-28 in section 2 of the STO survey. The questions shown in Table 7 were designed to represent a selection of the organizational technology outcomes discussed in the review of the literature as well as use of technology for management and administrative tasks.

Table 7

STO Survey Items for Construct 4

Section & Item No.	Question
Section 1.	**Do you agree or disagree with the following statements?**
7.	Our school relies heavily on technology
Section 2.	**How often do you use the following technology items for administrative and management tasks?**
24.	Email software; e.g., Groupwise
25.	Online courses for professional development; e.g., long distance learning for ESOL and Reading endorsement
26.	Databases for student information; e.g., Data warehouse, Terms/Rhumba
27.	Websites for posting information for students and parents: e.g. Schoolnotes.com
28.	Shared network directory to access shared files

Construct 5- Technology Proficiency, Progress, Goals and Standards. This construct was assessed using scaled scores obtained from 5 items involving questions 14, 16, 17, 22, and 23 in section 1 of the STO survey. The questions shown in Table 8 were designed to represent teacher perceptions of technology proficiency, progress, goals, and standards for educational organizations, their principals, teachers, and students.

Table 8

STO Survey Items for Construct 5

Section & Item No.	Question
Section 1.	**Do you agree or disagree with the following statements?**
14.	I am familiar with the district technology standards for teachers
16.	My students use technology for completing assignments
17.	My students are proficient at using technology for completing assignments
22.	I am familiar with the district technology standards for students
23.	I monitor student progress in technology use

Construct 6 - Technology Needs.

This construct was assessed using scaled scores obtained from 8 items involving questions 11, 12, 13, 15, 18, 19, 20, and 21 in section 1 of the STO survey. The following items shown in Table 9 identified technology needs and related educational objectives.

Table 9

STO Survey Items for Construct 6

Section & Item No.	Question
Section 1.	**Do you agree or disagree with the following statements?**
11.	I use technology to plan for instruction
12.	I use technology to interpret and analyze student assessment data
13.	I would like to learn more about teaching with technology
15.	I would like to have more technology tools to deliver instruction
18.	I would like to have more technology available for my students to use
19.	My classroom computers are insufficient for my students' needs
20.	The school computer labs are readily available for students to complete assignments
21.	I use technology to achieve curricular goals

STO Pilot Survey

A pilot survey was planned to test this survey. The principals of one middle school, one elementary school, and one high school were identified as possible pilot study participants. Two principals agreed to participate in the pilot prior to the launch of the pilot phase of the study. The results of the surveys completed by the faculty from the three schools in the pilot study would undergo factor analysis and item analysis to test for reliability and internal consistency. However, the principals at these schools did not complete and submit the PTLA during the pilot study time frame and formal consent to send the STO survey to their faculty could not be established. As contact letters to principals were limited to two, after an initial letter, and the time for the pilot study phase of the study had expired, general data collection from all schools commenced without pilot data. Two of the three schools originally earmarked for the pilot eventually participated after the second reminder email, and their data were used in the final results.

Procedures

All principals in the sample population (n = 44) were sent an email letter through the Collier County School District email via GroupWise requesting their voluntary participation in one online survey, as well as the voluntary participation of their faculty in one online survey. The circumstances, details, purpose, dates and confidentiality of the research survey were clearly stated in this email message, along with a request to allow the researcher to contact the faculty members and ask for their voluntary participation. The message contained a direct and uniquely coded hyperlink to the PTLA survey website at questionpro.com. The coding allowed the researcher to match the PTLA responses with the faculty STO responses from the same school. A second reminder email letter, sent out to all principals in the target sample (n = 44) approximately 14 days after the first letter, asked all principals who had not yet completed the survey to follow the link and directions to complete the PTLA survey. The number of follow up letters was limited to 2 by the Collier County Research Oversight Committee who reviewed the research proposal and approved this research study after amendments were made to reduce the amount of time required from principals who chose to participate in this study. Both email letters are in Appendix D. All PTLA respondent data were downloaded from questionpro.com in Excel spreadsheet format.

Shortly after principals had completed and submitted the survey, their faculty was sent an email message requesting their voluntary participation in the study. The first messaged described the circumstances, purpose, dates, anonymity, and confidentiality of the survey along with a request for their participation by followed by a direct and specific link to the STO survey at questionpro.com that was uniquely coded for each school in the sample. Once submitted, all faculty data were paired with the survey code for that school. In this way, faculty remained anonymous but STO responses from each school could be collectively paired with their school's PTLA responses. The data from each school survey were downloaded from Questionpro.com and stored in a spreadsheet format for further analysis.

A follow up second email reminder letter was sent out approximately 10 days later. This email letter asked all faculty who had not yet completed the survey to follow a direct and specific hyperlink to complete the STO survey. The number of follow up letters sent to faculty was limited to 2 by the Collier County Research Oversight Committee who reviewed the research proposal and approved this research study after amendments were made to reduce the amount of time required from faculty who chose to participate in this study. Email letters are in Appendices C and D.

The researcher's email, address, and phone numbers were made available for all participants to use if they needed to ask any questions about the survey. Over 56% of the schools in Collier County participated in this study. A total of 25 principals completed the PTLA and agreed to allow their faculty to participate voluntarily. Out of the 1248 STO surveys that were sent out, 339 faculty completed and submitted the surveys, which accounted for a total of 27% district-wide faculty participation.

<u>Data Analysis</u>

PTLA Survey

The PTLA yielded scale scores on the 6 constructs based on each of 6 the NETS-A technology standards for administrators. The range of scale scores for each dimension shown in table 10 used a 5 point Likert-type scale (*Not at all, Minimally, Somewhat, Significantly, Fully*). For each of the constructs, a high scale score indicated high levels of application, and low scale scores indicated low levels of application of the technology leadership constructs. Descriptive statistics, including frequencies, percentages, standard deviation, actual response range, and means were used to produce item analysis and evidence of possible trends across each of the constructs.

Table 10

Range of scale scores for PTLA constructs

PTLA Construct No.	Construct Name	Range of scale scores
PTLA Construct 1	Leadership & Vision	6-30
PTLA Construct 2	Learning and Teaching	6-30
PTLA Construct 3	Productivity and Professional Practice	5-25
PTLA Construct 4	Support, Management & Operations	6-30
PTLA Construct 5	Assessment & Evaluation	5-25
PTLA Construct 6	Social, Legal & Ethical Issues	7-35

STO Survey

The STO provided scale scores on 6 technology outcome constructs: Student Technology Use, Instructional Technology Use, Principal and Organizational Technology Use, Administrative and Management Technology Use, Technology Proficiency, Progress, Goals & Standards, and Technology Needs. The ranges of scale scores for each construct are shown in Table 11. The scale scores for each construct were obtained from responses to a 4 point Likert-type agreement scale in Part I (*Strongly Agree, Agree, Disagree, Strongly Disagree)* and frequency scale in part II (*Never, Occasionally, Frequently, Almost Always).*

Table 11

Range of Scale Scores for Constructs 1-6

Construct number	Construct Name	Range of scale scores
STO Construct 1	Student Technology Outcomes	15-60
STO Construct 2	Instructional Technology Outcomes	14-56
STO Construct 3	Principal and Organizational Technology Outcomes	9-36
STO Construct 4	Administrative and Management Technology Outcomes	6-24
STO Construct 5	Technology Proficiency, Progress Goals and Standards	5-20
STO Construct 6	Technology Needs	8-32

For the purpose of analysis the questions were coded in SPSS so that a high level of agreement and application (*Strongly agree, Almost Always*) generated 4 points, and a low level of agreement and application (*Strongly Disagree, Never*) generated 1 point. In this way high scale scores indicated a high level of agreement and application of each of the six constructs. Descriptive statistics, including frequencies, percentages, standard deviation, actual response range and means were used to produce item analysis and evidence of possible trends across each of the constructs.

A factor analysis was performed to analyze the common factors in the STO Survey variables. The survey was then tested for item reliability by obtaining Cronbach's coefficient Alpha for internal consistency. Assumptions were tested using Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) was obtained as a measure of sampling adequacy to see if factor analysis was an appropriate procedure.

STO Survey Factor Analysis

In the initial analysis, 12 components were identified as having an Eigen value over 1 and accounted for 67% of the variance. The first component had an Eigen value of 14.43 and accounted for over 25% of the total variance. A scree plot showed that the values became linear between the fifth and the seventh component, indicating that six factors would be an appropriate number to explain the variables in this study. The results shown in the scree plot are located in Appendix E.

The communalities were generally between .6 and .7. Question 54 was the only variable that scored below .5 in the communalities report, however it was not removed from the analysis proceedings. The KMO indicated a strong measure of sampling adequacy at .91 and Bartletts' Test of Sphericity was significant indicating that factor analysis was an appropriate procedure for analyzing the variables in this survey.

Table 12

KMO Measure of Sampling Adequacy and Bartlett's Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.910
Bartlett's Test of Sphericity	Approx. Chi-Square	11790.897
	Df	1596
	Sig.	.000

A varimax rotation was then performed to further clarify and explain the factor loading. For the purpose of accurate interpretation the analysis was rerun using the sort-blank procedure so the variable with the largest loading (correlation with the factor) is listed first. All items with values under .4 were blanked from the matrix for easier interpretation; the original complete matrices are included in Appendix E.

STO Survey Reliability

The STO Survey was tested for internal consistency by performing an item analysis and obtaining a Cronbach's Alpha for reliability of each of the six constructs in the survey.

Construct 1 consisted of 15 items. Questions 43-57 asked faculty how often their students used certain types of hardware and software for completing assignments. This factor counted for 14.6 % of the variance. This faction was named *Student Technology*

Use. Reliability for this factor, shown in Table 13, was good (above.7), with a Cronbach's Alpha of .93.

Table 13

Reliability Statistics for Construct 1

Cronbach's Alpha	N of Items
.93	15

Construct 2 consisted of 14 items. Questions 29-42 asked faculty how often they used certain types of hardware and software for planning and delivery of instruction. This factor accounted for 13.0% of the variance. This factor was named *Instructional Technology Use.* Reliability for this factor shown in Table 14 was good, considerably higher than .7 with a Cronbach's Alpha of .92.

Table 14

Reliability Statistics for Construct 2

Cronbach's Alpha	No. of Items
.92	14

Construct 3 consisted of 9 items. Questions 1, 2, 3, 4, 5, 6, 8, 9, and 10, asked faculty about their principal's and their organization's use of technology. This factor accounted for 5.05% of the variance. This factor was named *Principal and*

Organizational Technology Use. Reliability for this factor was good (above .7) with a Cronbach's Alpha of .88 shown in Table 15.

Table 15

Reliability Statistics for Construct 3

Cronbach's Alpha	No. of Items
.88	9

Construct 4 consisted of 6 items. Questions 7 in section 1, and questions 24–28 in section 2 of the STO survey. The questions in this section were designed to represent a selection of the organizational technology outcomes discussed in the review of the literature as well as use of technology for management and administrative tasks. This factor accounted for 4.8% of the variance. This factor was named *Administrative and Management Technology Use*. Reliability for this factor shown in Table 16, was acceptable (above .7), with a Cronbach's Alpha of .79.

Table 16

Reliability Statistics for Construct 4

Cronbach's Alpha	No. of Items
.79	6

Construct 5 consisted of 5 items. Questions 14, 16, 17, 22, and 23 asked faculty questions about technology standards, proficiency, curricular goals, and student progress.

This factor accounted for 3.2% of the variance. This factor was named *Technology Proficiency, Progress, and Standards*. Reliability for this factor was acceptable (above .7) with a Cronbach's Alpha of .80 shown in Table 17.

Table 17

Reliability Statistics for Construct 5

Cronbach's Alpha	No. of Items
.80	5

Construct 6 consisted of 8 items. Questions 11, 12, 13, 15, 18, 19, 20, and 21 were about faculty technology needs and their use of technology for data analysis and achieving curricular goals. This factor accounted for 2.95% of the variance. This factor was named *Technology Needs*. Reliability for this factor was acceptable (above.7) with a Cronbach's Alpha of .79 shown in Table 18.

Table 18

Reliability Statistics for Construct 6

Cronbach's Alpha	No. of Items
.79	8

The overall conclusion from the item analysis is that the STO survey was a reliable instrument for testing the 6 constructs that define Technology Outcomes measured by the variables in the School Technology Outcomes Survey.

Research questions and Data Analysis

The first research question sought to identify the technology activity of principals in terms of NETS-A standards. Descriptive statistics obtained from the PTLA in the form of frequencies, means, standard deviations and item-by-item analysis showed the self reported technology activity of principals for each of the 6 subscales in the PTLA. Each subscale represented one of the six NETS-A standards. Teacher perceptions of principal technology use are provided in the Principal Technology Outcome construct in the STO Survey. Descriptive statistics of this subscale generated from the faculty was used to compare and contrast to the self-reported activity of the principal in the same school. The second research question sought to identify how technology is used in Collier County Schools for organizational, instructional and educational purposes. Descriptive statistics of each of the STO subscales was used to identify the school technology outcomes as reported by teachers.

Finally, bivariate regression analyses were performed to address the third research question which sought to identify possible comparisons between some of the constructs in principals' technology leadership behavior and the dependent variable organizational, instructional and educational technology outcome constructs. These constructs were represented by scale scores in a bivariate regression analysis to determine if significant similarities($p=>0.5$) could reveal a relationship between principal behavior and technology outcomes.

<u>Statistical Analysis</u>

The Statistical Package for the Social Sciences (SPSS Version 15.0) was used for all analyses. The level of significance was set a $p<.05$ (a 95% level of confidence). Table 19 shows the statistical analysis procedure that was used for each research question. A bivariate regression analysis was conducted in SPSS to discover if there are any correlations between the leadership activities identified in the PTLA survey and the technology outcomes measured by the School Technology Outcomes survey.

Table 19

Comparison of Research Question, Survey Constructs, & Statistical Method

Research Question	Statistical Method	Survey
1. What is the technology activity of principals?	Mean item Analysis	PTLA Constructs 1-6 STO Construct 3
2. How is technology used in schools for organizational, instructional and educational purposes?	Mean item analysis	STO Constructs 1-6
3. What is the relationship between technology activity of principals and the use of technology for organizational, instructional, and educational purposes in schools?	Bivariate Regression Analysis	PTLA Constructs 1-6 STO Constructs 1-6

Summary

This chapter described the methodology used to conduct the research. The problem was stated and the processes used to identify the population were described with the size and composition of the target samples. The development and methodology of the two surveys used to measure the dependent variable Technology Outcomes, and the independent variable, Principal Technology Activities were described. The constructs used in both surveys, and the scale scores that they represented were outlined. The procedures for the preliminary pilot studies and the processes involved in implementing the online surveys and collecting the data were stated. The processes used to analyze the data and investigate reliability and internal consistencies of the instruments were detailed. Finally, the statistical procedures that were used to analyze the data for the purpose of answering the research question were reported.

CHAPTER 4 ANALYSIS OF DATA

This study sought to examine the technology behavior of principals in terms of NETS-A standards for administrators and how technology was used for organizational, instructional, and educational purposes in Collier County schools. A bivariate linear regression was conducted to determine if there was a relationship between the technology behavior of leaders and the school technology outcomes. This chapter presents the results of the data analysis conducted to answer research questions 1-3. The data used for these analyses were collected from two surveys, one was administered to principals to examine the independent variable, principals' technology behavior; a second survey was completed by their faculty to examine the dependent variable, technology outcomes.

Population and Sample

Of the 44 Collier County principals in the sample, 25 participated in the PTLA survey accounting for 56.8% of the total population. The percentage of high school, middle school, and elementary school principals are shown in Table 20. Just under half of the elementary school principals participated, with 14 of the possible 30 schools accounting for 31% of the total possible respondents. Eight of the 11 middle schools responded totaling another 18%, and 4 of the 9 high schools responded adding another 8%. The total response accounted for 56.8% of the principals in Collier County included in the sample. Of the 25 principals, only 3 had been principals in their school for less than a year, 2 for 5 months, and one had held the position for less than 1 month. The data from all 25 principals that responded to the survey were included in the initial analysis of the data.

Table 20

The Total Response of Principals to the PTLA Survey

Type of School	Number of Principals	Percentage of total responses (n=25)	Percentage of total population (N=44)
Elementary	14	56%	31.8%
Middle	7	28%	15.9%
High	4	16%	9.1%
Total	25	100%	56.8%

The STO Survey was completed by 339 faculty, which accounted for 27% of the total population of Collier County faculty who were asked to complete the survey. Table 21 shows the number of elementary, middle, and high school faculty that completed the survey. Three hundred and nine respondents indicated that they been at their current school for more than 1 year, only 16 respondents had been at their school for less than a year of these, 8 had for 10 months, 4 for 9 months and the remainder between 2 and 8 months. Fourteen respondents did not answer this question. The data from the 16 teachers who had been at the school for less than a year were included in the initial analysis of the data.

Teachers from all grade levels, kindergarten through to twelfth grade responded to the survey; the percentage of the total respondents from each grade level ranged from 11%-18%. Three teachers that answered the survey indicated that they taught Pre-K; their data was included in the initial analysis of the data, although the study was targeted mainly at K-12 faculty.

Table 21

The Total Response of Faculty to the STO Survey

Type of School	Number of Faculty	Percentage of Total Responses (n=339)	Percentage of Total Population (N=1258)
Elementary	163	48.1%	13%
Middle	101	29.8%	8%
High	75	22.1%	6%
Total	339	100.0%	27%

Descriptive Statistical Analysis of PTLA Survey Items

The six constructs in the PTLA survey were analyzed to identify and investigate possible technology leadership trends for each of the constructs. The choices of responses for principals were *Not at all, Minimally, Somewhat, Significantly*, and *Fully*. Principals that answered questions with the negative options *Not at all,* and *Minimally* indicated deficient and weak levels of leadership respectively for each construct. Principals that answered responses with the positive options *Significantly,* and *Fully* indicated strong and superior levels of leadership respectively in that construct. Those who answered questions with the most neutral option *Somewhat,* indicated indifferent or moderate levels of leadership in that construct. The percentage responses and item analysis results are described for each construct, followed by a description of the scale score results for each construct.

PTLA Construct 1 - Leadership and Vision

This construct contained 6 questions. The area that showed the overall weakest level of leadership was question 9 where 16% of the respondents indicated that they engaged only minimally in activities to identify best practices in the use of technology and 40% of the principals expressed indifference. Although none of the respondents to question 6 claimed that they did not attend to best practices at all, this was not the case for question 4, the question with the second lowest percentages of responses. Twelve percent of the respondents to this question indicated that they did not participate at all in the district or school's most recent technology planning process, 4% participated minimally and 32% expressed indifference by or moderate participation.

Question 7 received the highest response rate, where 32% of principals indicated that they had significantly compared and aligned their school technology plans with district-wide strategic planning processes and 28% had fully compared and aligned school plans with district plans. In total, 60% of principals stated that they were in alignment with district technology plans. The question that received the next highest percentage of responses for leadership and vision was question 5, where 60% of the principals specified significant communication to stakeholders about district and school technology planning and implementation efforts to school stakeholders.

Elementary and middle schools showed greater positive percentages promoting stakeholder participation in technology planning (question 6) than high schools. Question 8 regarding the use of research based technology practices received the highest percentage of positive responses for the leadership and vision construct at the high school level. Table 22 presents responses for each of the items in construct one (leadership and vision).

Table 22

Percentage Responses for Construct 1

Survey Item	Not At All	Minimally	Somewhat	Significantly	Fully
4. To what extent did you participate in your district's or school's most recent technology planning process?	12	4	32	40	12
5. To what extent did you communicate information about your district's or school's technology planning and implementation efforts to your school's stakeholders?	0	4	28	60	8
6. To what extent did you promote participation of your school's stakeholders in the technology planning process of your school or district?	0	8	32	44	16
7. To what extent did you compare and align your district or school technology plan with other plans, including district strategic plans, your school improvement plan, or other instructional plans?	4	4	32	32	28
8. To what extent did you advocate for inclusion of research-based technology practices in your school improvement plan?	4	8	24	52	12
9. To what extent did you engage in activities to identify best practices in the use of technology (e.g. reviews of literature, attendance at relevant conferences, or meetings of professional organizations)?	0	16	40	40	4

Note: All respondents completed each item N=25

PTLA Construct 2 - Learning and Teaching

This construct contained 6 questions. The area that showed the weakest levels of leadership was question 14 regarding assessment of staff needs for professional development. There were no principals that were entirely deficient in this area of technology leadership because none of the principals selected the *Not At All* option for any of the questions. However, 12% indicated that they only minimally assessed staff professional development needs and 32% responded to the question with *Somewhat,* indicating possible indifferent, or moderate technology leadership in this area. Another question with a high proportion of negative responses was question 12 about disseminating best practices in learning and teaching with technology. Twenty-eight percent of principals answered *Somewhat* to this question, showing possible indifferent or moderate levels of technology leadership. The question that received the highest score for the learning and teaching construct was question 10 about providing assistance to teaching for interpreting and analyzing student assessment data. An overwhelming majority, 92% of principals responded positively to this question. Forty percent indicated significant and over half, 52% fully provided assistance to teachers to use technology for interpreting and analyzing student assessment data. Another question with a strong positive response was question 11 where 48% selected the *Significan*t response, and 40% selected the *Fully* showing superior leadership in the provision of assistance to teachers for using assessment data to modify instruction.

High schools showed higher percentage of positive responses for questions 13, 14, and 15 about budgeting and facilitating the sharing of best practices, assessing staff needs, and ensuring subsequent delivery of professional development in technology respectively. The elementary and middle schools both showed a higher percentage of positive responses for data driven leadership behavior and more negative responses for facilitating best practices and staff development needs and training. Table 23 presents the responses for each of the items in the construct for learning and teaching.

Table 23

Percentage Responses for Construct 2

Survey Item	Not At All	Minimally	Somewhat	Significantly	Fully
10. To what extent did you provide or make available assistance to teachers to use technology for interpreting and analyzing student assessment data?	0	0	8	40	52
11. To what extent did you provide or make available assistance to teachers for using student assessment data to modify instruction?	0	4	8	48	40
12. To what extent did you disseminate or model best practices in learning and teaching with technology to faculty and staff? *(*N=24 on this item)*	0	0	28	56	12
13. To what extent did you provide support (e.g., release time, budget allowance) to teachers or staff who were attempting to share information about technology practices, issues, and concerns?	0	0	8	68	24
14. To what extent did you organize or conduct assessments of staff needs related to professional development on the use of technology?	0	12	32	36	20
15. To what extent did you facilitate or ensure the delivery of professional development on the use of technology to faculty and staff?	0	0	28	44	28

Note: All respondents completed each item N=25 (*except question 12)

PTLA Construct 3 - Productivity and Professional Practice

This construct contained 5 questions. Similar to the learning and teaching construct, none of the principals responded with the *Not at all* option to any of the questions in this construct, showing an absence of deficiency in this area of technology leadership too. The item that showed the weakest levels of leadership was question 16 about principal participation in professional practice and development activities to expand their use of technology. Although none of the principals responded negatively to this question, 36% expressed their possible indifference and moderate levels of leadership by selecting the *Somewhat* response for this question. The question that received the highest percentage of positive responses for this construct was questions 17, where 28% indicated significant use of technology for completing daily tasks and a further 56% indicated that that used technology to the fullest extent to complete daily tasks. An overwhelming majority of principals also responded positively to question 19, with 44% indicating strong use and a further 44% indicating superior use of technology management systems to access student records by selecting the *Significant* and *Fully* options respectively.

High schools showed the highest percentage of positive responses in the use of technology based management systems to access both employee and student records. They also showed the most positive responses for the use of technology as a means of communicating with educational stakeholders. Professional development for principals at all levels, elementary, middle, and high school was the weakest area in this construct. Table 24 presents the responses for each of the items in the construct for productivity and professional practice

Table 24

Percentage Responses for Construct 3

Survey Item	Not At All	Minimally	Somewhat	Significantly	Fully
16. To what extent did you participate in professional development activities meant to improve or expand your use of technology?	0	0	36	56	8
17. To what extent did you use technology to help complete your day-to-day tasks (e.g., developing budgets, communicating with others, gathering information)?	0	0	16	28	56
18. To what extent did you use technology-based management systems to access staff/faculty personnel records? *Note: N=24 on this item*	0	4	8	44	40
19. To what extent did you use technology-based management systems to access student records?	0	4	8	44	44
20. To what extent did you encourage and use technology (e.g., e-mail, blogs, videoconferences) as a means of communicating with education stakeholders, including peers, experts, students, parents/guardians, and the community?	0	4	20	32	44

Note: All respondents completed each item N=25

PTLA Construct 4 – Support, Management, and Operations

This construct contained 6 questions. The item that showed the weakest levels of leadership in the entire survey was question 23. An astonishing 20% of the principals indicated that they did not pursue any means of supplemental funding and a further 16% selected the *Minimal* option for this question showing that a total 36% of the principals exhibited weak levels of leadership for this item. Another question that generated a high percentage of negative responses was question 24 about ensuring that hardware and software replacements were incorporated in school technology plans. 8% of principals indicated that they did not provide for replacements and a further 16% only minimally addressed this issue in their planning.

Question 21 received the highest percentage of positive responses of all the questions in the survey, the entire population of respondents, 100% of principals responded positively to this item about providing support for staff and faculty to connect and use district and building level technology systems for general management and everyday operations. The question with second highest number of positive responses for this construct was question 25 about advocating at the district level for adequate, timely and high-quality technology support services. 48% of principals stated that they significantly advocated at the district level for support services and a further 20% advocated fully showing strong levels of leadership for this item in the construct. Over half of the principals stated that they had used campus discretionary funds significantly to meet their school's technology needs.

Support for staff and faculty to connect to, and utilize district and building level technology was consistently the strongest area in this construct at all levels, with advocating for adequate, timely and high quality support services showing the second strongest scores at all levels. Middle schools principals showed lower scores than elementary and high schools for investigating faculty satisfaction with technology district support services. Table 25 presents the responses for each of the items in the construct for support, management, and operations.

Table 25

Percentage Responses for Construct 4

Survey Item	Not At All	Minimally	Somewhat	Significantly	Fully
21. Support faculty and staff in connecting to and using district- and building-level technology systems for management and operations (e.g., student information system, electronic grade book, curriculum management system)?	0	0	0	60	40
22. To what extent did you allocate campus discretionary funds to help meet the school's technology needs?	0	8	40	52	0
23. To what extent did you pursue supplemental funding to help meet the technology needs of your school?	20	16	32	28	4
24. To what extent did you ensure that hardware and software replacement/upgrades were incorporated into school technology plans?	8	16	32	24	20
25. To what extent did you advocate at the district level for adequate, timely, and high-quality technology support services?	0	12	20	48	20
26. To what extent did you investigate how satisfied faculty and staff were with the technology support services provided by your district/school?	0	4	56	32	8

Note: All respondents completed each item N=25

PTLA Construct 5 – Assessment and Evaluation

This construct contained 5 questions. Question 29 generated the highest number of negative responses, indicating the weakest levels of leadership for this construct. 12% of principals were deficient in this aspect of technology leadership indicating that they did not assess and evaluate existing technology-based administrative operations and systems for modification or upgrade and a further 24% indicated that they only minimally addressed this issue. Another area of weak leadership for this construct was question 28 regarding the extent that principals promoted the evaluation of technology based instructional practices to assess their effectiveness. Although none of the principals exhibited leadership deficiency for this item, 20% of respondents indicated that they promoted the evaluation of instructional practices that were technology based *Minimally*, showing weak leadership.

The item that received the highest percentage of positive responses for this construct was question 27 about promoting and modeling technology systems to collect student assessment data. Over half the principals (56%) significantly promoted and modeled technology based systems to collect student assessment data, and a further 24% showed superior leadership for this item. The majority of principals also responded positively to question 30 with 40% showing strong leadership in evaluating the effectiveness of professional development offerings to meet the needs of teachers and their use of technology and a further 20% exhibited superior leadership for this item.

The highest and lowest percentages of responses for this construct were consistent at all levels. However middle school principals considered effective use of technology as a criterion for assessing the performance of faculty more important than elementary and middle school principals. Table 26 presents the responses for each of the items in the construct for assessment and evaluation.

Table 26

Percentage Responses for Construct 5

Survey Item	Not At All	Minimally	Somewhat	Significantly	Fully
27. To what extent did you promote or model technology-based systems to collect student assessment data?	0	0	20	56	24
28. To what extent did you promote the evaluation of instructional practices, including technology-based practices, to assess their effectiveness?	0	20	36	40	4
29. To what extent did you assess and evaluate existing technology-based administrative and operations systems for modification or upgrade? *Note. N=24 on this item*	12	24	32	20	8
30. To what extent did you evaluate the effectiveness of professional development offerings in your school to meet the needs of teachers and their use of technology?	0	8	32	40	20
31. To what extent did you include the effective use of technology as a criterion for assessing the performance of faculty?	0	12	32	40	16

Note: All respondents completed each item N=25 (*except question 29)

PTLA Construct 6 – Social, Legal, and Ethical Issues

This construct contained 7 questions. Question 38 had the highest number of negative responses suggesting that the weakest levels of leadership for this construct were principals dissemination of information about health concerns related to technology and computer usage in classrooms and offices. This was the only item in this construct that exhibited leadership deficiency; 12% of principals indicated that they did not attend to this aspect of technology leadership at all. Another area of weak leadership was question 34 about principal involvement enforcing policies related to copyright and intellectual property. Forty percent of respondents indicated moderate or indifferent levels of leadership for this item, and a further 20% indicated that they enforced these policies minimally.

The item that received the highest percentage of positive responses for this construct was question 32 about ensuring equity and access to technology. Nearly half the principals (48%) expressed superior leadership by responding to this item with the *Fully* option and a further 36% indicated that they addressed this issue significantly. Question 36 generated almost equal responses of superior leadership with 40% of principals fully supporting the use of technology to meet the needs of special education students, and a further 44% indicating that they significantly supported this issue.

The strongest areas of leadership were consistent at all three levels. However, middle school showed higher percentage of positive responses and stronger leadership supporting the use of technology for students with special needs over general equity and access to technology. The most negative responses were also consistent for all levels, except for high school principals who showed a higher number of negative responses, and weaker leadership in the area of implementing policies or programs meant to raise awareness of technology related social, ethical, and legal issues. Table 27 presents the responses for each of the items in the construct for social, legal, and ethical issues.

Table 27

Percentage Responses for Construct 6 - Social, Legal, and Ethical Issues

Survey Item	Not At All	Minimally	Somewhat	Significantly	Fully
32. To what extent did you work to ensure equity of technology access and use in your school?	0	0	12	36	48
33. To what extent did you implement policies or programs meant to raise awareness of technology-related social, ethical, and legal issues for staff and students?	0	12	44	24	16
34. To what extent were you in involved in enforcing policies related to copyright and intellectual property?	0	20	40	16	20
35. To what extent were you involved in addressing issues related to privacy and online safety?	0	0	44	28	24
36. To what extent did you support the use of technology to help meet the needs of special education students?	0	0	12	44	40
37. To what extent did you support the use of technology to assist in the delivery of individualized education programs for all students?	0	4	24	36	32
38. To what extent did you disseminate information about health concerns related to technology and computer usage in classrooms and offices?	12	48	12	20	4

Note: N= 24 on all items in this construct

Descriptive Statistical Analyses of PTLA Construct Scales.

The items in each of the 6 constructs were used to create a scale score that would enable further statistical analyses. Scales were created for each of the constructs that made up the independent variable, principal technology leadership. The number of items, the possible range, the actual range, the mean, and standard deviations for each construct scale are shown in Table 28. High scale scores (20-35) indicated strong leadership, and low scale scores (0-15) indicated weak leadership, and scale scores of between 16 and 19 indicated moderate or apathetic leadership.

Table 28

Means, Standard Deviations, and Ranges for each of the PTLA Scales

	No. of Items	Possible Range	Actual Range	Mean	Standard Deviation
Leadership & Vision	6	6-30	11-27	21.44	3.798
Learning & Teaching	6	6-30	16-30	24.16	3.375
Productivity & Professional Practice	5	5-25	15-25	20.64	2.660
Support, Management & Operations	6	6-30	15-26	21.16	3.132
Assessment & Evaluation	5	5-25	12-24	17.40	2.843
Social, Legal, & Ethical Issues	7	7-35	0-35	24.80	6.934

Overall, the mean scores for each of the construct scales reinforced the percentage responses discussed in the item analysis. However, the highest mean (24.80) and greatest standard deviation (6.934) and the most questions out of all 6 constructs was in construct

6 regarding social, legal, and ethical issues, 24 of the 25 respondents answered the questions in this section. Another construct exhibiting strong leadership was the learning and teaching construct with the second highest mean of 24.16. All respondents answered the 6 questions in this section (N=25), except for question 12, where 24 responses were made. Five out of the six construct scale score means fell inside the parameters established for high scales scores (20-35) indicating a strong general level of technology leadership. The exception was the assessment and evaluation construct, which had the lowest number of questions out of all 6 constructs.

Descriptive Statistical Analysis of STO Survey Items

The six constructs in the STO survey were analyzed to identify and investigate possible technology outcome trends for each of the constructs. Two response scales were used in the STO Survey. The choice of responses for faculty in section one of the STO survey were*: Strongly Disagree, Disagree, Agree*, and *Strongly Agree*. Faculty that answered questions with the negative options *Strongly Disagree,* and *Disagree* indicated low agreement with the items containing statements in the construct. Faculty that answered responses with the positive options *Agree,* and *Strongly Agree* indicated agreement with the items containing statements in the construct. The choices of responses for faculty in section 2 of the STO survey were; *Never, Occasionally, Frequently,* and *Almost Always*. Faculty that answered questions with the negative options *Never,* and *Occasionally* indicated low levels of technology use for the construct. Faculty that responded with the positive options *Frequently,* and *Almost Always* indicated high levels of technology use for the construct.

Descriptive statistics were used to identify the technology outcomes at different levels of the school. An item analysis identified two questions in each construct with the overall highest and lowest percentage responses. The similarities and differences between the percentage responses for elementary, middle and high school were reported for each construct. This section is followed by a description of the scale score results for each construct. The means, standard deviations and ranges for each of the school technology outcomes constructs were reported and analyzed for trends.

STO Construct 1 – Student Technology Outcomes

This construct contained 15 items which asked faculty to state how often their students used various types of software and hardware for completing assignments. Between 9% and 12% of respondents did not answer some or all of the questions in this construct. The design and engineering software, such as AutoCAD described in question 49, proved to be the least frequently used piece of technology included in this construct, with over 80% of faculty stating that their students never used it, and only 6% used it occasionally. The animation software, such as Macromedia Flash and Poser described in question 48, was used occasionally by 15% of the respondents' students but nearly 70% stated that they never used it. The classroom computers in question 57 received the most frequent use by students. Sixty four percent of faculty stated that their students used their classroom computers frequently, and nearly 40% of these stated that they used them almost always. It was interesting to see that 9% of the respondents indicated that their students never used their classroom computers, and 15% claimed that they used them only occasionally. School computer labs were the next most popular form of hardware used by students for completing assignments, with 26% of teachers stating that they used them frequently, and 33% stating that they used them occasionally. Wireless laptops were clearly much less frequently used compared to desktops, 40% of faculty stated that their students never used them, 28% stating that they used them occasionally, 11% frequently and nearly 8% stating that they used them almost always. The hardware with the lowest frequency of use were the Student Response Systems described in question 54, with over 65% of faculty stating that they never used them.

The technology item that yielded the second highest percentage of student use was the Internet search engine described in question 50. Nearly 60% of faculty stated their students used Internet search engines or online encyclopedias frequently or more often and 22% of these claimed that their students used them almost always. Only 9% of faculty respondents stated that their students never used the Internet as a resource for completing assignments. Microsoft products for word processing and presentation described question 43, were the second most frequently used software used by students for completing assignments. 26% of faculty claimed that their students used them frequently and a further 22% claimed that they used them almost always. In total, nearly 75% of respondents claimed that their students used them occasionally or more for completing assignments. Other types of software such as Excel spreadsheets in question 44, concept mapping software such as Inspiration in question 45 and image editing programs such as Paint or Adobe Photoshop proved much less popular with between 20% and 30% of students using them occasionally or more and nearly half of the students never using them at all.

Over 45% of the faculty respondents claimed their students used online textbooks for completing assignments. They were used occasionally by 33% of the students; however over 10% admitted to frequent use and 2% of students used them almost always for completing assignments. Less than 38% of the faculty respondents claimed that they never used online text books.

Design and engineering software consistently received the two lowest scores for all levels, however high schools students were reported as using student response systems or classroom clickers in question 54 the least of all of the items in this construct. High school and middle school faculty reported their students' use of Internet search engines in question 50 and Microsoft products in question 43 most frequently. Elementary school faculty reported more frequent use of classroom computers and computer labs than their secondary counterparts. Table 29 presents the percentage responses for each of the items in the student technology outcomes construct.

Table 29

Percentage Responses for STO Construct 1

Section 4.	**How often do <u>your students</u> use the following technology items for <u>completing assignments?</u>**					
Item No.	Question	% No Response	% Never	% Occasionally	% Frequently	% Almost Always
43.	Microsoft products for word processing and presentation (Word & PowerPoint)	9.7	14.2	27.7	26.3	22.1
44.	Spreadsheet software; e.g., Microsoft Excel	10.9	51.9	24.8	8.3	4.1
45.	Concept mapping software; e.g., Inspiration/Kidspiration	11.8	46.0	31.6	9.7	.9
46.	Image or video editing software; e.g., Paint, Adobe Photoshop, Macromedia Fireworks, Microsoft Moviemaker, Visual Communicator	10.6	52.8	24.5	9.4	2.7
47.	Html editing/web page or desktop publishing software; e.g., Macromedia Dreamweaver, Microsoft Front Page, Microsoft Publisher	10.6	51.6	26.0	10.3	1.5
48.	Animation software; e.g., Macromedia Flash, Poser	11.8	68.4	15.9	3.2	.6
49.	Design and engineering software; e.g., Autocad, Cadkey	11.2	81.4	6.2	.3	.9
50.	Internet search engines or online encyclopedias; e.g., Google, Yahoo Worldbook, Wikipedia	11.5	9.4	19.5	36.9	22.7

Item No.	Question	% No Response	% Never	% Occasionally	% Frequently	% Almost Always
51.	Web based skill development software; e.g., FCAT Explorer, Riverdeep	11.2	16.5	23.6	32.2	16.5
52.	Online Text books	11.5	37.8	33.9	13.9	2.9
53.	Image capture devices; e.g., digital cameras & scanners	10.9	37.8	29.2	16.8	5.3
54.	Student response systems/classroom clickers	11.5	66.4	14.2	6.5	1.5
55.	Portable wireless laptop computers	11.2	40.7	28.9	11.5	7.7
56.	School computer lab	11.5	15.0	33.9	26.8	12.7
57.	Classroom computers	10.0	9.1	15.6	25.7	39.5

N=339

STO Construct 2 – Instructional Technology Use

This construct contained 14 questions which asked faculty how often they used a variety of technology hardware and software for the planning and delivery of instruction. The range of faculty who did not respond to this question was between 6.5% and 8.5%. The technology item that showed the lowest levels of faculty frequency of use was the concept mapping software, such as Inspiration, described in question 31, with 43% of the faculty claiming that they never used it and 33% stating that they used it occasionally. The image editing software such as Microsoft Paint and Adobe Photoshop described in question 32 was equally as unpopular, never used by 44% and only occasionally used by only 26% of the respondents. Image editing software was used by approximately 3% more of the faculty for instructional purposes than concept mapping software. 16% stated that they used image editing software frequently, and just over 5.5% used it almost always.

The technology items that received the highest percentages for frequency of use by faculty for instruction were questions 20 about Microsoft word processing and presentation software, and question 34 about Internet search engines or online encyclopedias. Only 3% of the faculty stated that they did not use Microsoft word processing and presentation software for planning and delivery of instruction. Out of the remaining 97% of respondents, 7% did not answer the question, over 50% used it almost always, and the other 40% used it frequently or less, only 10% of these admitted to using it occasionally. Internet search engines and online encyclopedias were equally as popular, with less than 1% stating that they never used the Internet for planning or delivery of instruction. Proving to be slightly less popular than word processing software, the Internet received 6% less everyday use than Microsoft word processing and presentation software, with 46% of faculty respondents claiming that they used the Internet almost always. Other products in the Microsoft Office Suite, such as Excel spreadsheets were less popular, with over half of the faculty claiming that they used them occasionally or less. Fewer than 17% of respondents indicated that they used spreadsheets on a daily basis, and only marginally more expressed frequent use of spreadsheet for instructional purposes. Online text books were not nearly as popular as search engines; 35% of faculty stated that they never used them for planning or delivery of instruction and a similar percentage used them occasionally. Less than 20% expressed frequent or greater use of online text books. Web Publishing software and html editors such as Dreamweaver or Front page were only marginally more frequently used with 34% of faculty claiming that they never used them and 36% using them occasionally, just over 20% used web pages for planning and delivery of instruction frequently or more.

Video projectors and accompanying presentation devices such as audio enhancement were clearly the most popular piece of technology hardware, with over 53% of respondents claiming that they used them almost always, and a further 22% using them frequently. Fewer than 6% of faculty stated that they never used video projectors or similar devices for delivery of instruction. Image capture devices such as digital cameras were used frequently or more by nearly half of the respondents, and a further 30% claimed that they used them occasionally; only 10% never used them. A similar number of faculty used file copying and transportation devices such as flash drives or CD burners, although a nearly twice the amount of respondents, 20% stated that they never used them. DVD players were used frequently or more by 44% of the faculty, and occasionally by 42%; less than 6% claimed that they never used DVD players for the planning or delivery of instruction. Wireless laptop computers were the least frequently used hardware item in this construct, with 44% of respondents claiming that they never used them. Approximately 25% of the respondents claimed that they used them frequently or more, and 22% only used them occasionally.

Technology tools such as databases containing student information was frequently used by 30% of respondents for planning and delivery of instruction, and a further 47% used them almost always. A similar number of faculty also claimed that they used other technology resources such web based skills development software for planning and delivery of instruction purposes and their students used them as frequently for completing assignments.

Microsoft word processing and presentation applications were consistently the most frequently used applications by all levels. Elementary schools showed greatest use of presentation devices such as video projectors and sound enhancement, and middle and high school favored Internet search engines more. Concept mapping software such as Inspiration was in the bottom 2 or 3 at all levels. Html editing software and desktop publishing software was in the bottom two least used applications at the high school level. Portable wireless laptops were the least frequently used by elementary schools. Table 30 presents the responses for each of the items for instructional technology use.

Table 30

Percentage Responses for STO Construct 2

Sect. 3	**How often do you use the following technology items for planning and delivery of instruction?**					
Item No.	Question	% No Response	% Never	% Occasionally	% Frequently	% Almost Always
29.	Microsoft products for word processing and presentation (Word & PowerPoint)	7.1	2.7	10.9	27.1	52.2
30.	Spreadsheet software; e.g., Microsoft Excel	6.5	19.5	36.0	21.8	16.2
31.	Concept mapping software; e.g., Inspiration!	6.5	43.4	33.9	13.0	3.2
32.	Image or video editing software; e.g., Paint, Adobe Photoshop, Macromedia Fireworks, Microrosft Moviemaker, Visual Communicator	8.3	44.0	26.0	16.2	5.6
33.	HTML editing/web page or desktop publishing software; e.g., Macromedia Dreamweaver, Microsoft Front Page, Microsoft Publisher	7.4	34.5	36.0	15.6	6.5
34.	Internet search engines or online encylopedias; e.g., Google, Yahoo, Worldbook. Wikipedia	7.7	0.6	9.4	36.0	46.3
35.	Web based skill development software; e.g., FCAT Explorer, Riverdeep	6.8	16.2	27.1	29.8	20.1

Sect. 3	**How often do you use the following technology items for planning and delivery of instruction?**					
36.	Online Text books	7.4	35.4	36.3	17.1	3.8
37.	Databases for student information; e.g., Datawarehouse, Esembler	7.7	1.8	13.3	29.5	47.8
38.	Image capture devices; e.g., digital camera, scanner	8.3	11.5	31.6	26.8	21.8
39	File copying and transportation devices; e.g., CD burner, portable flash drive	8.3	20.9	30.1	21.2	19.5
40.	Presentation devices; e.g., video projector, sound enhancement, interactive whiteboard	6.5	5.6	12.1	22.4	53.4
41.	Portable wireless laptop computer or tablet	6.5	44.2	22.7	17.1	9.4
42.	DVD player	7.1	5.9	42.5	31.6	13.0

N=339

STO Construct 3 – Principal and Organizational Technology Use

This construct contained 9 questions which asked faculty how much they agreed or disagreed with statements about principal and organizational use of technology. The question that received the strongest percentage of faculty agreement was question 1 about how important technology was to the principal, with over 90% of the faculty agreeing with the statement that technology was important to the principal. A similar number of respondents agreed with the statement that technology had helped their organization communicate more effectively. The question that received the highest percentage of disagreement for this construct was question 3, with 33% of the faculty disagreeing that the principal had discussed the technology plan with faculty. However, over 60% of the faculty agreed with this statement. Question 4 had the second highest percentage of faculty who disagreed with a statement about technology goals. 68% of the faculty did agree that technology goals were readily available, but this question still had 25% of faculty disagreeing about their availability. Overall, the agreement with the statements about principal and organizational use of technology was high, 90% of the respondents agreed that the principal supported training for new technology, and 44% of these strongly agreed. A similar number (87%) agreed that the principal supported funding for new technology. A large amount of faculty, over 84%, agreed that their organization was technology proficient, and only a fraction less (82%) also agreed that their principal was proficient at using technology. Close to 80% of the respondents agreed that technology helped their school achieve adequate yearly progress (AYP), this question also received the highest percentage of non-responses, nearly 7% of respondents did not answer this question.

The importance of technology to the principal, and the role of technology in organizational communication were consistently the highest scores in elementary and secondary education. Principal support for new technology training was the third highest score consistently across all grade levels. The technology plan and goals received the lowest scores for all levels. The number of respondents that gave no response to the questions in this construct ranged from 2.1% to 6.8%, one of the constructs with the lowest number of non-respondents. Question 8 may have received such a high non response rate because it asked teachers if technology has helped the school achieve Adequate Yearly Progress, and they may have felt that they were not equipped with sufficient information to answer the question, and that administrators may have the access to information to answer a question of this nature. Table 31 presents the responses for each of the items for this construct.

Table 31

Percentage Responses for STO Construct 3

Section 1.	**Do you agree or disagree with the following statements?**					
Item No.	Question	% No Response	% Strongly Agree	% Agree	% Disagree	% Strongly Disagree
1.	Technology is important to the principal	2.1	53.4	39.8	3.2	1.5
2.	The principal is proficient at using technology	3.8	26.3	56.6	11.5	1.8
3.	The principal has discussed the school technology plan with the faculty	3.5	20.9	41.9	29.5	4.1
4.	The school's technology goals are readily available to the faculty	4.7	23.6	45.1	23.9	2.7
5.	The principal supports funding for new technology	4.7	36.0	51.9	6.2	1.2
6.	The principal supports training for new technology	3.5	44.0	46.9	4.7	.9
8.	Technology helps our school achieve AYP (Adequate Yearly Progress)	6.8	34.2	45.4	12.4	1.2
9.	Technology has helped our organization communicate more effectively	3.8	52.5	35.7	7.1	.9
10.	Our educational organization is proficient at using technology	3.2	25.4	59.3	10.6	1.5

N=339

STO Construct 4 – Administrative and Management Technology Use

This construct contained 6 questions from 2 different sections. One question from the first section asked faculty whether they agreed with the statement that their school relies heavily on technology. Five items from section 2 asked faculty how often they used a variety of technology software tools for administration and management tasks.Websites for posting information described in question 27 received the lowest frequency of faculty use for administrative purposes. Nearly 35% of the faculty claimed that they had never used websites to post information to students and parents and of the remaining 65%, less than 40% used them frequently or daily. Online courses for professional development described in question 25 were also infrequently used for administrative and management purposes, with over half of the respondents claiming that they used them occasionally and over 30% of these stating that they never used them. Less than 35% of the faculty indicated that they used online courses for professional development frequently or more.

The technology tool that received the highest frequency of use by faculty for administrative or management purposes was email, where less than 0.5% admitted to never using it and over 80% used it on a daily basis. Databases for student information were used almost always by 45% of the faculty, and frequently by a further 34%. Only 1% of respondents claimed that they never used databases and 14% occasionally used them for administrative and management purposes. Shared network directory access to files were also used by over 90% of the faculty, with only 6% indicating that they never used them and over 55% stating that they used network directories frequently and 23% of these used them daily. The responses to question 7 revealed that over 90% of the faculty did not agree that their school relied heavily on technology and 54% of these strongly disagreed.

Faculty perception of the school's reliance on technology received the lowest levels of agreement for both elementary and secondary schools, and use of email received the highest frequency of use. The number of respondents that chose not to answer questions in this construct ranged from 2.1% to 4.4%. Table 32 presents the responses for each of the items in administrative and management technology use.

Table 32

Percentage Responses for STO Construct 4

Section 1.	**Do you agree or disagree with the following statements?**					
Item No.	Question	% No Response	% Strongly Agree	% Agree	% Disagree	% Strongly Disagree
7.	Our school relies heavily on technology	2.1	0.9	3.8	38.9	54.3
Section 2.	**How often do you use the following technology items for administrative and management tasks?**					
Item No.	Question	% No Response	% Never	% Occasionally	% Frequently	% Almost Always
24.	Email software; e.g., Groupwise	3.8	.3	2.1	12.7	81.1
25.	Online courses for professional development; e.g., long distance learning for ESOL and Reading endorsement	3.8	31.6	29.8	17.4	17.4
26.	Databases for student information; e.g., Data warehouse, Terms/Rhumba	3.8	1.2	14.5	34.8	45.7
27.	Websites for posting information for students and parents: e.g. Schoolnotes.com	4.1	34.2	25.7	18.0	18.0
28.	Shared network directory to access shared files	4.4	6.2	32.7	32.7	23.9

N=339

STO Construct 5 – Technology Proficiency, Progress, and Standards

This construct contained 5 items that asked respondents if they agreed with a selection of statements about technology proficiency, standards, and progress. The item that had the highest percentage of agreement from faculty was about student use of technology for completing assignments. Nearly 80% of respondents agreed that their students used technology to completed assignments, and only 16% disagreed with the statement. A similar number of the faculty also agreed with the statement in question 17 about their students being proficient at using technology for completing assignments. The question that received the highest percentage of disagreement from faculty for this construct was question 22 about familiarity with technology standards for students. Approximately 36% of the respondents did not agree that they were familiar with student technology standards, and slightly fewer faculty respondents also disagreed that they were familiar with the technology standards for teachers included in the statement in question 14. 63% of faculty agreed that they monitored student progress in technology use, with only 30% disagreeing with the statement in question 23, and less than 3% strongly disagreeing.

Elementary and middle school responses for this construct were identical and consistent with overall results. Only high school faculty differed, with the highest percentage of disagreement for question 23 about monitoring student progress in technology use. The percentage of respondents that chose not to answer the questions in this construct ranged from 3.5% to 5% . Table 33 presents the responses for each of the items in Technology Proficiency, Progress, Goals, and Standards.

Table 33

Percentage Responses for STO Construct 5

Section 1.	Do you agree or disagree with the following statements?					
Item No.	Question	% No Response	% Strongly Agree	% Agree	% Disagree	% Strongly Disagree
14.	I am familiar with the district technology standards for teachers	3.8	18.6	46.6	29.2	1.8
16.	My students use technology for completing assignments	3.5	31.6	48.7	14.5	1.8
17.	My students are proficient at using technology for completing assignments	4.4	26.5	52.5	15.6	.9
22.	I am familiar with the district technology standards for students	5.0	16.2	42.8	34.2	1.8
23.	I monitor student progress in technology use	4.4	20.9	43.7	28	2.9

N=339

STO Construct 6 – Technology Needs

This construct asked faculty if they agreed or disagreed with 8 statements about technology use and needs. The item that received the highest percentage of agreement from faculty was question 11, where over 90% agreed that they used technology to plan for instruction, and 55% of these strongly agreed. A similar number of faculty also agreed with the statement in question 12 about using technology to interpret and analyze student data, and nearly 50% strongly agreed. The item that received the highest percentage of disagreement from faculty was question 19 about classroom computers being insufficient for student needs. Nearly half of the faculty disagreed with the statement and the other half agreed; only 3.5% of respondents chose not to answer this question. Question 15 received the second highest percentage of disagreement about having more technology tools to deliver instruction, but only 24% disagreed, the rest of the faculty agreed that they would like more technology tools, and 26% strongly agreed. The majority of respondents (89%) agreed that they used technology to achieve curricular goals, and a similar number of respondents agreed that they would like to learn more about technology or have more technology available for their students to use.

The two questions with strongest and weakest scores in this construct were the same at all levels, the two areas with the strongest needs for middle school technology involved using technology to analyze and plan for instruction respectively. The percentage of respondents that chose not to answer the questions in this construct ranged from 2.9% – 3.8%. Table 34 presents the responses for each of the items in technology needs.

Table 34

Percentage Responses for STO Construct 6

Section 1.	Do you agree or disagree with the following statements?					
Item No.	Question	% No Response	% Strongly Agree	% Agree	% Disagree	% Strongly Disagree
11.	I use technology to plan for instruction	2.9	55.8	35.7	4.1	1.5
12.	I use technology to interpret and analyze student assessment data	3.8	49.3	40.1	6.5	6.5
13.	I would like to learn more about teaching with technology	3.8	38.6	49.9	6.2	1.5
15.	I would like to have more technology tools to deliver instruction	3.2	26	45.7	22.7	2.4
18.	I would like to have more technology available for my students to use.	3.2	36.3	43.4	15.6	1.5
19.	My classroom computers are insufficient for my students' needs	3.5	19.8	27.7	39.2	9.7
20.	The School computer labs are readily available for students to complete assignments	3.8	15.3	45.4	27.4	8.0
21.	I use technology to achieve curricular goals	3.8	35.1	54.3	6.5	0.3

N=339

Descriptive Statistical Analysis of STO Construct Scales.

The items in each of the six constructs were used to create a scale score that would enable further statistical analysis. Scales were created for each of the constructs that made up the dependent variable, school technology outcomes. The number of items, the possible range, the actual range, the mean, and the standard deviations for each construct scale are shown in Table 35. High scale scores (36-56) indicated strong agreement with technology statements and high frequency of technology use. Low scale scores (0-15) showed little agreement with technology statements and low frequency of technology use. Mid-range scale scores (16-35) indicated moderate agreement with technology statements and moderate frequency of technology use.

Table 35

Means, Standard Deviations, and Ranges for Each of the STO Scales

STO Construct	No. of items	Possible Range of scale scores	Actual Range of scale scores	Mean	Standard Deviation
Construct 1 – Student Technology Outcomes	15	15-60	0-56	25.90	10.85
Construct 2 – Instructional Technology Use	14	14-56	0-54	32.73	10.91
Construct 3 – Principal and Organizational Technology Use	9	9-36	0-36	27.67	6.26
Construct 4 – Administrative and Management Technology Use	6	6-24	0-24	17.17	4.22
Construct 5 – Technology progress, goals and Standards	5	5-20	0-20	14.10	3.64
Construct 6 – Technology Needs	8	8-32	0-32	24.13	4.73

N=339

Overall, the mean scores for each of the construct scales reinforced the percentage responses discussed in the item analysis. Construct 1 had the highest number of questions, nearly double that of construct 6, but the mean for construct 2, instructional technology use, with 14 questions was the highest (32.73) showing a greater frequency of technology use and agreement with technology statements. The number of non-responses for each item also affected the scale scores, all of which ranged from zero, indicating that every item was left blank by one or more respondents to the survey.

Research Question 1

What is the technology behavior of principals in terms of NETS-A standards?

The 6 technology standards identified in the NETS-A standards (ISTE, 2002) provided the framework for each of the constructs in the principal technology leadership activity survey administered to 25 Collier County principals. Their responses to each of the items in this survey formed the data that was analyzed and interpreted to answer this research question.

NETS-A Standard 1 – Leadership and Vision

Leadership and vision is the first of the 6 NETS-A standards. The scale scores for the PTLA construct that addressed this leadership standard ranged from 11 to 27, and the mean was high (21.44), showing superior overall leadership for this construct. Over 60% of the principals stated that they had at least significantly compared and aligned their school technology plan with district-wide strategic plans and nearly half of these expressed complete alignment with the district. A similar number of principals expressed that they had significantly communicated to school stakeholders regarding technology planning and implementation. The vertical and horizontal articulation of technology planning and implementation is one of the leadership strengths despite the fact that 12% of the principals indicated that they played no part at all in establishing the district or school's technology plans, and over 30% expressed moderate or indifferent leadership inclination towards participating in this process. In terms of NETS-A standards, Collier County principals clearly practice a shared vision for comprehensive integration of technology, confirming their support for the district-wide technology goals by communicating these goals to their school stakeholders. The greatest area for improvement would be advocating for research-based best practices in the use of technology. Over half of the principal respondents expressed indifferent or moderately weak leadership behavior for actively seeking out new instructional practices. This is an important component of the NETS-A leadership and vision standard which involves advocating policies that promote continuous innovation through technology use.

NETS-A Standard 2 – Learning and Teaching

The second NETS-A standard, learning and teaching states that educational leaders should ensure that curricular design, instructional strategies, and learning environments integrate appropriate technologies to maximize learning and teaching (ISTE, 2002). The range of scale scores for this construct ranged from 16 to 30, with a high mean score of 24.16. This was one of the strongest areas of technology leadership with high scores for some questions reaching the maximum possible. There is substantial evidence that the principal respondents considered support for teachers utilizing student assessment data to modify instruction an absolute priority. Over 90% of the principals provided a high level of support for teachers to use technology to interpret and analyze student assessment data for the purpose of modifying instruction. The level of help ranged from significant to complete assistance with 40% of principals confirming complete commitment to this instructional need. The superior leadership exhibited by principals for learning and teaching is confirmed by an overwhelming 90% stating that they considered the sharing of best practices in technology to be a significant priority. In this way Collier County principal respondents facilitate and support collaborative technology-enriched learning environments and deliver the quality professional learning opportunities for improved learning and teaching with technology outline in the NETS-A standards. Assessing the needs of staff for professional development was the weakest area in this standard where strong leadership prevailed. Over half the principals stated that they had at least significantly assessed staff development needs and then subsequently provided staff development in the use of technology to meet those needs. 28% of these principals expressed full commitment to the provision of technology professional development to their staff. More than 50% of the principals also confirmed significant or greater dissemination and modeling of best practices with faculty and staff. Although this was one of the items with lower positive results, a majority participation in this area by principals indicates active use, and promotion of technology by school leaders.

NETS-A Standard 3 – Productivity and Professional Practice

Productivity and professional practice was the third NETS-A standard measured by five items in the PTLA survey construct bearing the same name. Although this was one of the constructs with the lowest number of questions, and the smallest possible range of scale scores from 5 to 25, some items received the maximum possible scale score. The high mean score for this construct (20.64) showed that this was another area of strong and in some cases, superior technology leadership. This standard states that educational leaders apply technology to enhance their professional practice and to increase their own productivity and that of others. An impressive 84% of principals stated that they made significant use of technology for completing daily tasks, and 56% of these indicated that they used technology fully for everyday routines. Accessing student records was just one example of these types of daily tasks; nearly 90% of principal respondents indicated at least significant use of technology, and 44% of these stated that they used technology fully for this purpose. This standard required educational leaders to employ technology for communication and collaboration among colleagues. The high scale score mean of 4.16 and the positive response by 76% of principals to the question 20 in the survey that related to this part of the standard evidenced the strong levels of technology leadership in this standard. The area that showed the most indifferent or moderate levels of leadership was principal participation in professional development activates, although leadership could not be described as weak 36% of the respondents indicated that they had only participated *Somewhat* in technology related trainings, the remaining 64% had participated at least significantly but only 8% stated that they had been fully involved with technology related professional development. Sustained job-related professional learning using technology resources, and the creation and participation of learning communities that support staff and faculty in using technology is one aspect of this standard that educational leaders can continue to focus on in the future for improved productivity.

NETS-A Standard 4 – Support, Management, and Operations

The fourth NETS-A standard about support, management, and operations encourages educational leaders to ensure the integration of technology to support productive systems for learning and administration. This area produced the highest percentage of positive responses and the greatest number of negative responses from principal respondents. The overall mean scale score for the PTLA construct was 21.16 and the scale scores for the five items in the construct ranged from 15 to 25 showing strong overall leadership for this standard. Clearly, supporting faculty with connecting to, and using district and building level technology systems for management and operation was a priority for principals; one hundred percent indicated significant or greater support for this item which is also one of the criteria outlined in this NETS-A standard. The other four questions in this section received considerably less support and greater levels of moderate or indifferent leadership. The use of campus discretionary funds to support technology needs and advocating for timely, quality support services were the only two questions that received a majority of positive responses from principals confirming that leaders in this population do follow the NETS-A guidelines that suggest educational leaders allocate financial and human resources to ensure complete and sustained implementation of the technology plan. The weakest area of leadership in the entire survey was related to the pursuit of supplemental funding to help meet technology needs. This may be an area for future growth as district technology plans develop more ways to generate resources to support new technology. The importance of the satisfaction of the faculty with technology support services generated the most indifferent or moderate leadership responses in the entire survey. It was also interesting to note that software and hardware replacement was not provided for in the technology plans by nearly one quarter of the principal respondents, which suggests that technology replacement cycles are another component of this NETS-A standard will contribute to a stronger technology leadership in the future.

NETS-A Standard 5 – Assessment and Evaluation

Planning and implementing comprehensive systems of effective assessment and evaluation is the fifth NETS-A standard. Educational leaders are urged to use multiple methods to assess and evaluate appropriate uses of technology resources for learning, communication, and productivity. The mean scale score for 5 items in the PTLA survey that measured this standard was 17.40, the lowest mean out of all the standards. With only 5 questions, the range of scores fell between 12 and 24. Overall the leadership in this area was moderate, but the weakest of all the standards measured in the PTLA constructs. Collier County leaders showed strong leadership for promoting and modeling technology based systems, and evaluating the effectiveness of professional development and the extent to which they suit the needs and ability of their faculty. One aspect of this standard which the principal respondents expressed their indifference was assessing and evaluating existing technology-based administrative operations and systems. More leadership is also needed to promote the importance of evaluating technology-based instructional practices to assess their effectiveness.

NETS-A Standard 6 – Social, Legal, and Ethical Issues

The sixth NETS-A standard about social, legal, and ethical issues had the most items in the PTLA construct of the same name. The seven questions yielded the highest mean score of all the constructs, with a range from 0 to 35. The mean of 24.8 indicated that leadership in this area was also strong for the principals that participated in this survey. This NETS-A standard requires educational leaders to understand and model responsible decision making related to these issues. Superior leadership by respondents was evidenced in the area of equity of access to technology and support for students with special needs. However, the health and safety aspects of technology were clearly an area of leadership deficiency, coupled with indifferent or moderate levels of leadership regarding the enforcement of policies related to intellectual property and copyright laws. Nearly half of the principals (44%) expressed indifferent or moderate leadership in their involvement with addressing issues relating to privacy and online safety and a similar number were also somewhat indifferent to their leadership role in raising awareness of technology related social, ethical, and legal issues for staff and students.

Research Question 2

How is technology used in schools for organizational, instructional, and educational purposes?

The data related to this question were obtained from teachers' responses to questions in the STO survey. The frequency of responses for each of the choices were analyzed in the percentage item analyses in this chapter, this provides a summary and overview of the results described earlier for each construct in the STO Survey.

School Technology Outcomes at the Organizational Level

Organizational technology use was measured by the STO survey items contained in constructs 3 and 4 with questions that asked faculty how often they used various types of hardware and software for administrative and management tasks, and their level of agreement with a selection of statements about their organization's use of technology. STO construct 4 (administrative and management technology use) revealed that over 80% of faculty respondents felt that their organization was proficient at using technology but the majority of faculty did not agree that their organization relied heavily on technology. However, the use of technology for organizational purposes was evidenced by the abundant use of software and hardware for administrative and management tasks. Nearly 90% of the faculty agreed that technology has helped their organization communicate more effectively. Email was the most popular application out of all the software listed, with over 99% stating that they used it for administrative and management purposes. Databases also received frequent use for administrative and management purposes along with shared network directories. The Internet proved to be a less frequently used tool for organizational purposes. Web sites were for posting information were used by two thirds of the faculty respondents, and a similar number used online courses for professional development more than occasionally. The most popular web-based tool used by faculty for administrative or management purposes was skills development software such as FCAT explorer or Riverdeep. STO construct 3 (principals and organizational technology use) showed that a large majority of faculty agreed that technology helped their school achieve adequate yearly progress and that technology helped their organization communicate more effectively. A similar amount of faculty felt that their organization was proficient at using technology, only a small percentage, around one tenth of the faculty did not agree that their organization was proficient at using technology.

School Technology Outcomes at the Instructional Level

The STO survey constructs that measured the use of technology for instructional purposes contained questions that asked faculty how often they used various types of technology software and hardware for planning and delivery of instruction, and their level of agreement with statements regarding their knowledge of technology standards for teachers and students, monitoring student progress in technology, using technology to interpret and analyze student assessment data, and achieving curricular goals with technology. STO construct 2 (instructional technology use) contained the questions about faculty use of hardware and software for planning and delivery of instruction. Microsoft word processing and presentation software and Internet browsers and search engines proved to be the most frequently used by nearly all the faculty respondents, with nearly half stating that they used either or both every day. Other types of software included in the survey such as concept mapping software, image and web page editors were much less frequently used and never used by over one third of the faculty. This was the case for both elementary and secondary school faculty. Spreadsheets were more frequently used out of all the remaining software programs listed, with over half of the respondents indicating that they used them occasionally or more. Over half the faculty stated that they used online text books occasionally or more for planning and delivery of instruction. The STO administrative and management construct 4 revealed that over three quarters of the faculty claimed that they used web-based skills development software for planning and delivery of instruction, and nearly half indicated that they used it frequently or daily. This construct also showed that most teachers frequently used databases containing student data for planning and delivery of instruction and nearly half used them every day. Only 2% of the faculty stated that they never used databases for instructional purposes.

The most popular pieces of hardware used by faculty for planning and delivery of instruction were presentation devices such as video projectors, sound enhancement, and interactive whiteboards, with over half of the faculty stating that they used them on a daily bases and around one third using them occasionally or frequently. Only 5% of the faculty indicated that they never used presentation devices for the delivery of instruction. Digital cameras, scanners, flash drives, and CD burners were used frequently more by over half of the faculty, and over a third also used DVD players frequently. Portable wireless laptops were used occasionally or more by over half of the faculty for planning and delivery of instruction.

Nearly two thirds of the faculty indicated that they were familiar with technology standards for teachers and an overwhelming majority stated that they used technology to plan for instruction, achieve curricular goals, as well as interpret and analyze student assessment data. A similar number of faculty respondents agreed that they would like to learn more about teaching with technology and have more technology tools to deliver instruction.

School Technology Outcomes at the Educational Level

The STO survey constructs that measured the use of technology for educational purposes contained questions that asked faculty to respond to questions about their students' use of technology for completing assignments as well as their students' proficiency and technology needs. STO construct 1, student technology outcomes showed that the Internet browsers and Microsoft word processing and presentation software were by far the most popular pieces of software used by both elementary and secondary school students for completing assignments. This finding confirms other research about software used in schools described in the review of the literature, the software that requires higher order thinking skills, such as mind mapping software, spreadsheets, image editing and design software received much less frequent use by up to one third of the students. Nearly half of the respondents indicated that their students never used these types of software for completing assignments and despite frequent use of the Internet for research purposes, html editing software and web design software was also never used by over half of the students, and only occasionally used by a quarter of the students for completing assignments. Web design software was used more by faculty for planning and delivery of instruction than by their students for completing assignments. Echoing the popular use of the Internet, student use of online text books was surprisingly high, with up to half of the students using them occasionally or more to complete assignments, mirroring the frequency of use by their teachers for planning and delivery of instruction. Three quarters of the faculty claimed that their students used web-based skills development software for completing assignments, and over half indicated that they used it frequently or daily. Student use of software such as FCAT Explorer, or Riverdeep was even greater than their teachers, who also used it regularly for planning and delivery of instruction.

The most popular hardware used by students was classroom computers, with 40% of respondents stating that they were almost always used by their students to complete assignments. A disappointing 9% of respondents stated that their students never used their classroom computers, and it was interesting to note that elementary students used classroom computers more than their secondary counterparts. Wireless laptops did not receive much regular student use according to the respondents to this survey. Although over 40% of students used them occasionally or more to complete assignments, an equal amount stated that they never used laptops, and they were only frequently used by only 11% of students. School computer labs proved to be more popular, used occasionally or frequently for completing assignments by one third and one quarter of the students respectively, only 15% of the respondents claimed that their students never used the computer labs for completing assignments. Image capture devices such as cameras and scanners were used occasionally or more by half of the students for completing assignments. However, image editing software was only used occasionally or more by a quarter of the students, showing that students used raw digital images in their work, but did not manipulate these images for any special purpose or effect.

The technology proficiency, progress, and standards for students measured in STO construct 5 showed that nearly 80% of teachers agreed that their students used technology to complete assignments. Three quarters of the faculty agreed that their students were proficient as using technology. Approximately two thirds of the faculty monitored student progress in technology and were familiar with technology standards for students.

The technology needs measured in STO construct 6 revealed that the majority of the faculty wanted more technology for their students to use and nearly half of the faculty felt that their classroom computers were insufficient for their students needs.

Research Question 3

What is the relationship between the technology leadership behavior of principals and the use of technology for organizational, instructional and educational purposes in schools?

Null Hypothesis: There is no relationship between the technology leadership behavior of principals and the use of technology for organizational, instructional and educational purposes in schools.

A simple linear regression analysis was conducted to examine the relationship between the technology leadership behavior of principals and the school technology outcomes. The null hypothesis was that the regression coefficient was equal to zero.

Initial review of Cook's distance, the scatterplot shown in Figure 1, and casewide diagnostics suggested that there was one potentially influential case, number 13, which was not removed for the purpose of this analysis.

Table 36

Survey Data by School

School ID	STO N	STO Score	STO Mean	STO Standard Deviation	PTLA Score
1	18	2458	126.56	41.78	126
2	5	752	150.40	22.58	160
5	10	1526	152.60	21.37	152
6	12	1568	130.67	38.31	125
8	13	1667	128.23	48.94	105
16	7	1026	146.86	15.98	124
17	11	1580	143.64	33.22	139
18	14	2181	155.79	14.73	151
19	10	1566	156.60	18.23	110
20	20	3085	154.25	19.50	135
22	9	1330	147.78	26.11	143
24	11	1595	145.00	34.70	112
25	10	1055	105.50	50.64	114
26	13	2030	156.15	14.85	108
31	16	2284	142.75	21.46	136
33	13	1783	137.15	27.51	146
34	15	1993	132.87	27.06	142
35	2	287	143.50	20.51	133
39	12	1754	146.17	28.09	118
40	30	4076	135.87	40.99	131
41	13	1831	140.85	24.54	116
45	25	3706	148.24	28.61	158
47	16	2273	142.06	27.74	113
48	7	866	123.71	59.13	129
49	27	3762	139.33	23.13	115

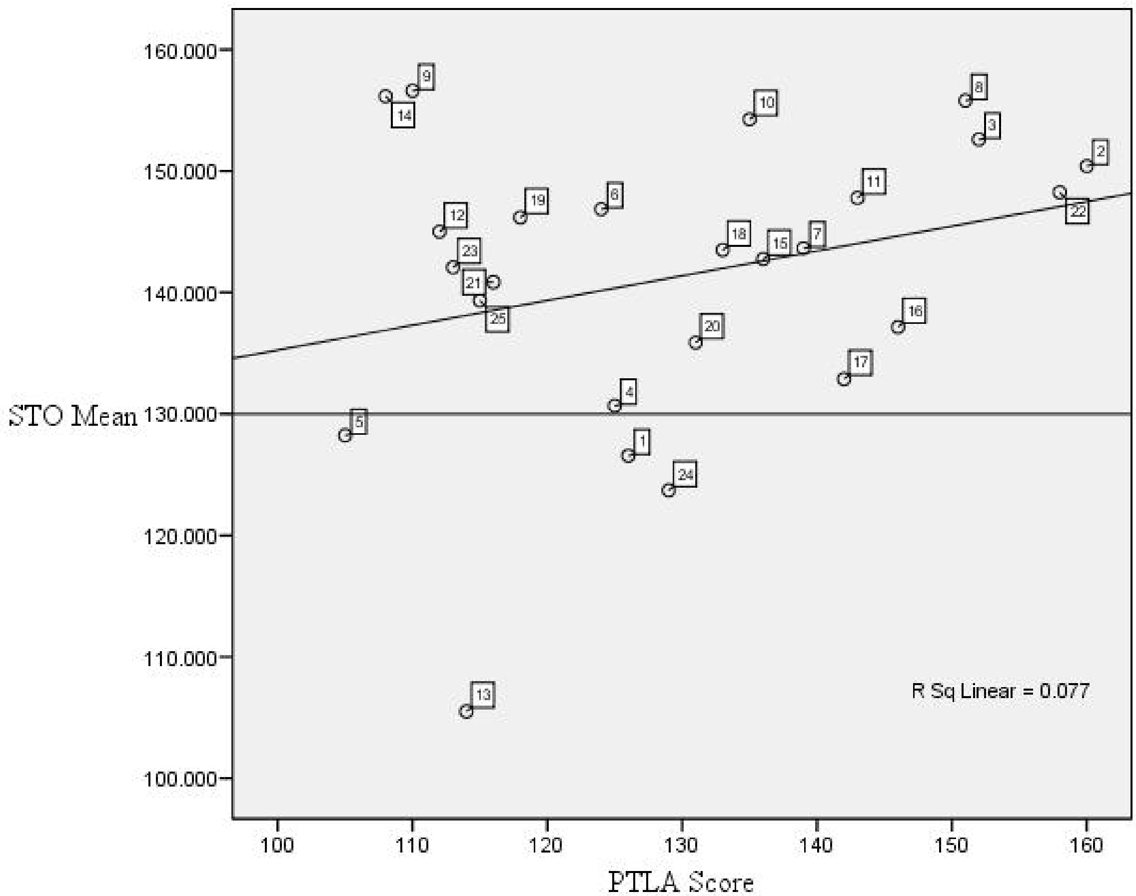

Figure 1

Scatterplot to Investigate Linearity

Simple linear regression assumptions for linearity, normality, independence, and homogeneity of variance were tested and met. To test for linearity, a scatterplot for the two variables shown in Figure 1 indicated that the variables were linearly related. As the PTLA score increased, the STO mean score increased. A scatterplot of unstandardized residuals to predicted values shown in Figure 2 also indicated that the assumptions of linearity were met.

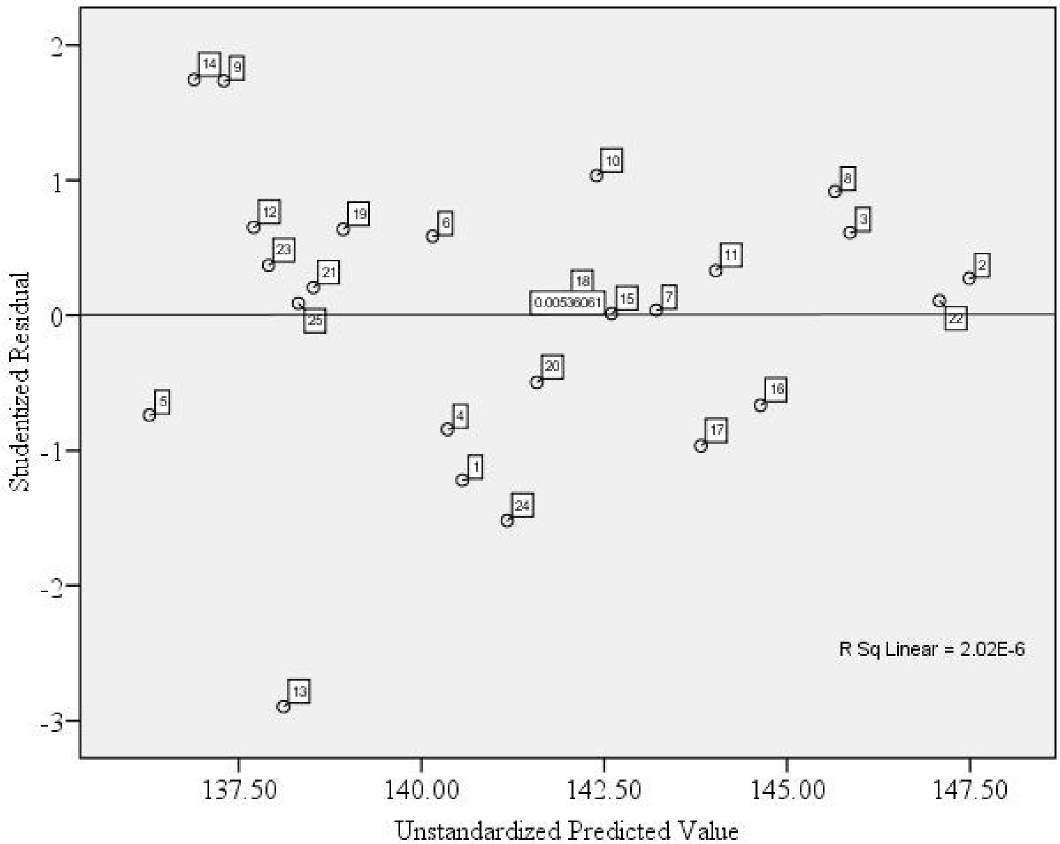

Figure 2

Scatterplot of Studentized Residuals to Predicted Values

The studentized residuals were plotted with the predicted values to show homogeneity of variance. The unstandardized residuals were reviewed for normality. The histogram and Q-Q plots indicated the distribution was what would be expected from a normal distribution.

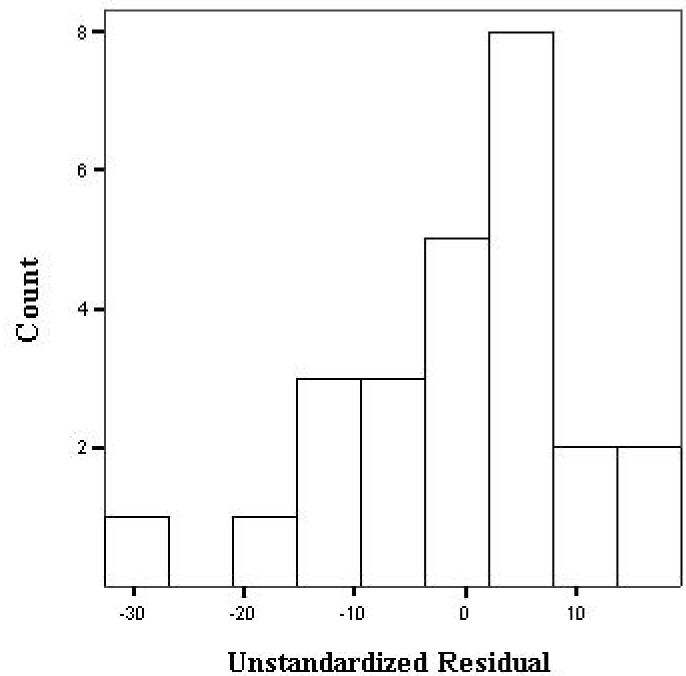

Figure 3

Histogram of Unstandardized Residuals to Show Normality

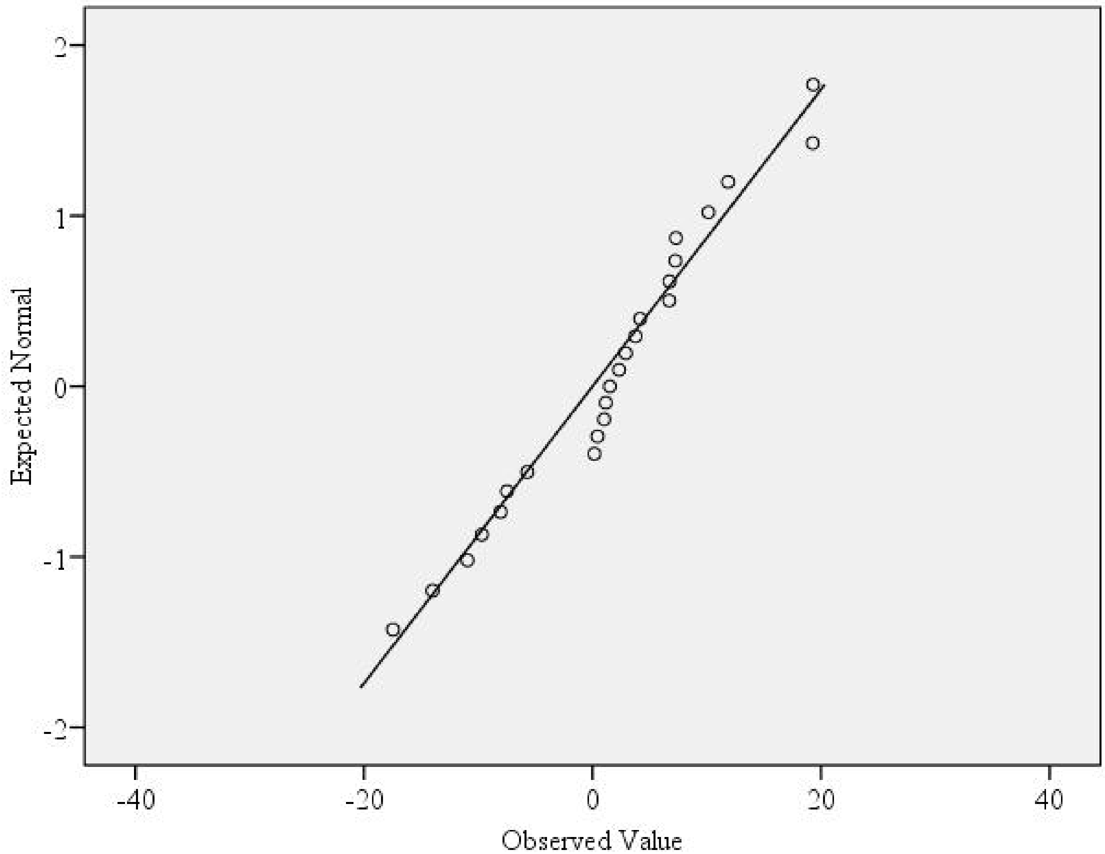

Figure 4

Q-Q plot of Unstandardized Residuals to Show Normality

In addition, skewness (-.823) and kurtosis (1.54) indicated normality, as did non significant Shapiro Wilks tests (W =.95, df = 24, p =.19). The scatterplot of studentized residuals to case number shown in Figure 2 indicated the assumption of independence was met as did a scatterplot of studentized residuals to unstandardized predicted *Y*. The scatterplot of studentized residuals to unstandardized predicted values showed random plotting of the data points around zero and ± 2 showed that the variance was constant suggesting that homogeneity of variance was a reasonable assumption.

Technology leadership behavior measured in the PTLA score of principals was not found to be a good predictor school technology outcomes, F(1, 24) = 1.916, p =0.18. Results of the ANOVA are shown in Table 36.

Table 37

ANOVA Results

	Sum of Squares	df	Mean Square	F	Sig.
Regression	263.645	1	263.645	1.916	.18(a)
Residual	3164.593	23	137.591		
Total	3428.238	24			

a Predictors: (Constant), PTLA Total Score
b Dependent Variable: Mean

As p was greater than .05 the relationship was not found to be significant at the 95% level of confidence. The parameter estimates are shown in Table 37.

Table 38

Parameter Estimates

	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B	
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
Constant	114.88	19.23		5.97	.000	75.10	154.66
PTLA Score	.20	.147	.277	1.38	.18	-.101	.51

a Dependent Variable: STO Mean

The regression equation for predicting the relationship between technology leadership behavior and school technology outcomes is :

School Technology Outcomes = 114.88 +.20 (PTLA score).

The model predicted that one unit in change of PTLA score would increase the school technology outcomes by .20. The accuracy of prediction was weak with a correlation between PTLA score and STO Score of .277. Just under 8% (R^2 = .077) of the variation in school technology outcomes was accounted for by it's linear relationship with principal leadership technology behavior. Table 38 shows the regression model summary.

Table 39

Regression Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.277(a)	.077	.037	11.729919

a Predictors: (Constant), PTLA Total Score
b Dependent Variable: Mean

In conclusion, the results of this research study were insufficient to reject the null hypothesis and it remains that there is no evidence to suggest that any statistical relationship exists between leadership technology behavior and school technology outcomes at any level, organizational, instructional or educational.

Summary

Two survey instruments were used for this study. The STO survey measured the dependent variable (school technology outcomes) at three levels: organizational, instructional, and educational. The PTLA survey measured the independent variable, leadership technology behavior. The survey questions were grouped into six constructs for each survey. These constructs were used to describe the leadership technology behavior reported by principal respondents to the PTLA survey and the technology outcomes reported by faculty respondents to the STO survey.

This study was guided by three research questions. The first two questions prompted a description of technology leadership behavior of Collier County principals and a description of school technology outcomes by their faculty respectively. Collier County principals exhibited an extremely high standard of technology leadership in all six constructs showing with exceptional strengths in terms of NETS-A standards in the areas of learning and teaching, and social, legal and ethical issues. Collier County faculty showed how they used a variety of software and hardware available to achieve curricular goals, interpret and analyze student data, plan and deliver instruction, and perform management and administrative tasks. Faculty perception of their student's technology proficiency was strong, indicating that they used an array of software and hardware to complete assignments on a regular basis. The faculty perceived their organization as technologically proficient, agreeing that technology has significantly improved organizational communication and assisted with their school wide goal of achieving adequate yearly progress as specified by the state requirements.

A third question sought to discover if there was a statistical relationship between the technology leadership behavior data reported by principals and the school technology outcomes data reported by faculty. The null hypothesis could not be rejected because analyses of variance was unable to yield a statistical significance between the leadership technology behavior of principals reported in the PTLA constructs and the school technology outcomes reported by faculty in the STO constructs.

Chapter five will present a discussion of the study's findings and implications for research based upon the descriptive and statistical analyses from this chapter.

CHAPTER 5 DISCUSSION AND RECOMMENDATIONS

This chapter begins with a summary of the first four chapters, followed by an overview of the structure of the research study. A summary of the descriptive statistical findings is then accompanied by a summary and discussion of the research questions. The implications for principals and educators are identified. Study limitations and recommendations for future research are presented followed by a final conclusion.

Summary of Chapters

Chapter 1 provided a statement of the problem: Does the leadership behavior and the technology activity of the principal affect the use of technology in schools? In this chapter, the research questions, null hypothesis, and the overall purpose of the study were described followed by an analysis of the results. The terms used to describe the kinds of technology used in this research study were identified. The population, sample, survey instruments, significance, limitations, and delimitations were described along with an overview of the study design.

Chapter 2 reviewed the research literature related to the purpose and research variables included in the study. The role of technology in educational reform was discussed followed by an analysis of the literature related to the influence of the principal on technology use in schools. This chapter also presented an overview of the literature concerning the use of technology in schools for organizational and educational purposes, pedagogical practice, and student learning. Measurement instruments and assessment tools used in research studies for identifying and documenting leadership behaviors and the technology activities of leaders as well as the methods used for measuring technology outcomes in schools were also described.

Chapter 3 provided a detailed explanation of the methodology used to conduct the study. A statement of the problem opened the chapter followed by a description of the population and sample. Survey development and methodology were then provided for the two instruments used for this study. An analysis of the reliability and validity of both the Principal Technology Leadership Assessment (PTLA) Survey and School Technology Outcomes (STO) Survey followed, with detailed descriptions of the constructs and data analysis for both surveys. A factor analysis of the STO survey was also presented in this section. Data collection procedures were explained followed by the statistical analysis procedures that were used to address each of the research questions.

Chapter 4 presented an analysis of the data. A review of the population and sample was followed by a descriptive statistical analysis of the percentage responses for the six constructs in the PTLA survey and the six constructs in the STO survey. Data analyses for the first two research questions were completed using descriptive statistics. A bivariate linear regression was conducted using data from both surveys to address the third research question.

Structure of the Study

This study was designed to answer the following questions:

1. What is the technology leadership behavior of principals in terms of NETS-A standards?
2. How is technology used in schools for organizational, instructional, and educational purposes?
3. What is the relationship between the technology leadership behavior of principals and the use of technology for organizational, instructional, and educational purposes in schools?

The null hypothesis associated with research question 3 stated that there was no relationship between the technology leadership behavior of principals and the use of technology for organizational, instructional, and educational purposes in schools.

Two surveys were used to answer these questions. The first research question was answered using data gathered from the Principal Technology Leadership Assessment Survey (PTLA) administered to principals in the sample. The second research question was answered using data gathered from the School Technology Outcomes (STO) survey administered to the faculty of principals in the sample. The third research question was answered by conducting a bivariate linear regression involving data from both surveys.

Summary of Descriptive Statistical Findings

An analysis of the descriptive statistical findings from principals that completed the PTLA survey and their faculty that completed the STO survey confirmed many of the research findings discussed in the review of the literature in Chapter 2 of this study. On the other hand, some of the responses from items in both surveys did not agree with previous research findings. Explanations for these discrepancies are discussed in this section. The findings from the PTLA survey are discussed in terms of each of the 6 NETS-A standards that provided the structure for identifying the leadership behavior and activities of principals that participated in this study. The findings from the STO survey are described in three sections that relate to school technology outcomes at three levels: organizational, instructional, and educational.

NETS-A Standard 1 - Leadership and Vision

The leadership and vision construct in the PTLA survey had a high overall mean scale score, indicating strong leadership with 60% of principals stating significant or full alignment with district technology plans. A similar number indicated significant communication with stakeholders about district and school technology planning and implementation efforts. This supports planning recommendations for administrators Czubaj (2002) and previous research studies (Anderson & Dexter, 2000) that showed the importance of communicating goals and coordinating the process of implementing and sustaining technology with the organization’s stakeholders. Principal participation in the design process of technology planning was deemed critical by many researchers identified in the review of the literature (Anderson, 2001; Kowch, 2005; Porter, 2003).

This was one of the weaker items in the leadership and vision construct, with nearly 40% expressing moderate to minimal participation in the school's most recent technology planning process.

NETS-A Standard 2 – Learning and Teaching

The learning and teaching construct showed that providing assistance for teachers with interpreting and analyzing student assessment for modifying instruction was clearly a priority, with around 90% of respondents indicating significant or greater assistance with this aspect of professional development. This finding supports recommendations made in the National Education Technology Plan (2004) which was established to facilitate the technology changes needed to compliment the No Child Left Behind Legislation (2001). The action steps outlined in the national plan included improved teacher training and integrated data systems, both of which were implemented by principals who responded to this survey. Although the results for the learning and teaching construct yielded the highest scale score mean and standard deviation out of all the constructs, one of the weaker components was shown to be assessing staff needs for professional development. Minimal consideration was reported by 12% of principals and 32% showed possible indifference to this aspect of staff assessment. Research conducted by Leithwood (2005) has shown that school districts showing improvement in instruction and achievement had superintendents that supported and encouraged school leaders to use stakeholder satisfaction data as well as student performance data to identify needs, set goals, plan, and track progress.

NETS-A Standard 3 – Productivity and Professional Practice

Gosmire and Grady (2007) reported that principals with the most influence on their faculty led by example and used technology as part of their professional daily practice. The productivity and professional practice construct was another strong aspect of these principals' technology leadership. With a high scale score mean of 20 and the lowest number of questions in the construct, quality leadership was demonstrated in this area. Nearly 90% of principals indicated significant or greater use of technology for completing daily tasks. A similar number also reported use of technology management systems to access student data.

Over 35% of principals reported indifferent or moderate levels of leadership by responding *Somewhat* to questions about participation in professional practice and development activities. The results of this construct concurred with research and reviews of the literature that described how many principals lacked technology training. Principals' contribution towards the implementation and integration of technology in schools has been linked with their level of professional development (Dawson & Rakes, 2003) and the extent of their knowledge and technology skills (Crandall & Loucks, 1982). Research has shown that training for teachers and their principals should be a priority (Holland, 2000). There is however, no evidence in this study that links the reduced levels of leadership in this area to technology outcomes reported by their faculty.

NETS-A Standard 4 - Support, Management, and Operations

The support, management, and operations construct was another strong aspect of technology leadership for Collier County administrators who completed the PTLA survey. All of principals responded positively to the item regarding support for staff and faculty connecting to and using district and building level technology systems for general management and everyday operations. This kind of support could be considered one of the key elements that may have generated the extensive and varied technology use reported by their faculty in their responses to the STO survey. Failure to implement technology in the classroom has been attributed to lack of support by administrators (Crandall & Loucks, 1982). Similarly, sustaining and maintaining technology as well as generating funding as an ongoing process has been shown to be fundamental for successful leadership in technology (Anderson & Dexter, 2005; Gosmire & Grady, 2007). Advocating for adequate, timely and high-quality technology support services was a priority for over two thirds of the principals. Over half of the principals stated that they used campus discretionary funds to support technology, but the majority of administrators stated that they did not pursue any means of supplemental funding for this purpose. Another result worth noting was that nearly a quarter of the respondents did not ensure that hardware and software replacements were included in the school technology plan. This may be due to the fact that hardware and software replacement is one of the major components in the district-wide technology plan, and therefore not considered as an area of concern at building level.

NETS-A Standard 5 - Assessment and Evaluation

Assessment and evaluation have been identified as critical components for responsive leaders who are committed to being accountable to the needs of their students and the community (Todd, 1999). The results of this survey showed that this aspect of technology leadership held the most room for improvement for Collier County administrators, with the lowest mean scale score of all the constructs. Principals made strong claims of support for teachers in using student assessment data; over three quarters of principals also stated that they actively promoted and modeled technology systems to collect student assessment data. In the light of these claims, principals revealed that they did not demonstrate similar use of data to assess and evaluate existing technology-based administrative operations and systems, or technology-based instructional practices. Approximately one third of the principals addressed this aspect of technology minimally or not at all. One explanation could be that there were no systems in place to perform these kinds of tasks, and if they did exist, their levels of understanding to implement them were deficient. This was not the case for professional development offerings, where 60% showed strong or superior leadership and indicated high levels confidence in their access to feedback data from teachers regarding the quality and effectiveness of training that they received.

NETS-A Standard 6 - Social, Legal, and Ethical Issues

The social, legal, and ethical issues construct yielded some of the highest and most diverse range of technology leadership scores, with a mean scale score of 24.8, and the largest standard deviation of 6.9. The issues of equity and access to technology received an overwhelming majority of positive responses with significant or complete compliance in over 80% of the respondents. These results confirmed compliance with the No Child Left Behind Act (2001) and appropriate use of subsequent government funding provided to reduce the gap between those who have access to technology and those who do not. This finding differed from results of studies in the review of the literature that showed disparities in access to technology for minority groups (Carvin, 2006). This construct also revealed a number of issues regarding health concerns, and enforcement of copyright and intellectual property (Gibson, 2005). These remain areas for future growth in technology leadership for principals in the sample population of this study.

School Technology Outcomes at the Organizational Level

The principal and organizational technology construct showed the highest scale score mean of all the constructs. Over 90% of the faculty agreed that technology was important to their principal. These results may be skewed by the design of the study which only surveyed the faculty of principals who participated in the survey. It is also reasonable to assume that principals who valued technology would participate in this kind of research study and so their faculty would evaluate them accordingly as principals that thought technology was important. A similar number of faculty also reported that technology helped their organization communicate more effectively, which has been identified in literature reviews as an essential element for organizational change (Boujut, 2003; Rowland, 2004; Venezky, 2004). Ninety percent of faculty reported that their principals supported training for new technology; 87% also reported that their principals supported funding for new technology. These findings echoed self-reported results by principals in the PTLA construct learning and teaching and the construct for support, management and operations enhancing the overall reliability of results for the PTLA survey. A large majority of respondents indicated that technology helped their school achieve adequate yearly progress (AYP), showing that technology was an active agent of change and school reform guided by public policy (Daggett, 2005).

The STO construct that measured faculty perception of administrative and management use of technology gave considerable insight into the use of technology for organizational purposes. The use of email proved to be the most widely used software, supporting previous claims by faculty that technology has helped their organization communicate more effectively. The frequent or daily use of databases for accessing student information by nearly 80% of the faculty, also confirmed claims by their principals in the PTLA construct for learning and teaching that they supported faculty with this task for the purpose of modifying student instruction. The use of web-based skills development software such as FCAT explorer was also notably high in this construct, used by around 80% of faculty. The finding suggested that testing for comprehension of knowledge strands used in standardized tests such as FCAT is well facilitated using these kinds of programs. This aspect of assessment and evaluation was not addressed in the review of the literature and is a good subject for future research. Online professional development remained one of the weakest technology outcomes for organizational purposes; 30% of faculty claimed that they had never enrolled in online classes. A considerable amount of research has shown that intellectual capital, in the form of organizational learning is a valuable commodity (Churchill, 2006; Rowland, 2004; Youndt, Subramaniam, & Snell, 2004). Technology therefore remains an option for future professional development initiatives targeted towards enhancing organizational learning and intellectual capital.

School Technology Outcomes at the Instructional Level

Instructional use of technology by faculty for planning and implementing instruction was measured in the STO survey instructional technology use construct. The ways that teachers used technology in their classrooms echoed the way that students used technology for completing assignments. Microsoft word processing and presentation software were the most popular means of presenting instructional material; 90% of the faculty used it on a regular basis. Internet search engines were equally as popular. Other types of software such as databases, spreadsheets, and mind mapping software purported to engage audiences in higher levels of critical thinking (Jonassen, 2002) showed less frequency of use. Studies mentioned in the review of the literature illustrated that the use of multimedia applications for presenting educational material improved student attitude and motivation towards learning (Gosmire & Grady, 2007; Shavinia & Loarer, 1999). There were also studies that showed multimedia leaning to be more demanding in terms of electrical activity in the brain, but less likely to stimulated transfer of information from one area of the brain to another (Gerlic & Jausovec, 2001). The findings in this study confirmed that substantial use of technology software by participants in this study has been facilitated by regular, and often daily, use of a variety of hardware such as computers, video projects, audio enhancement, DVDs and image capture devices for the purpose of preparing and presenting instructional material.

The technology needs construct produced a moderate mean scale score of 21.5. Over 90% of faculty agreed that they used technology to plan for instruction, interpret, and analyze data. These results supported results from the PTLA construct assessment and evaluation and the STO construct instructional technology use and added greater reliability to the results. Nearly 90% of faculty also agreed that they used technology to achieve curricular goals. Faculty identified a need to learn more about technology, and have more technology available for student use. Research has shown that insufficient access to modern technology is one of the barriers preventing teachers from successfully implementing technology in their classrooms (Bauer & Kenton, 2005). The need for more classroom computers was disputed by approximately half of the respondents, suggesting an overall ambivalence about the amount technology necessary to implement technology successfully in their classrooms. The debate regarding the amount and type of the benefits to students and teachers who regularly use instructional technology remains a topic for further research.

School Technology Outcomes at the Educational Level

The mean scale scores for the student technology outcomes construct in the STO survey showed a moderate frequency of technology use by students, and moderate agreement with technology statements about student use of technology reported by the faculty that responded to the survey. The results yielded from this construct support research described in the review of the research that the most commonly used software applications were Microsoft office products from the show-and-tell genre such as Word, PowerPoint and Publisher (Burns, 2006). Nearly 75% of STO faculty respondents claimed that their students used them occasionally or more for completing assignments. Other types of software that research has shown to foster critical thinking (Jonassen, 2000) such as spreadsheet technology embodied in software like Microsoft Excel, or databases such as Microsoft Access and concept mapping software such as Inspiration!

were much less prevalent in the classroom and less frequently used (Lei & Zhao, 2005). The results of this study supported this conclusion; only 20% to 30% of faculty reported that their students used these kinds of software occasionally or more for completing assignments, and nearly half of their students never used them at all.

The use of the Internet by students also received a strong response; over 45% of faculty stated that their students used online textbooks and 60% claimed that they used Internet search engines or online encyclopedias frequently or more often for completing assignments. Although there was no research about use of the Internet for completing assignments in the review of the literature, the National Education Technology Plan (2004) called for increased broadband Internet access and more digital content. It would be reasonable to assume that faster Internet access would foster greater use of the Internet in the classroom; the results of this study showed that this has happened in Collier County schools. Nearly two thirds of the faculty stated that their students used classroom computers frequently or more often for completing assignments. These results confirmed that computers were prevalent as tools that aided student cognition (Jonassen, 2002) and assisted students with the process of using higher order thinking skills (Alanis, 2004). It may also be possible that through greater use of technology more students have achieved greater autonomy and become more self-directed in their learning (Åkerlind & Trevitt, 1999; Cuban, 1993).

The technology proficiency, progress, and standards construct showed that approximately 80% of faculty agreed that their students used technology to complete assignments. This finding supported recommendations by the National Education Technology Plan (2004) to incorporate more digital content in the classroom. A similar number also believed that their students were proficient at using technology for completing assignments. Nearly two thirds of the faculty reported familiarity with student and teacher standards for use of technology, and a similar number also stated that they monitored student progress in technology. These results showed that there was substantial evidence to support the widespread use of technology in classrooms of the faculty respondents to this survey. This refutes claims made by many researchers that technology was under utilized, and computer usage in classroom remained disappointingly low (Cuban, 1993; Zhao, Pugh, Sheldon & Byers, 2002). The results of this construct yielded the lowest mean, with an overall low scale score mean of 14.1. Although this construct held the fewest number of items, it still produced a high overall percentage of positive responses for computer use and proficiency

Summary of Research Question Findings

Summary of Findings for Research Question 1

Research question 1 sought to discover the technology leadership behavior of principals outlined in the six NETS-A technology standards for administrators. Principals showed superior leadership in 5 out of the 6 of the PTLA constructs, with high mean scale scores falling between 20 and 35 for all constructs except assessment and evaluation, which produced a moderate mean scale score of 17.4. Each construct related to one of the NETS-A standards, indicating a strong overall technology leadership.

NETS-A Standard 1 - Leadership and Vision

The leadership and vision NETS-A standard called for leaders to inspire a shared vision for comprehensive integration of technology and foster an environment and culture conducive to the realization of that vision. Over 60% of the principals reported significant or greater levels of communication to stakeholders about district and school technology planning and communication showing strong leadership efforts to create a school culture that is informed about technology goals. Results also showed that a similar number of principals had significantly or fully compared and aligned their school technology plans with the district's strategic plan, which confirmed their commitment to implementing a shared comprehensive vision for technology integration. There was strong evidence to show that principals used data to make leadership decisions, nearly 90% reported significant or greater used of technology management systems to access student records.

Advocating for research-based effective practices in use of technology was one of the recommendations for this NETS-A standard that produced lower scores from respondents. More than half of the principals expressed indifferent or minimal participation in activities to identify best practices. Another area for leadership growth was greater participation by principals in their district and school's planning process. Nearly half of the respondents reported moderate, minimal, or no participation in an activity considered crucial for successful technology integration. Maintaining a long range technology plan is another aspect of the leadership and vision NETS-A standard. Principal respondents showed decreased levels of leadership in this area, over a quarter of respondents indicated that they provided minimal or less attention to hardware and software replacements. This standard also recommended that leaders advocate on the state and national level for policies, programs and funding opportunities that support implementation of the district technology plan. The levels of leadership in this area were not measured in this study as none of the questions on the PTLA survey asked respondents to report their extent of involvement beyond the district level.

NETS-A Standard 2 – Learning and Teaching

The NETS-A learning and teaching standard contained a selection of recommendations for educational leaders to ensure that curricular design, instructional strategies and learning environments integrated appropriate technologies to maximize learning and teaching. This was one of the strongest areas of leadership for respondents and held the second highest mean scale score that showed 90% of principals supported teachers in the use of data management systems for planning and modifying instruction and sharing of best practices. The self-reported commitment to professional development in technology was confirmed by faculty in the STO Survey. Assessing staff development needs was one of the weaker areas of leadership, only half of principals reported that they had significantly attended to their faculty's needs for technology training. This standard also contained recommendations for leaders to facilitate the use of technologies to support and enhance instructional methods that led to high levels of achievement, the development of higher order thinking, decision-making, problem solving, and a standards-based curriculum. The questions in the PTLA survey did not specifically address these aspects of the NETS-A learning and teaching standard, and therefore they were not measured in this study.

NETS-A Standard 3 – Productivity and Professional Practice

Educational leaders are asked to apply technology to enhance their professional practice and increase their own productivity and that of others in the NETS-A productivity and professional practice standard. Scale score means for this area of technology leadership were also strong. A large majority of principals used technology for completing daily tasks, modeling the routine, intentional, and effective use of technology according to recommendations outlined in the standard. Significant or greater use of technology was reported by 75% of principals for communicating with educational stakeholders. This finding satisfied another recommendation by this NETS-A standard for principals to employ technology to communicate and collaborate with colleagues, staff, parents, students, and the community. Participation in professional development activities was the weakest component in this standard, over one third of principals reported that they only somewhat engaged in sustained, job-related professional learning using technology resources. The other two thirds indicated significant or greater professional development, which showed that the majority of leaders followed recommendations outlined in this standard. The recommendations also required administrators to use technology to advance organizational improvement. Although there were no questions for principals to answer in the PTLA survey that addressed this aspect of productivity and professional practice, the use of technology for organizational purposes was evident in the results obtained from the STO construct principal and organizational technology use. Over 80% of the faculty agreed that their organization was proficient at using technology, and a similar number agreed that technology has helped their organization achieve adequate yearly progress. These responses indicated that technology was an integral part of their organizations. This finding suggested, but did not provide concrete evidence that principals were consciously using technology to advance organizational improvement.

This standard also recommended that principals maintained an awareness of emerging technologies and their potential uses in education. None of the questions in the PTLA construct asked principals to report on this aspect of the NETS-A productivity and professional practice standard, and therefore it were not measured in this study.

NETS-A Standard 4 - Support, Management, and Operations

The fourth NETS-A standard for support, management, and operations required educational leaders to ensure the integration of technology to support productive systems for learning and administration. The mean scale score for this construct was also high and confirmed another area of quality technology leadership by principal respondents. One hundred percent indicated significant or greater commitment to supporting faculty connecting to and using district and building level technology systems. This satisfied the recommendation in this standard to implement and used integrated technology-based management and operations systems. This standard recommended the integration of strategic technology plans to align with other plans and policies which was confirmed when over 60% of principals reported significant or greater efforts to align their school's technology plan with district-wide plans or other instructional plans. The kind of attention to other technological events reported by respondents shows that the majority of Collier County administrators have followed recommendations in this standard to significantly develop, implement, and monitor policies and guidelines that ensured compatibility of technologies. Over 75% of principals reported that they advocated at the district level for high quality technology support services, and over half of the principals allocated campus discretionary funds to meet school technology needs. These findings established that financial and human resources have been allocated to ensure complete and sustained implementation of the technology plan according to the recommendation outlined in the NETS-A standard. One component of this standard that remained an area for future technology leadership growth was technology replacement cycles. The standard required that educational leaders implement procedures to drive continuous improvement of technology systems and support technology replacement cycles. Over half of the principals participated moderately, minimally, or not at all to ensure that the hardware and software replacement and upgrades were incorporated into school technology plans.

NETS-A Standard 5 - Assessment and Evaluation

The assessment and evaluation NETS-A standard provided educational leaders with recommendations on how to use technology to plan and implement comprehensive systems of effective assessment and evaluation. This construct received the lowest mean scale score of 17.4 showing moderate technology leadership by principal respondents. An overwhelming majority of Collier County administrators showed their commitment to using technology to collect and analyze data, interpret results, and communicate findings to improve instructional practice and student learning. Eighty percent of principals reported that they significantly promoted and modeled technology based systems to collect student assessment data. The learning and teaching construct showed that principals were also committed to supporting training for teachers in assessment systems, and the productivity and professional practice construct showed that administrators use these assessment tools on a daily basis. However, the use of technology to assess and evaluate other educational areas outlined in recommendations for this standard, such as administrative and operational systems, faculty performance, the effectiveness of professional development and technology-based practices was not as widely reported. Twenty-four percent of principals indicated that they only minimally assessed technology based administrative systems, and a further 12% did not participate in this technology practice at all. Effective use of technology as a criterion for assessing the performance of faculty was of moderate importance to 32% of principals, a further 8% considered it of minimal importance. Evaluating the effectiveness of instructional practices was another shortfall in this standard, over half the principals paid somewhat, or minimal attention to this aspect of technology leadership.

NETS-A Standard 6 - Social, Legal, and Ethical Issues

The NETS-A standard that addresses social, legal, and ethical issues presents educational leaders with ways to understand how these matters are related to technology and how to model responsible decision-making. This construct yielded the highest scale score mean of 24.8 indicating superior levels of technology leadership. There was no doubt that Collier County administrators ensured equity of access to technology resources that enabled and empowered all learners. Findings confirmed that nearly half of the principals expressed superior leadership by reporting their full commitment to equity of access to technology, a further 36% reported significant commitment to this issue.

Significant or complete support for technology for students with special needs was clearly another priority for over 80% of principals. Over half of the respondents also reported significant or greater involvement with issues related to privacy and online safety. These results established that Collier County educators have followed the recommendations outlined in this standard to promote and enforce privacy, security, and online safety related to the use of technology. Some areas that showed reduced levels of principal leadership included the promotion and enforcement of environmentally safe and healthy practices in the use of technology, and the enforcement of policies related to copyright and intellectual property. Over half of the principals reported that they were somewhat or less involved in these leadership practices.

Summary of Findings for Research Question 2

The second research question in this study asked how technology was used in schools for organizational, instructional, and educational purposes. Faculty responses to the STO survey provided data to answer this question. A descriptive statistical analysis of the percentage responses for each question and mean scale scores for six constructs were used to identify student technology outcomes, instructional technology use, principal and organizational technology use, administrative and management technology use, technology proficiency, progress and standards, and technology needs.

School Technology Outcomes at the Organizational Level

The principal and organizational technology use and the administrative and management technology use constructs were analyzed in Chapter 4 to show how technology was used in schools in the target sample for organizational purposes. The STO construct that yielded the highest overall mean was principal and organizational technology use which showed moderate to strong agreement by faculty with organizational technology statements in the survey and moderate to strong frequency of technology use for organizational purposes. The administrative and management use of technology construct was the fourth highest mean which indicated slightly weaker and more moderate agreement and technology use in this category.

Over 90% of the faculty agreed that technology was important to their principal and that it helped their organization communicate more effectively. Over half the faculty agreed that technology helped their school achieve the mandated standards for yearly progress required for all schools by the State Department of Education. The daily use of email reported by over 80% of faculty for administrative purposes may have been a contributing factor to the improved organizational communication reported in these schools. The use of shared network directories to store files for school wide access was also used by over 90% of the faculty. This type of direct and immediate access to data and information may have reduced paper circulation, and speeded up communication through instant delivery and feedback. Other means of enhanced organizational communication such as the use of websites for posting information showed less use, just over 60% of the faculty stated occasional or greater use, and 34% stated that they never use them for administrative and management purposes.

The organizational improvement that this study sought to reveal implicated a wide variety of organizational, instructional, educational variables that involved technology; many of these still remain obscure and are therefore not addressed directly in this study.

Databases such as Data Warehouse and Esembler containing student information such as grades and test scores have provided faculty and principals with valuable data used daily by 45% of the faculty and frequently by 34% for administrative and management tasks. The use of web-based skills development software for planning and delivery of instruction by over 75% of the faculty has helped teachers and administrators monitor the overall progress and proficiency of their students in terms of learning benchmarks and standards used in state testing. Software programs like FCAT explorer and Riverdeep have contributed to the organizational body of knowledge by providing quality reports which can be analyzed by strands and learning objectives. This has provided educators and administrators with vital individual and aggregate information to make long term and short term decisions to needed to improve their schools' organizational performance. The multiple applications of this information for instructional purposes in the classroom to meet educational goals tailored to suit the needs of each and every student, as well as organizational purposes such as meeting state requirements for AYP or annual improvement are powerful.

The role of technology in organizational learning proved to be one of the weaker elements of organizational technology use, with online courses for professional development used occasionally or less by over half of the faculty, and 30% stating that they never used them at all. It was interesting to note that the majority of the faculty did not feel that their school relied heavily on technology. This could be a healthy indication of the faculty's confidence that a superior level of education would still be provided to students in the absence of technology. It could also suggest that they don't rely too heavily on any one single element too provide a comprehensive educational experience to their students. From an organizational perspective it suggests that technology is just one component of an existing organizational structure that is robust enough to continue to operate effectively in the absence of technology.

School Technology Outcomes at the Instructional Level

The second part of this research question asked how technology was used for instructional purposes. The percentage responses of faculty to STO survey items and the overall mean scale scores and standard deviations for the instructional technology use and technology needs constructs were used to answer this part of the question. The scale score mean for instructional technology use was the second highest of the six STO constructs. This showed moderate to strong agreement by faculty with statements in the survey that related to use of technology for planning and delivery, along with moderate to strong frequency of technology use for planning and delivery of instruction.

Over three quarters of the faculty agreed that their students used technology to complete assignments and that they were proficient at using technology for this purpose. More than 60% of faculty agreed that they monitored student progress in technology and only a few percent less agreed that they were familiar with technology standards for students. A greater percentage of faculty were familiar with technology standards for teachers, but a surprising 30% still did not agree that they were familiar with them.

Microsoft word processing and presentation software such as Word and PowerPoint proved to be the most popular forms of software used by 97% of the faculty. Internet search engines were also frequently used for planning and delivery of instruction by a similar number. Nearly 50% of the faculty claimed that they used web based skills development software frequently or more and only 16% of faculty claimed that they never used this kind of software for planning and delivery of instruction. Spreadsheets, mind mapping software, image editors, and html editors were much less frequently used by up to two thirds of the respondents, with the remaining third claiming that they never used them. Other less popular software included online textbooks which was used for planning and delivery of instruction frequently or more by only 20% and never used by one third of the faculty.

The reported use of this software was facilitated by daily use of presentation hardware devices such as video projectors, interactive whiteboards, and audio enhancement devices by over 50% of the faculty and frequent use by 22%. Other types of hardware such as scanners, DVD players, digital cameras, and file transportation devices such as external flash drives were used frequently by between 40% and 50% of the respondents. Wireless laptop computers were reported as the least frequently use of all the hardware included in this survey.

The STO construct for technology needs revealed that approximately 90% of the faculty agreed that they use technology to plan for instruction, interpret and analyze student data, and achieve curricular goals. The majority of respondents expressed a desire to learn more about teaching with technology and would like to have more technology tools to deliver instruction and for students to use. The mean scale score for this construct was the second lowest out of all six STO survey constructs, but still fell within the moderate level which showed overall moderate levels of agreement with statements that related to instructional technology needs.

School Technology Outcomes at the Educational Level

The third and final part of this research question asked how technology was used in schools for educational purposes. The percentage responses of faculty to STO survey items and the overall mean scale scores and standard deviations for the educational technology use and technology progress, goals, and standards constructs were used to answer this part of the question. The scale score mean for educational technology use was the third highest of the six STO constructs with the largest standard deviation showing a broader range of scaled responses, but overall moderate agreement by faculty with statements in the survey that related to use of technology by students for completing assignments, coupled with a moderate to strong frequency of technology use by students for completing assignments. The technology progress, and standards construct also used to show how technology was used for educational purposes had the lowest mean scale score, but it was also the construct with the fewest items. Results fell in the low to moderate range, indicating that faculty agreement with statements about technology progress, goals, and standards was moderately low and so was the reported frequency of technology use for educational purposes.

Internet search engines were the most widely used piece of software for completing assignments, nearly 60% of the faculty stated that their students used them frequently or almost always. Microsoft products for word processing and presentation such as Word and PowerPoint were the next most popular, with over 50% of faculty claiming that their students used them frequently or more. More than 70% of the faculty reported that their students used web based skill development software for completing assignments, fewer than 50% stated that they used them frequently or more; only 16% of faculty claimed that they never used them.

The software use by students for completing assignments was very similar to faculty use for presentation of delivery of instruction. Nearly half of the faculty stated that their students never used software such as Excel spreadsheets, concept mapping programs such as Inspiration! or image and html editing software such as Adobe Photoshop or Dreamweaver respectively. Only 20%-30% of the faculty reported that their students used these types of software occasionally or more. Animation, design, and engineering software were the least used types of software. Online textbooks were used occasionally by 33%, and frequently or more by 10% of students for completing assignments, over one third of the faculty stated that they were never used by students for completing assignments.

The most frequently used hardware that facilitated this software use by students were classroom computers, used almost always by 40% of respondents and frequently or more by over 60%. School computer labs were the next most frequently used hardware with frequent use by students for completing assignments reported by over one quarter of the faculty, and occasional or greater use by students reported by over 50%. Wireless laptops were much less frequently used; 40% of faculty reported that their students never used them and just under 20% claimed frequent or greater use. Image capture devices such as digital cameras and scanners were used by half of the students, but over 35% claimed that they had never used them for completing assignments. The least used piece of hardware for completing assignments were student response systems or classroom clickers, over 65% of faculty stated that their students never used them.

Summary of Findings for Research Question 3

Research question 3 asked whether there was the relationship between the technology leadership behavior of principals and the use of technology for organizational, instructional and educational purposes in schools. The null hypothesis stated that there was no relationship between the technology leadership behavior of principals and the use of technology for organizational, instructional and educational purposes in schools. The results of the bivariate linear regression showed that technology leadership behavior measured in the PTLA score of principals was not found to be a good predictor of school technology outcomes $p=.18$. The null hypothesis could not be dismissed and the results of this study show that there is no relationship between the technology leadership behavior of principals reported in the PTLA constructs and the school technology outcomes at organizational, instructional, and educational levels reported by their faculty who completed the STO survey to measure technology outcomes.

Discussion of Research Questions

Research Question 1

Educational leaders are responsible for understanding how technology can support and enhance teaching and learning in their schools (Anderson & Dexter, 2005). The first research question in this study sought to describe the technology behavior and activities of educational leaders in Collier County. The NETS-A standards used to answer this question were developed to provide administrators with body of knowledge and a set of skills or indicators for effective leadership and appropriate use of technology in schools (ISTE, 2000). The six PTLA constructs that measured the level of technology leadership exhibited by the principals in the target sample that completed the PTLA survey showed, without exception, superior levels of technology leadership in all six NETS-A standards. Responding administrators demonstrated a confirmed commitment to implement and maintain a high level of technology integration in their schools. The results of the PTLA showed how this task was accomplished in terms of each NETS-A standard.

NETS-A Standard 1 - Leadership and Vision

By carefully aligning the school technology plan with the district-wide technology plan, principal respondents in this study have evidently implemented a shared and comprehensive vision of technology integration. Educational leaders that participated in the design process of technology planning have been shown in research studies to impart a clear vision and more practical mission with attainable goals for technology use (Anderson, 2001; Kowch, 2005; Porter, 2003). The principals in this study reported high levels of communication with stakeholders about technology goals, but lower levels of participation in the actually technology planning process. The consequences of this reduced contribution further reduced their impact on shaping the school's direction through vision and mission. It could be possible that the school district's mission and vision for technology was so well researched and defined that it duplicated into each individual school setting without need for much alteration. This could explain why school leaders may have felt that their efforts were best spent focusing on how to communicate and execute the goals rather than tailor them to suit the individual needs of the school. There was also the possibility that too much deviation from the district mission and vision may have compromised the solidarity of the district-wide goals.

Another area where principals showed lower levels of leadership included providing for an ongoing plan of hardware and software replacement. A strong district plan would also alleviate school technology plans from attending to this matter. If an existing policy to replace hardware and upgrade software after a given number of years was in place, then school technology plans would not need to address this issue directly.

NETS-A Standard 2 – Learning and Teaching

The self-reported support for learning and teaching shown by principals in the PTLA survey was echoed by their faculty in the statements regarding principal and organizational use of technology in the STO survey. Supporting faculty by funding training on the use of technology was evident in the results of both surveys used in this study. The emphasis on providing support for interpreting and analyzing student data for planning and delivery of instruction was confirmed in the overwhelming use of databases by teachers for instructional purposes in the STO survey. The percentage of responses and scale scores for items from both surveys showed that the majority of faculty agreed that their principals funded and supported technology training. They also frequently used the technology for planning and delivery of instruction, although the data did not yield any significant statistical relationship in an analysis of variance,

NETS-A Standard 3 – Productivity and Professional Practice

The review of the literature in Chapter 2 showed that principals who regularly used technology in their daily activities and led by example, modeling the practical application of technology in an educational setting, had greater influence on the extent of technology integration in their school (Gosmire & Grady, 2007). The high levels of technology leadership exhibited by Collier County principals that participated in this survey confirmed their committed use of technology in their professional practice. The NETS-A standard that outlined recommendations for leaders in this aspect of technology leadership is supported by previous research described in the review of the literature that revealed a lack of professional development for leaders in this area in many schools (Crandall & Loucks, 1982; Kearsley & Lynch, 1992). Some of the areas for future growth for educational leaders could include increased levels of professional development in field of technology. Although the principals in this study strongly supported and funded technology training for teachers, without informed leadership by their principal, previous research has shown that most teachers did not successfully employ that training. Training for principals is therefore as important as teacher training for successful technology integration in schools (Holland, 2000). Reasons for lower levels of participation by Collier County school leaders in technology trainings could include a perception that instructional trainings are not practical for administrators. The influence of the principals on student achievement has been shown to be substantially mediated and diffused throughout the school (Anderson & Dexter, 2000) so principals may have felt obliged to send those who can provide the greatest direct benefit to the students to technology trainings.

NETS-A Standard 4 - Support, Management, and Operations

Previous research has shown that shortfalls in support, management, and operation of technology by educational leaders have been associated with failure by educators to successfully implement technology in their classroom (Crandall & Loucks, 2007). Support for infrastructure proved to be another area of superior leadership for Collier County principals, who reported that they advocated at the district level for high quality support services. However, it was apparent that these administrators did not pursue supplemental funding to a large degree. This may be due to a substantial annual technology budget for the district, or that other projects from departments with lower levels of district funding were earmarked for any money or resources generated by supplemental funding projects and grants.

NETS-A Standard 5 - Assessment and Evaluation

Assessment and evaluation of student data generated high levels of technology leadership through support for training and daily use in professional practice. However, the extent of principals' use of data for evaluation and assessment appeared limited to student data and professional development data from their staff and faculty. The reduced levels of leadership for evaluating the effectiveness of existing technology for educational, instructional, and organizational purposes suggested that these data may not have been available to administrators, or their ability to access and analyze the information was insufficient. Alternatively, the relative importance of student achievement and organizational improvement in the form of adequate yearly progress (AYP) may have overshadowed the importance of assessment and evaluation by school leaders for any other purpose.

NETS-A Standard 6 - Social, Legal, and Ethical Issues

The social, legal, and ethical role of the leader was another one of the principals' strongest areas of leadership, especially in the area of equity and access to technology. This supported the claims that government funded programs targeted to reduce racial and socio-economic inequities were working and refuted the claims made by some of the studies mentioned in the review of the literature, that the digital divide and the gap between those that have access to technology and those that have not was getting wider (Carvin, 2006). Collier County was however, reputed to be one of the smaller and more affluent school districts, with reduced levels of economically disadvantaged students compared to some of the larger school districts in Florida such as Dade County.

Other legal and ethical aspects of technology leadership such as health and safety, and enforcement of copyright and intellectual property policies showed lower levels of management. This may be due to the absence of any overriding district policies or lack of information regarding the extent and instances of violation that occur in their schools.

Discussion of Research Question 2

The second research question in this study sought to describe the use of technology in schools for organizational, instructional, and educational purposes. By identifying the uses and frequency of technology in these three capacities, this research study aimed to provide some structured insight into the differences and similarities of technology use for organizational, instructional, and educational purposes.

<u>School Technology Outcomes at the Organizational Level</u>

Technology has helped educational organizations in this school district communicate more effectively; the extensive use of email has been instrumental in this achievement. However, the design of this study did not allow for teachers or administrators to express any personal opinions on the advantages and disadvantages of this pervasive form of communication. There may have been teachers and educational leaders that preferred to discuss matters of a personal nature face to face. There are some matters that warrant privacy that are simply not appropriate subjects for email messages. The issue of privacy and security was discussed briefly in the PTLA construct that related to the social, legal, and ethical issues. Communication has become faster, and in this way it is easy to understand how faculty have perceived it as more effective, but breaches in privacy and the misdirection of information to the wrong people may compromise this improvement. Similarly network security threatens the benefits of file sharing. Students with superior network knowledge may find multiple ways to access sensitive information on administrative file servers with inadequate protection in the form of firewalls and data encryption. Inappropriate use of email by staff, faculty, and administrators for communication that does not belong in an educational setting is also cause for concern. Receiving and forwarding email that contains subject matter outside of the educational arena does not contribute to improved communication, and this kind of unwanted mail is time wasting and can be offensive. Some emails that contain links to web pages that mimic other login pages to extract passwords from employees are dangerous, and threaten network security for all kinds of organizations including education. These kinds of email scams or cons, known as phishing, are detrimental to enhanced communication through the use of technology.

One of the more surprising findings of this study was the extensive use of web-based skills development software by educators for administrative and management tasks as well as planning and delivery of instruction. Programs like FCAT explorer and Riverdeep which involve multiple academic disciplines have provided extensive reports allowing collective analysis at a variety of levels. Grade level teachers that plan together have been able to use these kinds of reports to identify trends in individual student growth patterns across the disciplines. From an organizational perspective, administrators have been able to access aggregate data that provided an immediate snapshot of how any particular grade level was performing in any, or all of the disciplines that are included tested in the State FCAT test. This data can be sorted by variables to explore reasons for growth or deficiencies in any given area. Organizations that are informed about their current strengths and weaknesses are able to take immediate action to improve and make the changes and interventions necessary to meet state guidelines for adequate yearly progress (AYP).

Databases containing student information have been used for these reasons, although the data are more retrospective, containing test scores from previous years and school grades that are used for more long term planning and individual student academic growth plans. Parents' access to their children's grades using web interfaces has also helped educational organizations communicate more effectively with a greater number of stakeholders. This feature had enabled report cards to be retrieved on demand by students and parents which in turn, have helped parents monitor their child's progress and allowed them to communicate more effectively with their children and teachers about academic performance. These benefits are however, only available to those families with access to the Internet. The level of access that parents and students have to the Internet also affects the level of enhanced communication that these kinds of web-based offerings bring. It is important to consider how many, and what percentage, of the school community use these kinds of Internet features, and more importantly, how to provide the same level of communication to those who do not have access to the Internet. In terms of equity and access, this kind of alternative hard copy communication should not be replaced by its digital counterpart for ethical reasons which might result in legal consequences. Examples of these include school newsletters which are often posted online in pdf form on school web sites. The information provided online must be readily available and actively communicated to school community members who do not have the resources to locate this information online.

School Technology Outcomes at the Instructional Level

The second part of this research question sought to discover the use of technology in schools for instructional purposes. The findings of this study refuted some of the research described in the review of the literature claiming that technology was underutilized (Cuban, 1993; Zhao, et al., 2002). Technology was used daily by an overwhelming majority of faculty that completed this survey. The results showed that the Internet and word processing and presentation software were the most popular types of software for planning and delivery of instruction. Technology presentation hardware such as video projectors, and audio enhancement devices were used frequently or almost always by the majority of the faculty. The high percentage of agreement with technology statements about using technology for planning and delivery of instruction coupled with the high frequency of use by these faculty members showed that the faculty as a whole was proficient and confident about using technology in their pedagogical practice. As this survey was administered online, there is a possibility that educators who were less technologically proficient did not choose to complete the survey, and therefore their limited use of technology could not be recorded in this study. Some educators who felt that technology did not apply to their teaching situation may have opened the survey and decided not to respond to the majority of the questions about instructional and educational use of hardware. This could account for the percentage of non-respondents for each question.

Technological innovation has been identified as a cause for a paradigm shift in pedagogical practice away from direct instruction, or teacher centered classrooms where technology is used as a resource to enhance presentation (Hopson, Simms, & Knezek, 2002). As the learning process becomes less passive and teachers spend less time lecturing with the assistance of technology audiovisual enhancement tools; students actively engage with the curricular content by using technology as tools that aid cognition in the classroom by completing assignments rather than watching PowerPoint presentations or DVDs (Jonassen, 2000). If this was the case in the classrooms of faculty respondents to this STO survey it would be reasonable to expect reduced levels of technology for presentation purposes. The results of this survey show that teachers have embraced technology for planning and delivery of instruction, and use it as much as their students, but there is no evidence to show reduced levels of technology use by teachers as their students' technology use increases.

Online textbooks were used occasionally or more by over half the faculty. This supported the recommendation for more digital content in the classroom outlined in the National Educational Technology Plan (2004). Appropriate use of the Internet as an educational tool is one of the challenges that teachers face in their quest to integrate technology in their daily instruction. Online textbooks are one way for teachers and students to navigate safely using the Internet to achieve curricular goals in a structured online environment. The substantial use of online textbooks by faculty for planning and delivery of instruction shows that carrying heavy textbooks around may soon become a thing of the past. Increased use of online textbooks in the classroom opens up the possibilities for students to access instructional tools previously unavailable outside the classroom. Homework could also be completed online, provided that students have access to the Internet at home.

School Technology Outcomes at the Educational Level

The final part of the second research question sought to discover the use of technology in schools for educational purposes. The intention of this question was to describe how technology was used in the classroom by students in Collier County. The results of this study show how faculty perceived that technology was used by their students for completing assignments. The faculty reported extensive use of classroom computers, which refuted claims made in the review of the literature by researchers that classroom computers were siting idle (Cuban, 1993; Zhao, et al., 2002). Only 9% of respondents reported that students never used their classroom computers for completing assignments. This percentage may be explained by the fact that all types of school faculty received this survey. In every school are a number of instructional faculty, such as guidance counselors, band, and physical education teachers who would understandably report limited or no opportunities for their students to use computer technology for completing assignments. These teachers could easily account for the 9% of faculty that reported no use of computers by their students for completing assignments.

Over one third of the faculty claimed that their students used the computer labs frequently or more for completing assignments. This was noticeably more than portable wireless laptop computers, which were never used by students according to 40% of the faculty. These results show that desktop computers were the prevailing form of hardware in most schools at the time that this research was conducted. The benefits and uses of one-to-one wireless laptop computing described in the review of the literature (McHale, 2007) may become evident as wireless technology becomes more widely available to more schools in this school district.

Some studies in the review of the literature made numerous claims that use of technology enhanced and encouraged students to engage in the process of critical thinking (Kehler et al., 2005). The results of this research study did not provide any information to support this claim. The types of software described in the review of the literature, such as spreadsheets, databases, expert systems, and mind mapping software (Jonassen, 2000) were reported by faculty as the least popular types software included in the survey. The findings described in this research question supported other claims by researchers that some of the technology proven to have the most impact on student achievement was less popular and less frequently used (Lei & Zhao, 2005).

Asynchronous learning tools such as emails and discussion threads that have also been linked through research to higher levels of critical thinking (Meyer, 2003) were not even included in the STO survey. Until recently these types of technology learning tools have been used mainly for higher education through distance learning. It would be reasonable to predict that successful use in adult education may lead to greater use in K-12 education in the future.

The results of this survey agreed with previous research cited in the review of the literature that the most commonly used software applications used by students for completing assignments were of the show-and-tell genre such as the Microsoft office products Word, PowerPoint, and Publisher (Burns, 2006). However, the faculty reported greater use of Internet search engines by students for completing assignments. The questions in STO survey used to find out how technology was used for educational purposes in schools did not provide educators the opportunity to describe how the final destinations that students reached through the search engines were used to achieve learning objectives and curricular goals. Simulations, collaborative learning environments, and problem-based learning projects are just a small selection of the educational opportunities that are available online which have been shown to foster higher order thinking skills (Alanis, 2004; Pederson & Liu, 2000; Randel, et al., 1992). The STO survey did not address these items and therefore this study did not measure these types of cognitive learning strategies.

Discussion of Research Question 3

The third and final research question asked whether there was a relationship between the technology leadership behavior of principals and the use of technology for organizational, instructional and educational purposes in schools. Previous research included in the review of the literature showed that principals' influence on their schools was significant (Halligner & Heck, 1998) and extended in multiple directions (Krüger, Witziers & Sleegers, 2007; Mulford, 2003). More specifically, the influence of educational leaders on technology use in schools was shown to be measurable (Anderson & Dexter, 2005). Despite these findings, this research study did not reveal any statistically significant association between the technology leadership behaviors reported by principals that completed the PTLA survey, and their faculty that completed the STO survey. An analysis of variance supported the null hypothesis that there was no relationship between the technology behavior of educational leaders and the use of technology in their schools.

Descriptive statistics revealed patterns of responses that indicated the possibility of a relationship between self-reported technology behavior of principals in the PTLA survey results and the use of technology by their faculty. Examples of these included a high percentage of responses by principals that reported strong commitment to the provision of assistance to teachers for interpreting and analyzing student assessment data, and using these data to modify instruction. Faculty that completed the STO survey reported high levels of use of databases for administrative and management tasks, such as interpreting and analyzing student data; and using databases for planning and delivery of instruction. However, a statistical analysis was unable to confirm that this similarity between principal and faculty responses held any statistical significance.

A number of the self-reported claims by principals about their leadership behavior and use of technology were confirmed by faculty responses in the STO construct principal and organizational use of technology. Examples included self-reported behavior by principals that shared high levels of communication of information about the school technology plan in the PTLA leadership and vision construct. These results were confirmed by faculty responses in the STO principal and organizational technology construct where a large majority agreed that the principal had discussed the school technology plan with the faculty. However, a statistical analysis was unable to confirm that this similarity between principal and faculty responses held any statistical significance.

Other similarities between PTLA results and STO results could be extended to most of the PTLA constructs and the use of technology for organizational, instructional, and educational purposes reported by faculty. Each member of the faculty that reported these outcomes is linked to the responses included in the PTLA in one fundamental way, they have the same principal and the percentage of responses by both parties about similar topics show commonalities, but the results of this study show that they are not mathematically related.

Implications for Educators

The findings from this study raise some areas of consideration for educators, but are subject to some cautionary statements. The faculty invited to respond to this survey were limited to those faculty whose principals chose to participate in this study. The results of the STO survey from which these implications are derived, are therefore limited to the perceptions of voluntarily participating faculty whose principals deemed this subject worthy of their time and effort. The resulting data may not be reflective of the perceptions of the general teaching population and therefore the implications that follow in this section may not be generalized to a greater population outside of the 25 schools in Collier County that participated voluntarily in this study.

Educators who responded to this survey clearly embraced technology and used technology in their pedagogical practice on a daily basis for a variety of purposes. From an organizational perspective, educators could enhance their intellectual value as an organizational asset through greater use of technology as a means of professional development. Online courses are an ideal means of increasing knowledge about technology, using technology. By using more technology to acquire knowledge teachers will be in a stronger position to share their learning with others using similar online educational media.

As educational stakeholders enjoy the benefits of improved communication through use of high speed technology and immediate access shared networks, they should be careful not exclude those without access to technology. Teachers should be especially careful to ensure that hard copies of items that are becoming standard in digital format, such as report cards, parent communication, and test results reach the families who do not possess computers at home. In case of school-wide network failure or unexpected breaches of security, teachers should maintain their own hard copy backups of all data needed for parent communication.

All educators should read and consider the guidelines set forth in their school district's acceptable use policy for Internet access. When sending, receiving, and forwarding email, and using the Internet in their classrooms faculty should follow the district acceptable use policy as a standard for general daily procedures. In this way, they will protect their students and themselves from intrusive external privacy and security issues.

Implications for educators using technology for planning and delivery of instruction involve using a wider variety of software to enhance critical thinking to achieve higher order learning objectives. Choosing alternative software to present lessons will expose their students to new ways to complete assignments using technology. The results of this study showed that student use of software and hardware was very similar to their teachers. If teachers present material in the classroom using new software, experimenting with ideas and experiencing some of the learning curves in the presentation process, their students will follow suit. Choosing software that is best suited to achieve their curricular objectives is one of the first decisions for an educator that actively integrates technology in their curriculum. Educators should pursue professional development opportunities that are designed to furnish teachers with information about the types of software that are available to achieve their curricular goals. Teachers should be encouraged to share their knowledge of new technology and provide feedback to faculty and administration evaluating the effectiveness of existing and new technology used in the classroom.

The prevailing implication for educators using technology for educational purposes is to encourage the use of a wider variety of technology outside of desktop computers and Microsoft Office Suite for completing assignments. Modeling different types of software and hardware in the educational presentation process will assist in this process. Encouraging members of the community and business partners to come into the schools and describe how technology is used in different commercial and professional applications. Students should be encouraged to share their personal knowledge of new technology and be given an avenue for feedback to faculty and administration evaluating the effectiveness of existing and new technology used in the classroom.

The benefits of e-learning and virtual education should be explored at all grade levels. It may be possible to incorporate some components that research has shown to be effective in adult education for elementary and secondary school education. As our students and teachers become more familiar with using technology in the learning process, they will in turn, utilize technology as an instructional tool.

Implications for Principals

The Collier County principals that responded to this survey are technologically proficient according to the NETS-A standards outlined by ISTE (2002). The implications for these principals who already exhibit superior leadership qualities in the area of technology are no less important and hold greater significance in the light of their technology expertise. However, it remains that the results reported by these principals are not representative of all educational leaders, and the implications that follow cannot be generalized and do not necessarily apply to school administrators outside of the sample population that responded to the survey used in this research study.

Long term technology planning that is specific to each school site and carefully aligned with the district-wide technology plan will provide the most benefit to all stakeholders. Principals should become personally involved with budgeting and funding the school technology maintenance and replacement plan for hardware and software even if their district has a well-defined upgrade strategy. There are a number of reasons for this including the possibility of reduced long term funding due to unforeseen expenditure cuts by the state, or national price fluctuations in hardware and software due to innovation, or international political unrest and changes in the global economic climate.

Intellectual capital is one of the most valuable assets that an educational institution can have. By using technology to achieve organizational learning and foster intellectual growth administrators are investing wisely in their organization’s future. Some examples of technology use in this area include, but are not limited to, online professional development courses, expert systems, blogs, discussion threads, message boards, and sharing best practices. The findings of this study are consistent with previous research that principals who model the use of technology, actively learn, and share their learning about technology are more likely to have faculty and students that use technology in their daily practice.

Areas for future leadership growth include developing policies and codes of conduct for technology use that safe-guards intellectual property, enforces copyright legislation, protects the environment, and ensures personal safety and well being. Findings from this study show that educational leaders hold all of the standards outlined in the NETS-A performance indicators as priorities in their leadership role. There is no doubt that they are proficient in technology and support their faculty through training and funding for new technology. It remains that the leaders should continue to promote and fund new technology in order to keep their schools up-to-date in order to prepare students for a rapidly changing technological society. The effectiveness of this new technology should be consistently evaluated by leaders for organizational, instructional and education purposes.

Limitations

This study contains a number of limitations that should be noted for future researchers. The 399 Collier County faculty that completed the STO survey were from schools in the district whose principals completed the PTLA survey. Therefore their answers cannot represent the school technology outcomes perceived by faculty from the district as a whole, or any greater teaching population in Florida or the rest of the United States of America. It could be possible that the principals that participated in this survey, and gave permission for their faculty to participate voluntarily in this research study were only those principals that valued technology and considered it an important component of their educational organization. If this was the case, then the data in this study fail to represent the technology leadership behavior of those principals and faculty who place less importance on technology and use it less in their daily practice. In this way, the results generated by 25 principals (56.8%) that participated in the PTLA survey may not represent the technology leadership activities and behavior of those 19 Collier County principals (43.2%) who did not complete the survey. The findings of both surveys are limited to the sample population only.

The second limitation of this study relates to the first research question which asked for a description of the technology leadership behaviors of principals in terms of NETS-A standards. A number of the recommendations for educational leaders in each standard where not addressed in any of the questions in the PTLA survey and consequently could not be measured by the corresponding constructs. The leadership and vision NETS-A standard called for educational leaders to advocate on the state and national levels for policies, programs, and funding opportunities that support implementation of the district technology plan. However, there were no questions in the PTLA survey that asked principals to respond to this aspect of funding. There was one question about seeking alternative funding, but it did not specify a state or national level. There was also a question about advocating at the district level for quality support but nothing higher (state or national). This important aspect of technology leadership was therefore not addressed in this study.

The NETS-A learning and teaching standard contained recommendations for leaders to facilitate the use of technologies to support and enhance instructional methods that lead to high levels of achievement, develop higher order thinking, decision-making, problem solving, and support a standards-based curriculum. The PTLA survey did not ask these questions, so this NETS-A standard was also incompletely analyzed.

The NETS-A productivity and professional practice standard contained a recommendation that principals maintain awareness of emerging technologies and their potential uses in education. None of the questions in the PTLA construct asked principals to report on this aspect of the NETS-A learning and teaching standard, and therefore it was not measured in this study. The recommendations also required administrators to use technology to advance organizational improvement. Although there were no questions for principals to answer in the PTLA survey that addressed this aspect of productivity and professional practice, the use of technology for organizational purposes was evidenced in the results obtained from the STO construct principal and organizational technology use. Over 80% of the faculty agreed that their organization was proficient at using technology, and a similar number agreed that technology has helped their organization achieve adequate yearly progress (AYP). These responses indicated that technology was an integral part of their organization, according to faculty perception, that principals consciously used technology to advance organizational improvement. However, as the PTLA survey did not include a question on this matter to principals, the perception reported by the faculty may not have been an accurate reflection of the principals' self-reported use of technology for organizational improvement.

A third limitation of this study relates to the second research question which asked for a description of technology use in schools for organizational, instructional, and educational purposes. The principal and organizational technology construct used to show how technology was used for organizational purposes had the highest scale score mean of all the constructs. Over 90% of the faculty agreed that technology was important to their principal. These results should not be generalized to represent the faculty who did not get the opportunity to respond to this survey because their principals chose not to participate. The responses to this item may be skewed by the design of the study which only surveyed the faculty of principals who participated in the survey. It follows that principals who valued technology would be more willing to participate in this kind of research study and so their faculty would evaluate them accordingly as principals that thought technology was important.

The educational technology outcomes constructs in the STO survey showed how technology was used for educational purposes through students' use of technology for completing assignments. These results were limited to teachers' perceptions of their students' technology use. Actual use of technology in schools reported by students, rather than their teachers, may be very different than the perceptions reported in the educational technology use construct and the technology progress, proficiency, and standards constructs by teachers.

The constructs used to measure the instructional and educational use of technology identified the types of hardware and software but did not afford faculty the opportunity to describe how they were used to achieve curricular objectives. There were no questions that allowed respondents to express how they used technology to stimulate higher order thinking skills and higher level learning objectives. The review of the literature described the role of technology in supporting and enhancing these vital instructional and educational components, but the STO survey did not provide respondents with an avenue to show how these were evident in their classrooms. This important aspect of technology use in schools was therefore not measured in this study.

A fourth limitation is accessibility to this study by principals and their faculty teachers and their inclination towards technology. The survey was only available online through the use of technology; the absence of hard copy alternatives may have discouraged educational leaders who were not confident or comfortable using technology. Principals and faculty that were not technologically inclined, and were apprehensive about revealing their technology ability may also have been discouraged from participating in this study. Consequently, the responses of faculty from the schools whose leaders chose not to participate were also omitted from the research. It follows that the data yielded in this study may have an inflated portrayal of the actual technology leadership behavior and technology use that takes place in schools.

Suggestions for Future Research

Although this study was unable to find a statistically significant relationship between the use of technology in schools and the technology behaviors and activities of educational leaders, there are a number of trends and similarities in the data yielded by principal and faculty respondents in this study to suggest that further research in this area is warranted. The use of technology in schools for different educational purposes and how educational objectives and outcomes connect with leadership and organization (Lay, 2007) are other valuable areas for future research. The use of technology for organizational, instructional, and educational purposes and the role of leadership in the diffusion of technology in these areas are all avenues for further investigation (Vensky, 2004.

Budgeting and expenditure for organizational technology and its effect on organizational growth, school improvement, and educational reform are all areas where research is needed. There is very little research on the role of technology in educational organizations and organizational learning. The findings of this study revealed that web-based skills development software received considerable use from teachers for organizational purposes, further research in this area may explain how enhanced reporting and analysis options in software offered on a variety of platforms can further assist teachers and administrators to simultaneously monitor and track individual and organizational progress.

Questions surrounding the amount and type of the benefits to students and teachers who use instructional technology remain topics for further research. How teachers and students use technology in schools, and how it is related to student achievement will also continue to be areas for debate. Research is needed that uses a variety of measurement techniques that are tailored specifically to the types of technology being used by respondents in the sample populations. The use of technology to achieve curricular objectives and stimulate higher order thinking skills may be better measured with a combination of quantitative and qualitative measurement techniques. Interviews and surveys with open ended questions may yield more insightful details about how technology is used for instructional and educational purposes than multiple choice questions and scale score analysis. Empirical research study designs that incorporate a variety of instruments designed specifically for these purposes (Achacoso, 2003) may deliver results confirming relationships between technology use and student achievement that are currently just speculations.

The use of technology as a tool for enhancing student cognition, motivation, and affective growth (Alanis, 2004) are areas where more research would provide greater insight into how technology is used for educational purposes. The expansion of virtual high schools and distance education in K-12 learning is another area where new technology has had an enormous impact on instructional and educational processes (Rice, 2006). Many of the studies about adult education distance learning could be replicated at secondary and elementary level as students of increasingly younger ages are experiencing the benefits of online learning opportunities. The use of wireless technology and one-to-one learning though the use of student laptops in the classroom (The Peak Group, 2002) is another exciting opportunity to discover how technology is changing the role of educators and student learning.

Finally, more research is needed to reveal the influence of the principal on school technology use (Anderson & Dexter, 2005). Previous research has shown that principals that advocate for technology funding at the national and state level are more involved with technology planning in their own schools. The relationship between long term strategic planning, public policy, and funding on technology use in schools over a period of years demands additional longitudinal research. As more technologically competent administrators enter leadership roles in schools, new research is needed to explain how their technology expertise alters their expectations and evaluations of technology use in the classrooms by their teachers and in turn its effect on the ways in which their students achieve learning objectives.

Conclusion

This research study sought to investigate whether the leadership behavior and technology activity of the principals affected the use of technology in schools. Educational leaders in Collier County, Florida showed superior leadership in all six technology standards for administrators expressed through their responses to the Principal Technology Leadership Assessment survey. The substantial response to the survey by over half of the principals in the target sample provided secondary evidence of their confirmed commitment to technology as a valued educational resource. These strengths however, did not translate directly into equally strong technology outcomes in their schools. The findings of this study showed that technology was being used by teachers for organizational purposes for conducting administrative and management tasks; for instructional purposes through planning and delivery of instruction; and for educational purposes by students for completing assignments. However, school technology outcomes at organizational, instructional, and educational levels respectively, could not be predicted by the technology leadership behavior of the building administrator.

The review of the literature suggested that much of the principal's leadership behavior could not be directly related to school outcomes because their efforts and influence were substantially mediated through the variety of activities and proceedings that occurred inside a complex organizational structure (Halligner & Heck, 1998). The findings of this research study confirmed that there was no measurable relationship between leadership and technology use. However similarities and trends between the two were apparent, suggesting that the two may be related in some indiscernible way.

School technology outcomes at all three levels, organizational, instructional, and educational showed that a variety of technology was used regularly by faculty for organizational and instructional purposes and by their students for educational purposes; but there was no statistical evidence to suggest that these uses were related to any of the technology behaviors reported by their principals. The extensive use of technology reported by faculty respondents to the survey instrument used in this study confirmed that infrastructures were in place to support widespread, continuous use of technology in the classroom. As modern technology becomes increasingly prolific as an educational tool in the classroom and administrators become more proficient at using this technology in their professional practice, further research involving these indicators would benefit from the development of instruments designed specifically to measure and describe the use of new and emerging technology in schools. Future research that integrates quantitative and qualitative design methodologies that compliment these measurement tools may yield a more concrete affiliation between the latest technological applications and leadership processes through long term study of systemic reform.

APPENDIX A PTLA SURVEY

Principals Technology Leadership Assessment

Instructions

Items in this survey are based on the International Society for Technology in Education's (ISTE) National Educational Technology Standards for Administrators (NETS-A).

The individual items in the assessment ask you about the extent to which you have engaged in certain behaviors that relate to K-12 school technology leadership. Answer as many of the questions as possible. If a specific question is not applicable, leave it blank. Note that leaving multiple items blank may limit the usefulness of the assessment results.

As you answer the questions, think of your actual behavior over the course of the last school year (or some other fixed period of time). Do not take into account planned or intended behavior. As you select the appropriate response to each question, it may be helpful to keep in mind the performance of other principals that you know. ***Please note that the accuracy and usefulness of this assessment is largely dependent upon your candor.***

Average time to complete the assessment is about 15 minutes. To take the assessment, log on to www.questionpro.com

Please check those that apply

☐ I have been a principal at this school for at least one school year.

☐ I have been a principal at this school for less than one full school year.

Please indicate the grade levels at your school

K - 5 6 -8 9-12

I. Leadership and Vision

1 To what extent did you participate in your district's or school's most recent technology planning process?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2 To what extent did you communicate information about your district's or school's technology planning and implementation efforts to your school's stakeholders?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3 To what extent did you promote participation of your school's stakeholders in the technology planning process of your school or district?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4 To what extent did you compare and align your district or school technology plan with other plans, including district strategic plans, your school improvement plan, or other instructional plans?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5 To what extent did you advocate for inclusion of research-based technology practices in your school improvement plan?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6 To what extent did you engage in activities to identify best practices in the use of technology (e.g. reviews of literature, attendance at relevant conferences, or meetings of professional organizations)?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

II. Learning and Teaching

1 To what extent did you provide or make available assistance to teachers to use technology for interpreting and analyzing student assessment data?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2 To what extent did you provide or make available assistance to teachers for using student assessment data to modify instruction?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3 To what extent did you disseminate or model best practices in learning and teaching with technology to faculty and staff?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4 To what extent did you provide support (e.g., release time, budget allowance) to teachers or staff who were attempting to share information about technology practices, issues, and concerns?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5 To what extent did you organize or conduct assessments of staff needs related to professional development on the use of technology?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6 To what extent did you facilitate or ensure the delivery of professional development on the use of technology to faculty and staff?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

III. Productivity and Professional Practice

1 To what extent did you participate in professional development activities meant to improve or expand your use of technology?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2 To what extent did you use technology to help complete your day-to-day tasks (e.g., developing budgets, communicating with others, gathering information)?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3 To what extent did you use technology-based management systems to access staff/faculty personnel records?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4 To what extent did you use technology-based management systems to access student records?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5 To what extent did you encourage and use technology (e.g., e-mail, blogs, videoconferences) as a means of communicating with education stakeholders, including peers, experts, students, parents/guardians, and the community?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

IV. Support, Management, and Operations

1 Support faculty and staff in connecting to and using district- and building-level technology systems for management and operations (e.g., student information system, electronic grade book, curriculum management system)?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2 To what extent did you allocate campus discretionary funds to help meet the school's technology needs?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3 To what extent did you pursue supplemental funding to help meet the technology needs of your school?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4 To what extent did you ensure that hardware and software replacement/upgrades were incorporated into school technology plans?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5 To what extent did you advocate at the district level for adequate, timely, and high-quality technology support services?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6 To what extent did you investigate how satisfied faculty and staff were with the technology support services provided by your district/school?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

V. Assessment and Evaluation

1 To what extent did you promote or model technology-based systems to collect student assessment data?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2 To what extent did you promote the evaluation of instructional practices, including technology-based practices, to assess their effectiveness?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3 To what extent did you assess and evaluate existing technology-based administrative and operations systems for modification or upgrade?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4 To what extent did you evaluate the effectiveness of professional development offerings in your school to meet the needs of teachers and their use of technology?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5 To what extent did you include the effective use of technology as a criterion for assessing the performance of faculty?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

VI. Social, Legal, and Ethical Issues

1 To what extent did you work to ensure equity of technology access and use in your school?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2 To what extent did you implement policies or programs meant to raise awareness of technology-related social, ethical, and legal issues for staff and students?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3 To what extent were you in involved in enforcing policies related to copyright and intellectual property?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4 To what extent were you involved in addressing issues related to privacy and online safety?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5 To what extent did you support the use of technology to help meet the needs of special education students?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6 To what extent did you support the use of technology to assist in the delivery of individualized education programs for all students?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

7 To what extent did you disseminate information about health concerns related to technology and computer usage in classrooms and offices?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

APPENDIX B SCHOOL TECHNOLOGY OUTCOMES SURVEY

SCHOOL TECHNOLOGY OUTCOMES SURVEY

☐ I have been a member of the faculty at this school for at least one school year.

☐ I have been a member of the faculty at this school for less than one full school year.

Please indicate the grade levels that you teach

K 1 2 3 4 5 6 7 8 9 10 11 12

Directions

This survey has two sections:

- In Part I please respond to the question by indicating how much you **AGREE OR DISAGREE** with the statement in the question.
- In Part II please respond to the question by indicating **HOW OFTEN** you use the technology contained in the question.

PART I: AGREE/DISAGREE

Please circle the number that represents how much you agree or disagree according to the following scale:
1 = Strongly Agree 2 = Agree 3 = Disagree 4 = Strongly Disagree

Section 1. Do you agree or disagree with the following statements?		**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
1.	Technology is important to the principal……………………	4	3	2	1
2.	The principal is proficient at using technology………………	4	3	2	1
3.	The principal has discussed the school technology plan with the faculty…………………………………………	4	3	2	1
4.	The school's technology goals are readily available to the faculty……………………………………………….…..	4	3	2	1
5.	The principal supports funding for new technology…………	4	3	2	1
6.	The principal supports training for new technology…..……..	4	3	2	1
7.	Our school relies heavily on technology ……………………	4	3	2	1
8.	Technology helps our school achieve AYP (Adequate Yearly Progress)………………………………………...	4	3	2	1
9.	Technology has helped our organization communicate more effectively…………………………………………………	4	3	2	1
10.	Our educational organization is proficient at using technology…………………………………………….....	4	3	2	1
11.	I use technology to plan for instruction………..…..…………	4	3	2	1
12.	I use technology to interpret and analyze student assessment data…………………………………………………...	4	3	2	1
13.	I would like to learn more about teaching with technology….	4	3	2	1
14.	I am familiar with the district technology standards for teachers………………………………………………….	4	3	2	1
15.	I would like to have more technology tools to deliver instruction………………………………………………	4	3	2	1
16.	My students use technology for completing assignments……	4	3	2	1
17.	My students are proficient at using technology for completing assignments……………………………...….……	4	3	2	1
18.	I would like to have more technology available for my students to use……………………………………...……	4	3	2	1
19.	My classroom computers are insufficient for my student needs……………………………………………………	4	3	2	1
20.	The school computer labs are readily available for students to complete assignments……………………………………..	4	3	2	1
21.	I use technology to achieve curricular goals………………....	4	3	2	1
22.	I am familiar with the district technology standards for students…..	4	3	2	1
23.	I monitor student progress in technology use………………...	4	3	2	1

PART II: – HOW OFTEN?

Please circle the number that represents how often you use the following technology items:

1 = Never 2= Occasionally 3= Frequently 4=Almost Always

Section 2. How often do you use the following technology items for administrative and management tasks?	**Never**	**Occasionally**	**Frequently**	**Almost Always**
24. Email software; e.g., Groupwise……………………………..	1	2	3	4
25. Online courses for professional development; e.g., long distance learning for ESOL and Reading endorsement………	1	2	3	4
26. Databases for student information; e.g., Data warehouse, Terms/Rhumba……………………………………………..	1	2	3	4
27. Websites for posting information for students and parents; e.g., Schoolnotes.com ……………………………………...	1	2	3	4
28. Shared network directory to access shared files………………	1	2	3	4

Section 3. How often do <u>you</u> use the following technology items for <u>planning and delivery of instruction?</u>		Never	Occasionally	Frequently	Almost Always
29.	Microsoft products for word processing and presentation (Word & PowerPoint)…………………………………….......	1	2	3	4
30.	Spreadsheet software; e.g., Microsoft Excel………………….	1	2	3	4
31.	Concept mapping software; e.g., Inspiration!………………...	1	2	3	4
32.	Image or video editing software; e.g., Paint, Adobe Photoshop, Macromedia Fireworks, Microrosft Moviemaker, Visual Communicator…………………………………………	1	2	3	4
33.	HTML editing/web page or desktop publishing software; e.g., Macromedia Dreamweaver, Microsoft Front Page, Microsoft Publisher…………………………………........................	1	2	3	4
34.	Internet search engines or online encylopedias; e.g., Google, Yahoo, Worldbook. Wikipedia ………………………………	1	2	3	4
35.	Web based skill development software; e.g., FCAT Explorer, Riverdeep……………………………………..……………….	1	2	3	4
36.	Online Text books………………………………………….	1	2	3	4
37.	Databases for student information; e.g., Datawarehouse, Esembler……………………………………………………	1	2	3	4
38.	Image capture devices; e.g., digital camera, scanner………..	1	2	3	4
39.	File copying and transportation devices; e.g., CD burner, portable flash drive……………………………………………	1	2	3	4
40.	Presentation devices; e.g., video projector, sound enhancement, interactive whiteboard ………………………...	1	2	3	4
41.	Portable wireless laptop computer or tablet ………………….	1	2	3	4
42.	DVD player………………..……………………………….	1	2	3	4

Section 4. How often do <u>your students</u> use the following technology items for <u>completing assignments?</u>		Never	Occasional	Frequently	Almost Always
43.	Microsoft products for word processing and presentation (Word & PowerPoint)………………………………………	1	2	3	4
44.	Spreadsheet software; e.g., Microsoft Excel………………….	1	2	3	4
45.	Concept mapping software; e.g., Inspiration/Kidspiration……	1	2	3	4
46.	Image or video editing software; e.g., Paint, Adobe Photoshop, Macromedia Fireworks, Microsoft Moviemaker, Visual Communicator……………………………………..….	1	2	3	4
47.	Html editing/web page or desktop publishing software; e.g., Macromedia Dreamweaver, Microsoft Front Page, Microsoft Publisher……………………………………....................	1	2	3	4
48.	Animation software; e.g., Macromedia Flash, Poser…………	1	2	3	4
49.	Design and engineering software; e.g., Autocad, Cadkey ……	1	2	3	4
50.	Internet search engines or online encyclopedias; e.g., Google, Yahoo Worldbook. Wikipedia……………………	1	2	3	4
51.	Web based skill development software; e.g., FCAT Explorer, Riverdeep…………………………………..……………….	1	2	3	4
52.	Online Text books………………………………………….	1	2	3	4
53.	Image capture devices; e.g., digital cameras & scanners …….	1	2	3	4
54.	Student response systems/classroom clickers………………...	1	2	3	4
55.	Portable wireless laptop computers ………………………….	1	2	3	4
56.	School computer lab……………………………………….	1	2	3	4
57.	Classroom computers…………………………………….....	1	2	3	4

APPENDIX C INSTITUTIONAL REVIEW BOARD APPROVAL

University of Central Florida Office of Research & Commercialization

April 13, 2007

Alexandra Page-Jones
c/o Dr. Jess House
University of Central Florida
Department of Educational Research, Technology, & Leadership
ED 223M
Orlando, FL 32816-1250

Dear Ms. Page-Jones:

With reference to your protocol #07-4264 entitled, "Leadership behavior and technology activities: The relationship between principals and technology use in schools," I am enclosing for your records the approved, expedited document of the UCFIRB Form you had submitted to our office. **This study was approved on 3/20/2007. The expiration date for this study will be 3/19/2008.** Should there be a need to extend this study, a Continuing Review form must be submitted to the IRB Office for review by the Chairman or full IRB at least one month prior to the expiration date. This is the responsibility of the investigator.

Please be advised that this approval is given for one year. Should there be any addendums or administrative changes to the already approved protocol, they must also be submitted to the Board through use of the Addendum/Modification Request form. Changes should not be initiated until written IRB approval is received. Adverse events should be reported to the IRB as they occur.

Should you have any questions, please do not hesitate to call me at 407-823-2901.

Please accept our best wishes for the success of your endeavors.

Cordially,

Joanne Muratori

Joanne Muratori
(FWA00000351 Exp. 5/13/07, IRB00001138)

Copies: IRB File
Jess House, Ph.D.

JM:jm

12201 Research Parkway • Suite 501 • Orlando, FL 32826-3246 • 407-823-3778 • Fax 407-823-3299

An Equal Opportunity and Affirmative Action Institution

APPENDIX D INFORMED CONSENT LETTERS

REVISED 4/7/07

First Email to Teachers

Dear Collier County Public School Faculty,

I am a Collier County Public School technology teacher and a doctoral student at the University of Central Florida. As part of my coursework I am conducting a survey, the purpose of which is to explore the relationship between principals' technology activities and leadership behaviors on technology use in schools. I am asking you to participate in this survey because of your position as a Collier County Public School educator.

Faculty at each school are being asked to voluntarily complete a survey about technology outcomes. This survey will only take about 15 minutes to complete. Results are compiled into a database that keeps all information strictly confidential. No names or e-mail address are included in the database. Participation in this study is entirely voluntary. Participants do not have to answer any questions they do not wish to answer. The results of this study may be published. However, the data obtained from you will be combined with data from others in the publication. The published results will not include your name or any other information that would personally identify you in any way. All answers will be completely anonymous and will be released only as summaries in which no individual answers can be identified. No individual results from participating schools will be released. There are no anticipated risks, compensation or other direct benefits to you as a participant in this study. You are free to withdraw your consent to participate and may discontinue your participation in the study at any time without consequence

My dissertation committee chair is Dr. Jess House. If you have any questions about the research project you can call me at (239) 784-2977 or email me at pagejoal@collier.k12.fl.us. This research has been reviewed and approved by the Collier County School District Research Oversight Committee and the UCF institutional Review Board. Questions or concerns about research participants' rights may be directed to the UCF IRB office, University of Central Florida Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246. The phone number is (407) 823-2901.

Your participation and support is greatly appreciated. By following this link and completing questions, you are providing me with your informed consent to participate in this research study.

http://www.questionpro.com/akira/TakeSurvey?id=676969

Thank you very much for your time.
Sincerely,

Alex Page-Jones
Technology Teacher – CCPS
Student, University of Central Florida

APPROVED BY
University of Central Florida
Institutional Review Board
VICE CHAIRMAN

Second Email to Principals

REVISED 4/7/07

Dear Collier County Public School Principals,

Last week I sent you an e-mail about participating in a research study I am conducting to explore the relationship between principals' leadership behaviors and the use of technology in schools. Your agreement to participate is very much appreciated. If you have already completed the survey please disregard this email letter.

If you are still deciding whether to participate in this survey, please be assured that all answers will be completely confidential and will be released only as summaries in which no individual answers can be identified. I am asking each school principal to complete a survey about technology activities and general leadership behavior. Faculty at each school will also be asked to volunteer to complete an anonymous survey about leadership and technology outcomes. The surveys are online and will take no more than 15 minutes to complete.

Results are compiled into a database that keeps all information **strictly confidential. Participation in this study is voluntary**. Participants do not have to answer any questions they do not wish to answer. The data obtained from you will be combined with data from others in the publication. The published results will not include your name or any other information that would personally identify you in any way. There are no anticipated risks, compensation or other direct benefits to you or the faculty who choose to participate in this study. You are free to withdraw your consent to participate and may discontinue your participation in the study at any time without consequence.

My dissertation committee chair is Dr. Jess House. If you have any questions about the research project you can call me at (239) 784-2977 or email me at pagejoal@collier.k12.fl.us. This research has been reviewed and approved by the Collier County School District Research Oversight Committee and the UCF institutional Review Board. Questions or concerns about research participants' rights may be directed to the UCF IRB office, University of Central Florida Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246. The phone number is (407) 823-2901.

If you have not already responded, please do so today by following this link and completing the survey about technology and leadership. It is important that I hear from as many principals in the school district as possible so that the responses represent an accurate reflection of leadership and technology in Collier County Public Schools. By following this link and completing questions, you are providing me with your informed consent to participate in this research study. Your agreement to participate does not implicate the participation of any members of your faculty, but affords me the opportunity to request their voluntary participation in an anonymous survey about technology outcomes.

Click below to follow the link and take the survey.
http://www.questionpro.com/akira/TakeSurvey?id=676992

APPROVED BY
University of Central Florida
Institutional Review Board
CHAIRMAN

Thank you again for your response.
Alex Page-Jones
Technology Teacher – CCPS
Student, University of Central Florida

REVISED 4/7/07

Second Email to Teachers

Dear Collier County Public School Faculty,

Last week I sent you an e-mail about a research study I am conducting on the relationship between principals' technology activities and leadership behavior on technology use in schools. Your participation is very much appreciated, and if you have already completed the survey please disregard this email.

If you are still deciding whether to participate in this survey, please be assured that your answers are completely anonymous and responses will be released only as summaries in which no individual answers can be identified.

It is important that I hear from as many teachers in the school district as possible so that the responses represent an accurate reflection of leadership and technology in Collier County Public Schools. Your participation in this study is entirely voluntary. Results are compiled into a database that keeps all information confidential. No names, or e-mail addresses are included in the database. Participants do not have to answer any questions they do not wish to answer. Your identity will not be connected to the answers you submit and participants will not be revealed in the final report. There are no anticipated risks, compensation or other direct benefits to you as a participant in this study. You are free to withdraw your consent to participate and may discontinue your participation in the study at any time without consequence

If you have any questions about the research project you can call me at (239) 784-2977 or email me at pagejoal@collier.k12.fl.us. This research has been reviewed and approved by the Collier County School District Research Oversight Committee and the UCF institutional Review Board. Questions or concerns about research participants' rights may be directed to the UCF IRB office, University of Central Florida Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246. The phone number is (407) 823-2901.

Your participation and support is greatly appreciated. By following this link and completing questions, you are providing me with your informed consent to participate in this research study.

http://www.Questionpro.com ...... (complete link an login directions to be announced)

Thank you again for your response.

Alex Page-Jones
Technology Teacher – CCPS
Student, University of Central Florida

APPROVED BY
University of Central Florida
Institutional Review Board
Vice CHAIRMAN

APPENDIX E SPSS OUTPUT

SPSS OUTPUT

Rotated Component Matrix

Component	**1**	**2**	**3**	**4**	**5**	**6**
How much do you agree or disagree with the following statements?						
1. Technology is important to the principal.			.745			
2. The principal is proficient at using technology.			.622			
3. The principal has discussed the school technology plan with the faculty.			.781			
4. The school's technology goals are readily available to the faculty			.705			
5. The principal supports funding for new technology.			.777			
6. The principal supports training for new technology.			.775			
7. Our school relies heavily on technology.				.411		
8. Technology helps our school achieve AYP (Adequate Yearly Progress).			.512			
9. Technology has helped our organization communicate more effectively.			.627			
10. Our educational organization is proficient at using technology. --			.673			
11. I use technology to plan for instruction						.526

Component	1	2	3	4	5	6
12. I use technology to interpret and analyze student assessment data.						.431
13. I would like to learn more about teaching with technology.						.610
14. I am familiar with the district technology standards for teachers.					.623	
15. I would like to have more technology tools to deliver instruction.						.748
16. My students use technology for completing assignment					.593	.413
17. My students are proficient at using technology for completing assignments.					.625	
18. I would like to have more technology available for my students to use. -						.753
19. My classroom computers are insufficient for my students' needs.						.512
20. The school computer labs are readily available for students to complete assignment						
21. I use technology to achieve curricular goals.					.427	.460
22. I am familiar with the district technology standards for students.					.754	
23. I monitor student progress in technology use.					.663	

Part II: How Often? ***How often do you use the following technology items for administrative and management tasks?***						
Component	**1**	**2**	**3**	**4**	**5**	**6**
24. Email software; e.g., Groupwise.		.481		.521		
25. Online courses for professional development; e.g., long distance learning for ESOL and Reading endorsement.				.489		
26. Databases for student information; e.g., Data warehouse, Terms/Rhumba.				.656		
27. Websites for posting information for students and parents; e.g., Schoolnotes.com.						
28. Shared network directory to access shared files .		.413		.542		
How often do you use the following technology items for planning and delivery of instruction?						
29. Microsoft products for word processing and presentation (Word & PowerPoint).		.627				
30. Spreadsheet software; e.g., Microsoft Excel.		.621				
31. Concept mapping software; e.g., Inspiration!		.473				
32. Image or video editing software; e.g., Paint, Adobe Photoshop, Macromedia Fireworks, Microrosft Moviemaker, Visual Communicator .		.612				
33. HTML editing/web page or desktop publishing software; e.g., Macromedia Dreamweaver, Microsoft Front Page, Microsoft Publisher.		.561				

Component	1	2	3	4	5	6
34. Internet search engines or online encylopedias; e.g., Google, Yahoo, Worldbook. Wikipedia.		.594				
35. Web based skill development software; e.g., FCAT Explorer, Riverdeep.				.715		
36. Online text books.		.410				
37. Databases for student information; e.g., Datawarehouse, Esembler .		.405		.519		
38. Image capture devices; e.g., digital camera, scanner.		.692				
39. File copying and transportation devices; e.g., CD burner, portable flash drive.		.696				
40. Presentation devices; e.g., video projector, sound enhancement, interactive whiteboard.		.629				
41. Portable wireless laptop computer or tablet.		.612				
42. DVD player.		.591				
How often do your students use the following technology items for completing assignments?						
43. Microsoft products for word processing and presentation (Word & PowerPoint)	.774					
44. Spreadsheet software; e.g., Microsoft Excel.	.731					
45. Concept mapping software; e.g., Inspiration/Kidspiration.	.644					

Component	1	2	3	4	5	6
46. Image or video editing software; e.g., Paint, Adobe Photoshop, Macromedia Fireworks, Microsoft Moviemaker, Visual Communicator.	.770					
47. Html editing/web page or desktop publishing software; e.g., Macromedia Dreamweaver, Microsoft Front Page, Microsoft Publisher.	.771					
48. Animation software; e.g., Macromedia Flash, Poser.	.766					
49. Design and engineering software; e.g., Autocad, Cadkey.	.719					
50. Internet search engines or online encyclopedias; e.g., Google, Yahoo Worldbook. Wikipedia.	.721					
51. Web based skill development software; e.g., FCAT Explorer, Riverdeep.	.475			.647		
52. Online Text books.	.596					
53. Image capture devices; e.g., digital cameras & scanners.	.722					
54. Student response systems/classroom clickers.	.544					
55. Portable wireless laptop computers.	.598					
56. School computer lab.	.556			.422		
57. Classroom computers.	.639			.498		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 8 iterations.

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	14.434	25.322	25.322	8.322	14.601	14.601
2	7.419	13.016	38.338	6.055	10.623	25.224
3	2.883	5.058	43.396	5.352	9.389	34.613
4	2.714	4.762	48.158	4.586	8.045	42.658
5	1.821	3.195	51.353	3.382	5.934	48.592
6	1.682	2.950	54.303	3.256	5.712	54.303
7	1.492	2.618	56.921			
8	1.379	2.419	59.340			
9	1.200	2.105	61.445			
10	1.117	1.960	63.405			
11	1.096	1.923	65.328			
12	1.018	1.786	67.114			
13	.926	1.625	68.739			
14	.846	1.485	70.224			
15	.837	1.468	71.692			
16	.785	1.377	73.069			
17	.768	1.347	74.417			
18	.727	1.276	75.692			
19	.697	1.222	76.915			
20	.678	1.189	78.104			
21	.631	1.106	79.210			
22	.622	1.092	80.302			
23	.599	1.051	81.352			
24	.581	1.020	82.372			
25	.560	.982	83.354			
26	.541	.949	84.303			
27	.511	.897	85.200			
28	.493	.865	86.065			
29	.458	.804	86.869			
30	.430	.754	87.623			
31	.426	.747	88.371			
32	.408	.716	89.087			
33	.387	.679	89.766			
34	.374	.656	90.423			
35	.369	.647	91.069			
36	.351	.617	91.686			
37	.343	.601	92.287			

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
38	.331	.580	92.867			
39	.325	.570	93.437			
40	.294	.516	93.953			
41	.276	.484	94.437			
42	.271	.475	94.912			
43	.263	.462	95.373			
44	.256	.450	95.823			
45	.241	.422	96.245			
46	.225	.394	96.639			
47	.223	.390	97.030			
48	.216	.379	97.409			
49	.211	.370	97.779			
50	.190	.333	98.111			
51	.172	.301	98.412			
52	.166	.292	98.705			
53	.165	.289	98.993			
54	.156	.274	99.267			
55	.145	.254	99.521			
56	.142	.249	99.771			
57	.131	.229	100.000			

Extraction Method: Principal Component Analysis.

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