

The Role of the School Superintendent as a Technology Leader:
A Delphi Study

by

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ABSTRACT

School superintendents have been thrust into the complex world of technology leadership often armed with little technology related training or expertise. District and school leaders are often faced with purchase decisions of costly equipment and software with minimum knowledge of what impact it will have on their organization or specific knowledge of how it will be used to meet curriculum goals. With continued local, state, and federal support and rapid advances in technology, school superintendents are expected to provide leadership in this fast-changing arena. The purpose of this study was to define the role of the school superintendent as an effective technology leader in terms of knowledge, performances, and dispositions. The research questions guiding this study were:

- What does a superintendent need to know about technology to be an effective technology leader?
- What actions should be performed by a superintendent to be an effective technology leader?
- What are indicators of a superintendent's disposition as an effective technology leader?

The study was conducted using a three-round Delphi with an expert panel composed of 29 stakeholders with diverse perspectives in the area of school technology leadership. The findings in this study showed a group consensus on 27 knowledge items, 27 performance actions, and 35 dispositional indicators of school superintendents as effective technology leaders. The study contains criteria that may be useful in the development of technology related preparation practices for school superintendents. The findings may also be of interest to those concerned with professional development for superintendents or to those involved in the selection of superintendents for technology leadership positions.

Dedicated to the memory of my loving mother:

Marie Mirra

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CHAPTER 1

INTRODUCTION TO THE PROBLEM

School leaders have been thrust into the complex world of technology leadership often with little training or expertise. District and school leaders are often faced with purchase decisions of costly equipment and software with little knowledge of what impact it will have on the organization or specific knowledge of how it will be used to meet curriculum goals (Cuban, Kirkpatrick, & Peck, 2001). Because technology has become a mainstay of our classrooms and because states continue to receive federal funding for the continued use of technology, (United States Department of Education, 2003) the topic of technology leadership warrants study for a variety of reasons.

First, expenditures to place technology into our schools are significant. The infusion of technology into public education over the last decade is well documented. According to recent government estimates, approximately \$5 billion is being spent annually in the United States to attain a computer to student ratio of 1:5 (United States Department of Education, 2000). Expenditures for technology include installation of technology infrastructure, purchase of hardware and software, employment of instructional technology and technology support staff and provision of professional development for teachers and other technology-related expenses (United States Department of Education, 2000). With taxpayer dollars being allotted on a regular basis, it is incumbent on school leaders and policy makers to ensure resources are utilized meaningfully and efficiently.

Second, computers in public schools have become a core addition in classrooms with connectivity to the Internet currently at an all time high. In seven years, the percentage of schools with Internet access rose from 35 % in 1994 to 99 % with access in

2001 (National Center for Education Statistics, 2003). Although our schools have been populated with computer technology, approximately only 35 % of teachers felt they were "well prepared" or "very well prepared" to use technology effectively (Education Week, 2002). While the 35% figure showed a significant gain from the prior year, the US Department of Education responded to the data by making the improvement of professional development for teachers in using technology a national goal. One only has to visit classrooms across the nation to conclude that computer technology is prevalent and available. In Virginia, for example, the student to computer ratio is 1:6 and the number of Internet capable classrooms is 93% (Education Week, 2002).

Third, because of the emphasis on technology in our schools over the past decade, school superintendents have found themselves in the complex and fast changing world of technology leadership (Hudanich, 2002). As such, they must understand not only technical requirements, but also the variables that affect a teacher's adoption of innovations in the classroom. As school divisions continue to invest in technology, it is important for school leaders to understand and be able to develop and articulate a clear vision of how technology can best be utilized in achieving school goals and objectives. Cuban (1999) stated that computers aren't used in classrooms partly due to a disconnect between policy and actual classroom practice "...the prevailing assumptions guiding policies on new technologies in schools are deeply flawed and in need of reassessment" (p. 830). It is important to note that some school divisions do "better" than others with the incorporation and integration of technology into the schools. Public school leaders in education are subject to influences acting upon them from multiple sources. They must be

attuned to the needs of students, teachers, parents, staff, as well as those of the community. The political landscape is one that cannot be disregarded if a school leader is to successfully move a school division through the rapidly changing world of technology and innovative uses of it.

Last, the topic of technology in education is of personal importance. As the Director of Instructional Technology and Information Services for a growing Virginia school district, I am accountable for all aspects of technology within our school division to include software and hardware acquisition, professional development, maintenance, data driven decision making, communication, and all other facets of technology support. I have first-hand knowledge of the tremendous benefits that correctly “infused” technology can provide to students as well as staff. Conversely, I have witnessed and been accountable for technology that is “force-fed” to staff and students causing inefficiency in terms of time and money.

Purpose

There is evidence that funding to place technology in our schools is continuing with emphasis on ensuring that the investment is having an impact on student achievement (United States Department of Education, 2003). The ever-changing nature of technology presents a formidable challenge for instructional leaders and administrators. Rapid changes to technology make it incumbent on school leaders to take an active role in the determination of school technology innovation, or run the risk of being “left behind” in technological advancement. The purpose of the study was to define

the role of the school superintendent as an effective technology leader in terms of knowledge, performances, and dispositions.

Research Questions

The study identified knowledge, performances, and dispositions that contribute to the superintendent's development as an effective school technology leader. The question guiding this study was this: What is the role of the school superintendent as an effective technology leader? Three additional questions were addressed in the study: (a) What does a superintendent need to know about technology to be an effective technology leader? (b) What actions should be performed by a superintendent to be an effective technology leader? and (c) What are indicators of a superintendent's disposition as an effective technology leader?

Conceptual Framework

“There are countless variables potentially influencing whether a change program is started” (Fullan, 2001, p. 53). As decision makers, school superintendents are subject to personal, external, and internal influences, that impact their knowledge, performances, and dispositions associated with a particular program or change process (Fullan, 2001; Rogers, 2003). The initiation of change with regard to technology leadership can result from the impact of any one or any combination of more than one of the influences. Influences on the emerging role of a school superintendent as an effective technology leader are shown in Figure 1.

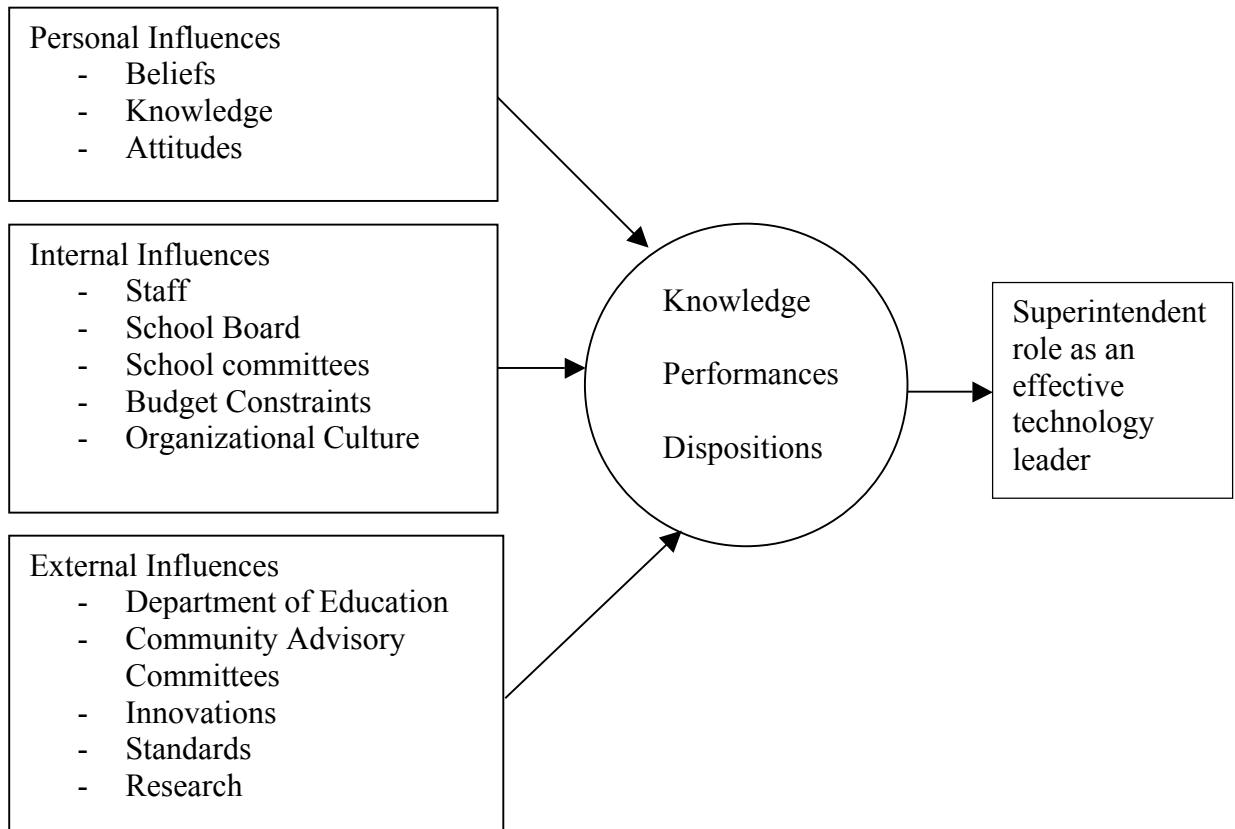


Figure 1 A conceptual framework for influences affecting the knowledge, performances, and dispositions of school superintendents as effective technology leaders.

Overview of Methods

The Delphi technique was used to gain consensus of an expert panel regarding knowledge, performances, and dispositions that are indicative of a superintendent as an effective technology leader. Because there is little research on the superintendent in the role of a technology leader, this study focused on the development of information that may be useful in the preparation of superintendents as technology leaders.

Definition of Terms

For purposes of this study, the following terms are defined:

Awareness Knowledge: The awareness that an innovation exists (Rogers, 2003).

Disposition: A proclivity to move an organization in one direction or another (Perkins, 1995). Dispositional indicators in this study included organizational evidences of a superintendent's attitude as an effective technology leader.

Educational Tool: An aid that mediates between our world and our understanding (Norton and Wiburg, 2003). Technology used in direct support of students engaging in the learning process. This may be in the form of independent learning activities or in the form of classroom instructional support.

How-to Knowledge: An understanding of how an innovation works and what benefit it might offer to an organization; how to knowledge includes information regarding how to use an innovation properly (Rogers, 2003).

Innovation: An idea, practice, or object perceived as new by an individual or other unit of adoption (Rogers, 2003).

Knowledge: An understanding of an innovation and how it works (Rogers, 2003).
What a superintendent should know to be an effective technology leader.

Performances: Those actions performed by a leader that indicate a level of proficiency (Chief Council of Chief State School Officers, 1996). Performances are defined in terms of actions performed by a superintendent who is an effective technology leader.

Principles Knowledge: An understanding of the underlying principles associated with adoption of an innovation (Rogers, 2003).

Technology: The systematic application of a design action that reduces uncertainty. Technologies usually consist of both hardware and software tools (Rogers, 2003). The definition is refined to include computers and their associated peripherals (printers, scanners, digital cameras, etc.) that have become widely available in school divisions within the last decade.

Significance

Research regarding the role of the superintendent as a technology leader has not been extensive. This study provides specific new information relative to the domains of knowledge, performances, and dispositions that may be useful in the development of school leaders as effective technology leaders. The study was conducted on a national level with a wide variety of experts participating.

Overview of the Dissertation

Chapter 1 contains an introduction to the problem, the purpose of the study, an overview of the research questions, a conceptual framework, an overview of the

methodology, definitions of terms, and significance of the problem. A review and synthesis of the literature is found in Chapter 2. The methodology for the study is presented in Chapter 3. Research findings and analysis of the data are summarized in Chapter 4. Chapter 5 contains the conclusions and recommendations for further research.

CHAPTER 2

REVIEW OF RELATED LITERATURE

The growth of technology in our public schools is obvious. The common measure of successful incorporation is often the student to computer ratio (Cuban et al., 2001). Measuring success with computer technology in schools has been largely a measure of “how many” rather than “how effective.” Over the last 10 years, schools have continually lowered the student to computer ratio (Cuban et al.). Between 1983 and 2001, the ratio of students to computers across the United States dropped from 92:1 to just over 5:1 (Education Week, 2002).

A comprehensive 10-year study, Apple Classrooms of Tomorrow (ACOT), associated with the adoption of technology by students and teachers in classrooms showed that simply placing state of the art technology into classrooms did not revolutionize classroom instruction (Sandholtz, Ringstaff, & Dwyer, 1996). Teachers and students exhibited five stages of orderly acceptance: (a) entry, (b) adoption, (c) adaptation, (d) appropriation, and (e) invention. Each of the stages is sequential and required at least two years of concentrated support to be realized. The study contained further data to suggest that although students’ learning tasks were unchanged, interactions with teachers became more collegial and often teaching methods became more facilitative than didactic when technology was integrated.

As school investment in technology continues, so do the requirements for continued, relevant, and meaningful research in the educational technology arena (Honey, McMillan, & Carrigg, 1999; Norris, Smolka, & Soloway, 1999; Thomas & Hofmeister, 2002). Research on factors affecting use and staff development (Blankenship, 1998;

Cuban et al., 2001; Hoover, 1997) were aimed at teacher utilization and training. Other studies (Honey et al.; Norris et al.) focused on the efficacy of one technology over another relative to student learning. These studies and others offered confirmation that certain technologies are effective (e.g. drill and practice software, instructional video television, or hypermedia applications). However, advances in technology such as shared virtual classrooms may be rendering many of these technologies relatively obsolete (Jukes & McCain, 2001). Because early technology-specific studies were associated with the effectiveness of technology as a learning aid, they did not explore more fundamental issues in technology associated with the development of suggestions to guide policy makers and practitioners in the area of technology leadership and decision-making.

National standards for administrators have been developed and published as part of an effort to address the need for technology savvy leaders in our schools. The standards were developed with the intent of providing guidelines on technology skill sets for students, teachers, and administrators. As of February 2004 the standards for administrators have been adopted, adapted, or aligned with other standards in 32 states (Collaborative for Technology Standards for School Administrators [TSSA], 2001). The standards have been embraced as broad based indicators of what all administrators should know and be able to do as leaders in the effective use of technology in schools (International Society for Technology in Education [ISTE], 2003).

Some states have chosen to develop their own technology standards. Virginia, for example, has adopted technology standards for teachers but not for administrators (Virginia Department of Education, 2002). The state endorsed administrator technology

and leadership training through the Virginia Initiative for Technology and Administrative Leadership [VITAL] program that is sponsored by the Bill and Melinda Gates Foundation. Superintendents can rely on this vehicle for administrator technology training in their districts, with a stipend of \$500.00 offered for all participants (Virginia Initiative for Technology and Administrative Leadership, 2002) but unlike standards for students and teachers, VITAL training is not mandatory, it is voluntary. All school divisions do not participate and the program of instruction delivered to school leaders is not necessarily based upon the standards that have been established for students and teachers. Because of this nonstandard approach, there is a potential disconnect between what leaders are learning about technology integration in classrooms and factors associated with technology's use or nonuse by teachers.

Factors affecting Use

Understanding the factors for use or nonuse of technology in classrooms is of concern to school leaders and technology decision makers. It is one thing to place technology in schools; it is another to use it. The conditions around which technology is used was germane in determining its effective use in classrooms (Blankenship, 1998; Cuban, et al., 2001; Jaber, 1997). Regardless of the claimed educational benefits, technology must be used to have any impact on learning. Though there has been a large influx of technology to public schools, (Anderson & Ronnkvist, 1999; Education Week, 1999), computer use classrooms is surprisingly low (Cuban, et al., 2001; Cuban, 1999; Kent & McNergney, 1999; Loveless, 1996; Office of Technology Assessment, 1995). The disparity between availability and use is cause for one to question the wisdom of

placement of computers in schools or perhaps more importantly to explore factors affecting technology's use in the school environment.

Factors affecting the adoption and use of technology in schools can be attributed to equipment availability, personal preference, training, mandates, perceived effectiveness and other factors (Honey & Moeller, 1990). Medelin (2001) identified social, motivational, and organizational factors associated with the decision to use electronic technologies in an instructional situation. Social factors included friends, mentors, peer support, and students. Organizational factors included physical supports such as network infrastructure, computer availability, and mandates from organizational leadership. Personal motivational factors included interest in enhancing student learning, improvement in teaching, and in the usage of instructional technologies.

Relevant Studies

Hoover (1997) conducted participatory action research in the development of a plan to implement the Commonwealth of Virginia's Technology Standards for Instructional Personnel (TSIPs). Three hundred-ninety instructional personnel were surveyed to determine the need for staff development to ensure wider classroom computer use across a school division. Findings included a wide degree of variance in teacher skill and the necessity for training.

Blankenship (1998) used both quantitative and qualitative methodologies in a study conducted to determine factors associated with computer use in classrooms. "Use" was measured in four ways: (a) over-all computer use and use in drill and practice, (b) whole class instruction, (c) student-directed learning, and (d) computer skills instruction.

The population of the study consisted of public school classroom teachers of Carroll County (Virginia) Public Schools. A survey instrument was designed to measure computer use and the factors related to use. Multiple regression techniques were employed to determine which factors were predictors of computer use by teachers in classroom instruction. The qualitative portion of the study consisted of the formation of five focus groups. The nominal group technique was used to create a prioritized list of strategies to improve teacher use of computers by focusing on the factors determined to be predictors. The primary findings of the study indicated that computer use varied by grade level. Teacher training was the most common predictor of computer use in the classroom followed by attitude, support, access, and age of teacher.

In another study Hester (2002) investigated the influence of select variables in the use of instructional computer activities to identify positive features and improvements needed to enhance the instructional use of computers within a school district in Shelby, Tennessee. A quantitative methodology was used in which a survey instrument was developed to ascertain relationships between selected variables and student and teacher use of computer technology in classrooms. The sample consisted of a randomly selected group of teachers (10) from each of 46 schools across the district. Two main findings of the study were that computer activities requiring critical thinking were most apt to be found in smaller K-5 schools rather than larger ones and use of computers requiring critical thinking were more likely to occur in both K-5 and 6-8 schools than in 9-12 schools. Other factors considered were teacher professional development, access to equipment, and technology maintenance support. Surprisingly, the results showed little or

no relationship between these factors and technology use in the classroom.

In a study designed to ascertain factors that hinder or facilitate teacher use of technology in classrooms, Zhao, Pugh, Sheldon, & Byers (2002) showed the emergence of data around three themes associated with teacher use or non use of technology innovations: (a) the innovator, (b) the innovation, and (c) the context. Each of the themes contained subsets that included familiar factors such as teacher proficiency, access, support, and infrastructure. In this study, the notion of distance from pedagogical beliefs emerged as a factor that might affect teacher adoption of technological innovations and use of technology in the classroom. The practices of 10 teachers (cases) were analyzed using the precepts of grounded theory in which a constant comparison approach was taken in search of common themes.

In another qualitative study (Cuban, et al., 2001) studied the effect of high technology access in two high schools located in northern California's silicone valley. Data were collected through interview, inspection of documents, surveys, and shadowing of 21 students and 26 teachers. Findings suggested that access to equipment and software seldom led to widespread teacher or student use. The researchers argued that time and training were key factors hindering more widespread use. Also suggested as explanations for low use was the notion of "slow revolution" in which there existed a lag time between an innovation and its acceptance. A second explanation given for low use was that high schools exist in context as principally "teacher centered" instructional institutions.

Synthesis of Research Studies

Each of the studies chosen for analysis presented findings that pertained to factors related to teacher and student use of technology in the classroom. Common themes among the early studies (Hoover, 1997; Blankenship, 1998) as well as more current ones (Hester, 2002; Zhao et al., 2002; Cuban et al., 2001) related use to time, access (to include instructional and technical support), and training. It was interesting to note that although different methodologies were used in the studies, these three factors were consistently common.

Zhao et al., (2002) following the precepts of grounded theory (Strauss & Corbin, 1998), presented additional factors associated with use of technology in classrooms that included a foundation in innovation and context. The identification of 11 prominent factors included the three previously mentioned but also included pedagogical beliefs, social awareness, technological infrastructure, and human infrastructure as key factors associated with use. Other factors in the study could be generally classified as inclusive of the consistently recurring factors of time, access, and training.

Each of the studies was limited in that sample size was relatively small, which could limit generalization. The largest study (Hester, 2002) was conducted with a sample of 460 while the smallest (Zhao et al., 2002) was completed with a sample of 10. All studies focused on technology use in classrooms. Though some studies referenced the leader's role in facilitating the use of technology in schools, rigorous research on the topic of technology leadership was noticeably absent. Only available were opinion pieces and editorials.

Research Implications

Since the widespread introduction of technology into our classrooms, research on the topic seemed to be centered on its use and efficacy. Key areas that received minimal research “air time” included leadership factors associated with technology in schools, the impact of the community on school technology decisions and direction, and the role of key leaders in schools in the area of school technology.

Though the literature regarding classroom teaching and learning had much to offer (Becker, 1989; Peterson & Walberg, 1979; Wittrock, 1986), there seemed to be a paucity of attention devoted to the rationale and logic of how and why classroom teachers actually incorporate technology in their teaching. “There has been relatively little research on how and why American teachers use technology” (United States Office of Technology Assessment, 1995, p. 51). Predominant in the literature about teachers and technology were survey studies attempting to correlate the many variables influencing teachers’ use of technology for professional and personal reasons (Becker & Ravitz, 1999; Honey & Moeller, 1990; Hoover, 1997; Harris & Grangenett, 1999; Jabar, 1997). While important to the body of literature in the area, these types of studies explored neither the notion of teacher adaptation to innovation, nor did they investigate the leader’s role in the diffusion of technology as an innovation.

Although past research in educational technology has mostly ignored the issue of leadership and innovation as factors related to computer use, there remain many explanations about why computers and other technologies have not been used more in schools. Explanations for nonuse include: incompatibility between technology and the

current school culture, inherent unreliability of technology, ill-preparedness of teachers, poor quality of educational software, conservative teaching methods, preoccupation with standardized assessments, and resistance to change (Collins, 1996; Cuban, 1986, 1999; Hodas, 1993; Loveless, 1996; Zhao, & Cziko, 2001; Zhao et al., 2002).

While each of the explanations for use or nonuse of technology by teachers is well documented, the leadership context associated with each explanation was is not well defined. Neither are the requirements for effective technology leadership. The literature includes such a wide variety of factors affecting technology use that it is extremely difficult for school leaders to draw any meaningful insights as to what they might do to improve their school division's technology posture. These issues present school superintendents and other school leaders with formidable leadership challenges

Leadership Considerations

The literature in the area of technology leadership in schools did not present a clear roadmap for school leaders to follow. Because of the many potential roles for technology in education and because of limited monetary and human resources it is necessary for school leaders to understand and articulate what their vision might be for technology as educational as well as business tools (Anderson, 1999; International Society for Technology in Education, 2003). Understanding innovation and change as they relate to technology implementation offers a logical perspective for leading schools toward efficient uses of their limited resources.

Innovation and Change

Rogers (2003) theorized, “the innovation-decision process begins with the knowledge stage, which commences when an individual (or other decision-making unit) is exposed to an innovation’s existence and gains an understanding of how it functions” (p. 171). Rogers saw the diffusion of innovations within an organization in specific stages: (a) knowledge, (b) persuasion, (c) decision, (d) implementation, and (e) confirmation. The placement of state of the art technology into schools often represents the diffusion of an innovation at the implementation stage without the benefit of knowledge. Rogers offered three kinds of knowledge as a necessary backdrop for innovation decision-making: (a) awareness knowledge, (b) how-to knowledge, and (c) principles knowledge.

Awareness knowledge is simply the awareness that an innovation exists. How-to knowledge includes an understanding of how an innovation works and what benefit it might offer to an organization. Principles knowledge is the most complex form of knowledge regarding an innovation. It includes the leader’s understanding of underlying principles associated with adoption (Rogers, 2003). An educational example of principles knowledge related to adoption of technology in schools is understanding how a computer in a classroom might transform the way teachers teach or the way students learn in terms of authentic problem solving.

Rogers (2003) categorized individuals according to a combination of actions related to change and adoptive behaviors. He developed the classifications of innovators, early adopters, early majority adopters, late majority adopters, or laggards. Earlier

research (Hamilton, 1992) asserted that individual predispositions and the timing of their responses to the adoption of newer methods and innovations might be predicted. Thus, it might be possible for school leaders to ascertain organizational “readiness” for change or it may be feasible for school leaders to influence individuals within organizations to accept change. Rogers (2003) argued that any innovation must be successfully diffused across an organization if it is to be integrated. It is not enough for a school leader to dictate the adoption of innovation; rather the leader must be successful in influencing the members of an organization to adopt it.

The role of the leader in the adoption of school technology is not clear. Educational leaders are expected to be decision-makers yet some (Reidl, Smith, Ware, Wark & Yount, 1998) indicated that leaders are in some ways being left out of the rush to technology and innovation. While there are national technology standards for indicators of administrative leadership in technology (International Society for Technology in Education, 2003) they are guidelines only and are not binding on administrators as they and other standards are on students and teachers. Without specific standards, school leaders stand a good chance of not only being “left behind” students and teachers in a basic understanding of technology’s role as an educational tool; they also run the risk of having little leadership credibility in the area of technological innovations for their schools.

With computer processing power doubling every 18 months or less (Jukes & McCain, 2001) what was once a Cray supercomputer filling an entire room in 1991, has since become the equivalent of a Sony Play Station without color. With technology

changing so rapidly, it is incumbent on school leaders to take an active leadership role in technology decision-making and in the development of a technology vision for a school division.

Vision

The literature frequently refers to “vision” as a characteristic of a leader. Manasse (1986) offered four different types of vision: (a) organizational, (b) future, (c) personal and (d) strategic. Organizational vision involves having a complete picture of a system's components as well as an understanding of their interrelationships. “Future vision is a comprehensive picture of how an organization will look at some point in the future, including how it will be positioned in its environment and how it will function internally” (p. 157). Personal vision includes the leader's personal objectives for the organization and serves as the driving force for the leader's actions that will link organizational and future vision. “Strategic vision involves connecting the reality of the present (organizational vision) to the possibilities of the future (future vision) in a unique way (personal vision) that is appropriate for the organization and its leader” (p. 162). A leader's vision needs to be shared by those who will be involved in the realization of the vision. The need for a clearly articulated vision of where the leader wants an organization to “go” technologically is clear (International Society for Technology in Education, 2003; Loveless, 1996; Means, 1994; Picinano, 2002). Development of that vision however, has been left largely up to the individual leaders. How leaders, specifically superintendents, view their role as technology leaders is important to the development of an organizational technology culture.

The notion of “vision” has been expanded to include members of organizations as sharing the vision. Manasse (1986) saw vision shared between leaders and organizational members as a distinguishing factor between true leaders and managers. A leader's vision needs to be shared by those who will be involved in the realization of the vision. Whether the vision of an organization is developed collaboratively or initiated by the leader and agreed to by the followers, it becomes the common ground, the shared vision that helps to motivate all involved. "Vision comes alive only when it is shared" (Westley & Mintzberg, 1989, p. 21). Shared vision is a necessary catalyst for change.

Educational change encompasses a change in practice at any level within an organization (Fullan, 2001). As an innovation, teacher adoption of technology in a classroom, for example, would entail a change in practice. Fullan (2001) saw three dimensions associated with educational change and the implementation of innovative policies or practices: (a) the possible use of new materials (technologies), (b) the possible use of new teaching approaches (strategies or activities), and (c) the possible alterations of beliefs (pedagogical assumptions and underlying theories). Understanding these dimensions is of interest to those charged with leading the implementation of innovations. The changing nature of leadership responsibilities and roles of school superintendents over the years may be categorized as byproducts of educational change dimensions (Fullan, 2001).

Evolution of the Superintendency

The position of public school superintendent was established in the mid 1800s with administrative duties as the superintendent's main focus. In the first half of the

twentieth century, the role of the superintendent expanded to include a business management requirement. Preparation programs for superintendents were primarily focused on technical and business management aspects of the position. In the late 1950s, the position became subject to more public attention and criticism. (Carter & Cunningham, 1997).

In response to public attention and criticism, the late sixties saw the superintendent's role expand. Superintendents became responsible for "planning and evaluation; organization; management of personnel; business, buildings, and auxiliary services; provision of information to the community; and coordination of the entire school system" (American Association of School Administrators & National School Boards Association, 1968, p.6).

The 1970s saw the superintendent's role as becoming more controversial. Besides serving the school board, the superintendent was expected to be responsive to a wide group of disparate interest groups and stakeholders. The superintendent became subject to multiple influences and often conflicting political agendas (Boyd, 1974; Cuban, 1976). During this time the notion of accountability became a predominant focus of the superintendency (Carter and Cunningham, 1997).

With the publication of "A Nation at Risk" in 1983, increased pressure on superintendents was obvious as politicians became more inclined to "fix" education (Carter & Cunningham, 1997). As the school reform movement continued, the job expectations of the superintendent expanded to include the necessity to garner community support for reform efforts aimed at increasing student achievement. As a

result of the school reform movement superintendents were expected to become actively involved in instructional leadership (Bjork, 1993). During the 1990s a continued decline of the superintendent's positional authority was noted. Both the privatization of public education and state takeovers of school board functions were primary evidences of the decline (Glass, 1997).

It is clear that the role of the superintendent has continually evolved since its inception in the mid 1800s. Early criticisms required superintendents to pacify community and political pressures, and more recent criticisms have required them to look inward while becoming knowledgeable in all areas of education in a school division.

Specific university level preparation programs for superintendents are not plentiful as most states grant superintendent licensure to graduates of Ph.D. and Ed.D. programs in educational administration. Because requirements of the superintendency vary dependent upon size, location of district, state laws, local school boards, and other complexities, preparation programs are generalized to a great extent (Kowalski, 1999).

In the area of technology in schools, however, certain commonalities are evident as challenges for school leaders. Almost all schools are wired and connected to the Internet. In order to maintain connectivity certain recurring technology decisions will continue to be necessary. Because funding from federal, state, and local sources will be available, superintendents will need to be prepared to provide leadership in the technology arena. Superintendents working in concert with local school boards should be informed leaders capable of tapping into technology to strengthen teaching, learning, and school governance (Goodman & Zimmerman, 2000).

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

This chapter contains an overview of the purpose for the study, a presentation of research questions, a description of the research design and rationale, and a description of the procedure. The topic was developed through a review of the literature, discussions with people who are knowledgeable in the area of technology and leadership, and from personal experience. The Delphi technique was used because the researcher was seeking a group consensus regarding a school superintendent's role as an effective technology leader.

Purpose

The purpose of this study was to define the role of the superintendent in terms of knowledge, performances, and dispositions as effective technology leaders. The literature in the area of technology leadership in schools does not offer a clear model for school leaders in ensuring the best possible use of technology resources given to school divisions. Because of the many potential roles for technology in education and because of limited resources, it is necessary for school leaders to understand and articulate their vision for technology as educational and business tools. This study identified knowledge, performances, and dispositions that contribute to the school superintendent's development as an effective school technology leader.

Research Questions

This study was conducted to identify the knowledge, performances, and dispositions that identify school superintendents as effective technology leaders. The overarching question guiding the study was: What is the role of the school superintendent as an effective technology leader? Specific research questions for the study were: (a) What does a superintendent need to know about technology to be an effective technology leader? (b) What actions should be performed by a superintendent to be considered an effective technology leader? and (c) What are indicators of a superintendent's disposition as an effective technology leader?

The domains that anchor each of the research questions: knowledge, performances, and dispositions are patterned after those found in the Interstate School Leader's License Consortium (ISSLC) Standards (Chief Council of Chief State School Officers, 1996). The standards are the product of a collaborative effort by 24 state education agencies and representatives. The standards have been either adopted or have been adapted for use by 35 states.

Research Design and Rationale

The study was conducted using the Delphi technique, a process that assembles the ideas and opinions of a group of individuals considered to be knowledgeable experts in a given field. The purpose of a Delphi is to produce a reliable consensus of opinion through the use of a panel of experts (Linstone & Turoff, 1975). "Delphi may be characterized as a method for structuring a group communication process so that it is effective in allowing a group of individuals, as a whole, to deal with a complex problem" (Linstone & Turoff,

p.3). The design was germane in this study due to limited research available on the specific knowledge, performances, and dispositions of school superintendents as effective technology leaders.

Type of Design

The Delphi technique involves the interaction between a researcher and a group of identified experts on a topic, through sequencing a series of questionnaires (Skutsch & Hall, 1973). Pfeiffer (1968) recommended a three step process in the conduct of a Delphi: (a) the development and distribution of an open ended question or a series of questions; (b) a second “round” of questions that represents a synthesis of the responses to the first set of questions in which the experts are asked to rate each item by some criterion of importance; and (c) a third round of questions that includes the results of the previous rounds and an opportunity for revision of previous responses in an attempt to gain consensus.

Brooks (1979) identified the following steps in using the Delphi technique:

1. Identify a panel of experts.
2. Determine willingness of individuals to participate.
3. Gather individual input on the issue being studied.
4. Analyze initial data from the panel.
5. Compile information and develop a new questionnaire for a second round of input.
6. Analyze second round input and return to panel members.

7. Request that all panel members evaluate their responses relative to responses from the group.
8. Analyze input and conduct a third and final round of questions (Brooks, p. 379).

The Delphi technique has the following advantages: (a) there is no requirement for the expert panel to meet as a group, hence a national survey is logistically feasible in a reasonable period of time and with minimal expense; (b) responses are anonymous among participants, thus providing an environment of collegial idea sharing; and (c) feedback to panel members is moderated by a facilitator (Linstone & Turoff, 1975; Martino, 1972).

Role of the Researcher

I am currently the Director of Instructional Technology and Information Systems for Stafford County Public Schools in Virginia. I began my professional association with technology in education as an assistive technology specialist in burgeoning Stafford. I was directly accountable for the development and implementation of a division-wide assistive technology program under the auspices of the director of special education. The primary goal of this emergent program was to establish a standardized system of matching student instructional needs to available technology solutions to meet curriculum goals. Solutions are in the form of appropriate software and hardware that enable both access to and understanding of the goals developed as part of a student's Individualized Educational Plan (IEP). Perhaps the most unique aspect of the program is to first consider the learning goals of students then to look to technology for assistance in meeting those

goals. This is in contrast to typical one-size fits all technology acquisition in which software titles and hardware are frequently provided in bulk to schools and classrooms with little or no thought as to specific needs or desired learning outcomes.

As I gained experience in the assistive technology arena, it became obvious that the individual approach and methodology used to match students' needs to technology solutions was easily transferable and could be successful in meeting the needs of a wider group of students. I became interested in understanding how technology could assist in meeting the needs of all students. Many of the solutions that worked for students with special needs, were also applicable to other students with learning challenges. The school division leadership team soon adopted specialized software that could predict words, talking word processors, and specialized hardware to assist in the writing process as necessary classroom tools across the entire division.

What I noticed from the system wide availability of devices and hardware was that some teachers used the technology and some did not. Even in cases where technology tools clearly could have assisted their students, some teachers would choose not to employ them. This phenomenon served as the backdrop for this study.

Procedures

The research procedure consisted of a three-round Delphi to gain consensus on determination of the necessary knowledge, performances, and dispositions required for school superintendents to be considered effective technology leaders. The Delphi I instrument consisted of three open-ended statements: (a) To be an effective school technology leader, a superintendent should know; (b) To be an effective school

technology leader, a superintendent should perform the following; and (c) The following are indicators of school superintendent's disposition (attitude) as an effective technology leader. Questionnaires were developed for rounds two and three based upon the synthesis of responses from each previous round. The questionnaires for Delphi II and III consisted of a five-choice Likert scale instrument that was mailed to each panel member.

Responses were gathered, collated, and redistributed after each round. After rounds two and three, statistical analysis of results was performed using Microsoft Excel, NCSS, and SPSS statistical software. The final results were shared using statistical measurement with the final figures representing the group's ideas.

Setting

The study was conducted on a national level with all participants agreeing to take part in a three round Delphi. An internal committee (Appendix A) consisting of persons with technology leadership experience and school leadership experience assisted in the identification of potential expert panel members and as a resource in development of each of the survey instruments.

Panel Member Identification and Selection

Scheele (1975) recommended three types of panelists for a successful Delphi: (a) stakeholders, or those who will be directly affected by the developed consensus; (b) those with relevant experience in the area being studied; and (c) facilitators, those with the ability to synthesize and offer more global views. For this study, stakeholders consisted of school board members, school district technology directors, school principals, school superintendents, teachers recognized in the area of technology integration, and parents of

students in public schools. For those with relevant experience in the area being studied, the study included leaders at state and national level organizations, published technology experts, and university level faculty charged with the development of educational leadership curricula for school leaders. I served as the facilitator.

Selection of panel members was based upon my personal knowledge, input from the internal committee, and recommendations of expert panel members. The number of panelists for a Delphi study typically ranges from 10 to 50 individuals depending on the nature of the topic (Linstone & Turoff, 1975). A total of 29 panelists participated in the study. The panel was composed of 11 males and 18 females representing 11 states, the District of Columbia, and Canada. Of the 29 panelists, one was African-American.

Because the purpose of the study was to seek consensus of experts on a particular topic, geographic dispersion of panel members was not a primary concern in panel selection. Expertise in some aspect of technology leadership in schools was the primary criterion. The following panelists participated in the study:

Nationally Recognized Members

Ian Jukes is the Director of the InfoSavvy Group and the Committed Sardine Website. He is a visionary thinker in the area of technology in education.

Dr. Jamie McKenzie is the editor of the electronic educational technology journal, From Now On. He is also the founder of the From Now On press, a technology oriented publishing company. Dr. McKenzie has served in the positions of teacher, principal, assistant superintendent and superintendent.

Ann Flynn is the Director of Educational Technology at the National School Boards Association (NSBA) in Alexandria, Virginia.

Judy Wurtzel is Executive Director of the Learning First Alliance headquartered in Washington DC. The alliance is a collaboration of 12 national organizations working to improve student learning in America's public elementary and secondary schools.

Parents

Joy Hall Bryant of Austin, Texas is past president of Northwest Elementary School Parent Teacher Organization, Pflugerville Independent School District, near Austin. She works as a technology analyst for the Texas Department of Information Resources.

Melissa Caswell of Palo Alto, California is president of the Duveneck Elementary School PTA. She is an active parent leader.

Corinne Wolfe-Cornwell of Virginia Beach, Virginia is the parent of students in the Virginia Beach school system. She is the PTSA president and member of the planning council at Princess Anne High School in Virginia Beach.

Principals

Mary Foreman is principal of Stafford Elementary School in Stafford, Virginia. She is an advocate for technology integration into the classroom.

Cindy Rudrud is the principal of Raymond S. Kellis High School in Glendale, Arizona. She is currently serving as President of the National Association of Secondary School Principals (NAASP).

Paul Stringer is the principal of Weaver High School in Hartford, Connecticut. Mr. Stringer was named Connecticut's high school principal of the year for 2003.

School Board Members

Cathy Kroymann is president of the Palo Alto Unified School Board in Santa Clara County, California. She is also past president of the Santa Clara County School Boards Association. Santa Clara County is in the heart of California's Silicone Valley.

Susan Mayer is the school board president of the Campbell Union School District in Campbell, California.

Ellen Wheeler is the clerk of the school board for the Mountain View-Whisman School District in Mountain View California. She is an attorney and a credentialed teacher.

School District Technology Professionals

Dan Greenwood of Richmond, Virginia is the technology director for St. Catherine's school in Richmond. He is the author of a guide on digital video production. (Greenwood, 2003).

Dan Hopper is the Director of Technology for King George County Public Schools in Virginia. He has been active in the development and implementation of technology in education for over 10 years.

Jan Wee is the Technology Services Director for the Cooperative Education State Agency #4 (CESA #4) in Wisconsin.

Dr. Nan Wodarz is the Director of Academics at the Church Farm School in Paoli, Pennsylvania. Dr. Wodarz is an adjunct faculty member at Penn State University. She has previously served as a technology director in the Paradise Valley School District in Phoenix, Arizona.

School Superintendents

Dr. Fred Frick of Holmen, Wisconsin is the District Administrator for the Holmen School District.

Dr. Tim Jenney is Superintendent of the Virginia Beach City Public Schools in Virginia. Dr. Jenney is recognized as a visionary leader in the area of technology in education.

Jim Negri is the superintendent of the Mountain View-Whisman School District in Mountain View, California.

State Education Leaders

Dr. Larry Hoover of Kilmarnock, Virginia was instrumental in the development of technology standards for Virginia teachers as a member of the Executive Committee on the Virginia Educational Technology Advisory Committee. He is the former superintendent of Gloucester County Public Schools in Gloucester, Virginia.

Margaret McKinnon is the Title 1 Supervisor and No Child Left Behind Administrator for the Alaska Department of Education.

Lan Neugent is the Assistant Superintendent for Technology at the Virginia State Department of Education.

Teachers

Jackie Chow of Palo Alto, California is a fourth grade teacher at Juana Briones Elementary School. She maintains an active classroom web page that can be found at <http://montblanc.pausd.palo-alto.ca.us/~jchow/>

Kathy Schrock is currently serving as the Administrator for Technology for the

Nauset Public Schools on Cape Cod, Massachusetts. Previously a library media specialist, she is very interested in search strategies, evaluation of Internet information, copyright issues, and use of the computer as a tool to support instruction. Kathy's web site is sponsored by the Discovery Channel and can be found at <http://discoveryschool.com/schrockguide/>

Linda Leyva is a high school science teacher at Palo Alto High School in Palo Alto California.

University Faculty

Dr. Chris Dede of Cambridge, Massachusetts serves as the Chair, Learning and Teaching in the Graduate School of Education, Harvard University. He is a Timothy E. Wirth Professor in Learning Technologies.

Dr. Barbara Lockee is an Associate Professor of Instructional Technology in the Department of Teaching and Learning at Virginia Polytechnic Institute and State University. Dr. Lockee has been involved in the development of online courses designed to give K-12 teachers the instructional technology tools needed in today's public schools.

Dr. Priscilla Norton is a professor in the Graduate School of Education at George Mason University, Fairfax, Virginia. She is the co-author of a book addressing instructional technology and design of learning (Norton & Wiburg 2003).

Assurances of Confidentiality

Individual responses were known only to the researcher throughout all rounds of the Delphi. All participants agreed to have their names and a brief description of their area of expertise published as part of the study.

Issues of Entry and Ethics

Participants were asked to participate in the study on a voluntary basis initially by individually prepared email messages containing a brief description of the study. Follow up contact via telephone was made in three instances as requested by the participants. Perhaps the single most important factor in improvement of survey response rates is to ensure there are multiple contacts (Dillman, 2000). Re-contact of non-responders included multiple mail, email, and phone contacts. Because the focus of the study dealt with technology, and those knowledgeable in the area of technology, there was a high technology “comfort level” with electronic communication and survey completion. Six of the panelists requested that each round of the Delphi be sent to them electronically for completion. The remaining 23 surveys were sent and returned by postal service. “A mixed mode method of surveys provides an opportunity to compensate for the weaknesses of each method” (Dillman, p. 218).

The participation of all panel members was in accordance with guidelines set by the Virginia Tech Institutional Review Board for projects involving human subjects (Institutional Review Board [IRB], 2003). Participation was strictly on a voluntary basis and all participants were informed of their right to terminate their involvement in the study at any time without fear of retribution. The potential for injury or unethical treatment of human subjects was considered and determined to be negligible.

Data Collection

The study was conducted to create a consensus regarding knowledge, performances, and dispositions necessary for school superintendents to be considered

effective technology leaders. The Delphi technique was chosen to facilitate obtaining input from a diverse group of panelists without the requirement of bringing the group together. Measures taken to increase response rates on each of the three rounds were: (a) an email reminder on the survey due date, (b) a telephone reminder one week after the due date, and (c) another telephone reminder 1 week after the due date. Self-addressed postage paid envelopes were used for all mailings. Each participant's name was placed in the lower left corner of each self-addressed stamped envelope for easy identification upon return.

Pilot Study

A pilot study was used to assist in the development and refinement of each round of the Delphi. Input from individuals representative of the expert panel was received and the final survey instrument was developed for each round. In all instances, recommendations on pilot study instruments were associated with grammar and clarity of meaning. Examples included spelling out abbreviations such as "LAN" with local area network, and adding the word technology to the phrase "evidence of cost/benefit analysis is ongoing" to read, "evidence of technology cost/benefit analysis is ongoing." Recommendations from each pilot study did not advocate removal of any items from the corresponding Delphi instruments.

Delphi I

The first round instrument consisted of three open-ended statements designed to elicit general statements of opinion from each panelist. Each panelist was asked to write as many responses as possible to each of the statements. To anchor the statements,

definitions for key terms were available to all members of the expert panel. Martino (1972) indicated that panelists might have difficulty in the generation of lists of characteristics or attributes in an unstructured scenario. Example answers were provided to ground the expert panel members in the requirements. A packet of information (Appendix C) was sent to each participant that included: (a) a letter that confirmed each panel member's participation and the established timeline, (b) a participant agreement form, and (c) a Delphi I instrument. All forms to be returned were on green colored paper for easy identification.

Upon receipt of responses from each of the twenty-nine panelists, individual responses were entered into excel formatted spreadsheets with individual worksheets entitled knowledge, performances, and dispositions. Panelist responses were sorted and grouped with similar responses being compiled to avoid redundancy. Using this method, all responses were reviewed and compiled in preparation for development of the Delphi II instrument.

Delphi II

Each of the items from the Delphi I instrument was placed on an instrument that measured panel member responses to each item on a five point Likert scale. Ratings on the scale were as follows: (a) 1= not important; (b) 2= slightly important; (c) 3= important; (d) 4= very important; and (e) 5= extremely important. A second-round packet was sent to each panelist consisting of a letter explaining the results of the Delphi I instrument and the Delphi II instrument (Appendix D).

Question 1 consisted of 41 compiled items under the heading of "To be an

effective school technology leader, a superintendent should know....” The second question dealt with performances and consisted of 41 items that were preceded by the prompt “ To be an effective school technology leader, a superintendent performs the following actions....” The final question dealt with dispositions and consisted of 44 items prompted by “The following are indicators of a school superintendent’s disposition (attitude) as a technology leader....”

The Delphi II instrument was mailed to all 29 panel members and was sent via email to six members of the expert panel at their request. Email copies were sent on the same day the instrument was placed in the mail. On the due date, panelists who had not yet responded were sent a reminder email. A follow up telephone call was made one week after the due date if a response was not yet received.

All responses to the Delphi II instrument were recorded for further analysis. Data included individual identification, and three individual worksheets for each of the domains of knowledge, performances, and dispositions. For each item, the mean, standard deviation, and percentage of favorable response were calculated. The mean represented the average of the panelists’ responses while the standard deviation represented the distribution of responses that varied from the mean. The percentage of favorable responses was calculated based upon responses of “important, very important, or extremely important.” Survey items not rated within the three most favorable categories by at least 80% of the panelists were not considered on the Delphi III instrument but shown with a text strikethrough.

Delphi III

The Delphi III instrument (Appendix E) was developed using data generated from responses on the Delphi II. Calculations on each item were completed to ascertain a frequency distribution, mean, and response rate. Any item that did not receive a response in the highest three categories by at least 80% of the panel, was removed from further consideration and delineated on the instrument with a ~~strike through~~. The Delphi III packet contained: (a) a letter with information on the results of Delphi II, (b) the Delphi III instrument, (c) a self addressed stamped envelope, and (d) a publication and receipt of results form for those participants that wished to receive a copy of the results.

The study was conducted over a four-month period (see Table 1). The time between receipt of Delphi I data and mailing of the Delphi II instrument was approximately 6 weeks. Delphi III was mailed within one month of Delphi II.

Reliability and Validity

Both Brooks (1979) and Pfeiffer (1968) indicated that a three round Delphi was sufficient to produce accurate results. Because communications in a Delphi study are done primarily through paper or electronic means, a potential disadvantage of the technique is the minimization of participant feelings and the researcher's inability to make inferences based on direct physical observation of the participants (Linstone & Turoff, 1975). This was not considered to be detrimental to this study since the objective was to develop a group consensus in three specific areas rather than attempting to provide thick description of a case or particular phenomenon.

The nature of the Delphi method may create some questions about reliability for some individuals. Because participants in a Delphi are being given an opportunity to

Table 1

Timeline for Study Completion

Date	Task
August 2003	Identify Internal Committee
September-October 2003	Attain IRB approval Identify Professional Contacts Identify Expert Panel Develop Round I Instrument
November 2003	Mail Round I Instrument Return Round I Instrument Analyze Round I Results
December-January 2003	Develop Round II Instrument Mail Round II Instrument Return of Round II Instrument Analyze Round II Results
February 2003	Develop and Refine Round III Instrument Mail Round III Instrument Return of Round III Instrument Analyze Round III Results Analyze Round III Instrument Results

revise their responses based on the thoughts of others, some may see this as a weakness in design. “There is far from universal agreement on the merits of the Delphi Techniques” (Ludow, 1975, p. 114). Dalkey (as cited in Martino, 1972), however, indicated that the Delphi Method is reliable.

The results of [Dalkey’s] experiments. . . indicate that forecasts produced by the Delphi procedures are reliable; that is, different panels tend to produce about the same results. Furthermore, this reliability can be enhanced by choosing a panel sufficiently large- . . . fifteen members is sufficiently large to obtain a high degree of reliability. This evidence of reliability should be reassuring to those faced with the necessity of utilizing expert opinion in preparing a forecast. They can have a high degree of confidence that a different panel would have produced about the same forecast. (Martino, 1972, p. 52)

In an effort to ensure the highest degree of reliability, an expert panel of 29 members participated. In addition, collaboration with internal committee members was conducted throughout the study.

Validity is associated with the inferences drawn from the results of any study. “Validity can be defined as the best available approximation to the truth of a given proposition, inference, or conclusion” (Trochim, 2001, p. 20). Though typically of concern when seeking answers to causal research questions, the results of this study contained conclusions based upon the collective opinion and judgment of a panel of experts. “The degree of consensus among the experts is associated with the validity in a Delphi” (Mitroff & Turoff, 1975, p.22). A consensus level of 80% was used as the level of consensus needed for an item to remain as a necessary indicator of knowledge, performance, or disposition for a school superintendent to be considered an effective

technology leader.

Summary

Chapter 3 contained a presentation of the design, rationale for the design, methodology, and a listing of the panel members. A three-round Delphi design was used to conduct the study. Panel members included representation from a diverse group of stakeholders and other experts. Groups represented in the conduct of this study included: (a) nationally recognized technology professionals, (b) parents, (c) principals, (d) school board members (e) school district technology professionals (f) school superintendents, (g) state education leaders (h) teachers, and (i) university faculty.

The study was conducted using a three-round Delphi in which panelists were asked to come to consensus anonymously on knowledge, performances, and dispositions of a school superintendent as a technology leader. The first round of the study included open ended questions designed to allow panelists to make input on each of the domains. The Delphi II instrument was developed from the compiled responses of Delphi I. A five-point scale was added and panelists were asked to rate each of the items on the scale. The Delphi III instrument was developed from results of second round surveys. Results of the Delphi III instrument were compiled so that the consensus of the panel on knowledge, performances and dispositions of a superintendent could be developed to help define the role of a school superintendent as an effective technology leader.

CHAPTER 4

PRESENTATION AND ANALYSIS OF THE DATA

A three-round Delphi was used to define the role of the school superintendent as an effective technology leader in terms of knowledge, performances, and dispositions. An expert panel of 29 stakeholders was used on each of three rounds to first develop a list of items within each domain, then to come to consensus on their importance. Panel members were selected based upon their expertise and diverse perspectives on technology in education. The results of the group's consensus are presented here.

Delphi I

The Delphi I instrument contained open-ended questions that allowed panelists to share their expertise in an unstructured manner. The questions were designed to obtain responses that would identify (a) what a school superintendent should know about technology, (b) performances indicative of a school superintendent who is an effective technology leader, and (c) dispositional indicators of a superintendent who is an effective technology leader.

All 29 panelists responded to the first round of the study. The number of responses from each panelist ranged from 3 to 11 for each of the three questions. Each of the panelists responded without comments regarding difficulty or lack of understanding. Three example responses were given for each of the three questions on Delphi I. Twelve panelists selected one example response on the knowledge instrument, 13 panelists selected one example response on the performance instrument, and 16 panelists selected one example response from the dispositions instrument.

Knowledge

The expert panel generated a total of 112 responses regarding what a school superintendent should know about technology to be considered an effective technology leader. After grouping similar responses and irrelevant responses were eliminated, a total of 41 knowledge items emerged from the group (see Table 2).

All but one of the responses identified by more than one panel member were technology specific knowledge items such as “how to mobilize staff toward technology goals” and “how to identify properly qualified technology staff.” A total of four responses to the knowledge question were not specific to technology leadership, but could be considered general knowledge items for all leaders. These responses included: (a) how to work cooperatively with people, (b) how to think “out of the box,” (c) how to strategically link inputs and outputs, and (d) the importance of printed materials in support of curriculum goals.

Of the technology related knowledge items 25 panelists indicated that a superintendent should know the relationship of technology to the curriculum. Other knowledge items included technical or how-to knowledge (Rogers, 2003). These included items such as intermediate skills with productivity tools, basic networking concepts, and basic skills in data analysis. Other more advanced knowledge items included knowing and understanding the underlying principles regarding how technology could be used to track performance, how to develop a vision for technology and the relationship of the 21st century workplace to fluency in various information technologies. Rogers (2003) referred to this type of knowledge as “principles knowledge.”

Table 2

Results of Delphi I: Knowledge Items Required by Superintendents who are Effective Technology Leaders

Item	Number of responses
the relationship of technology to curriculum	25
basic technical terms	8
basic skills in data analysis to support data driven decision making	7
how to establish technology budget priorities	7
basic technology skills with productivity tools (email, wp, db, ss, presentation)	5
management skills for a technology rich environment	5
the central role of professional development to achieving a return on technology investment	4
identification of total cost of ownership factors	4
how to create a culture of technology investment	3
how to identify pitfalls associated with adding new technologies to school programs	3
importance of network security	3
how to mobilize staff toward technology goals	3
how technology can be used to track performance	2
how to identify properly qualified technology staff	2
limitations of technology	2
how to assess staff readiness for technology use	2
how to work cooperatively with people	2
how constructivism relates to technology integration	2
internet search strategies	1
how technology can link schools and community	1
how mediated learning distributed across space and time complements face to face learning	1
intermediate technology skills with productivity tools (email, wp, db, ss, presentation)	1
funding sources available for technology	1
ethical aspects of technology use in schools	1
differences between instructional uses of technology and business uses of technology	1
the relationship of the district technology plan to the districts strategic plan	1
current research on educational technology	1
the relationship of socio economic factors as limits to technology availability	1
basic skills in matching specific technologies to teaching and learning	1
potential longevity of an instructional technology	1
the conceptual relationship between technology and business efficiency of the school district	1
the current status of instructional delivery methodologies throughout the district	1
how to develop a vision for technology	1
goals for technology use in the district	1
the relationship of technology to success in industry	1
dangers of an Information Technology staff subverting the educational value of a network	1
how to think out of the box	1
basic networking concepts	1
how to strategically link inputs and outputs	1
the importance of “hard copy” printed materials in support of curriculum goals	1
the relationship of 21st century workplace to fluency in various information technologies	1

Performances

Of the 101 responses provided by panelists as necessary actions performed by school superintendents who are seen as effective technology leaders, 41 responses emerged as unique (see Table 3). The three most frequent responses: (a) participates in technology related conferences, (b) models use of technology, and (d) uses data to support decisions are associated with technically oriented performance skills that the panel believed were necessities for school superintendents.

Dispositions

Panelists provided a total of 98 responses regarding dispositional indicators of superintendents who were considered to be effective technology leaders (see Table 4). From these, 44 items were derived. Thirteen responses were provided by more than one panelist. The most frequently provided response in this domain “recognition programs are evident for both staff and student technology use” was provided by 16 panelists. Major themes in the dispositional domain in Delphi I included the importance of recognition programs, effective assessment of staff and programs in terms of technology employment, clear delineation of technology leaders in the district, necessity for community involvement in school technology, importance of innovation and vision, technology’s relationship to curriculum goals, and evidence of adequate funding for technology throughout the district. The importance of vision was evident in the literature (Lovess, 1996; Manesse, 1986; Means, 1994; Picciano, 2002) and was evidenced in the responses of the panel. The importance of “vision” for a superintendent in the area of technology leadership remained a common theme throughout each round of the study.

Table 3

Results of Delphi I: Actions Performed by Superintendents who are Effective Technology Leaders

Item	Number of responses
participates in technology related conferences	17
models use of technology	9
uses data to support decisions	9
supports professional development in the area of technology	7
ensures adequate technology resources are available to accomplish integration of technology into learning	5
evaluates staff on use of data for school improvement	5
assesses technology integration	4
questions how technology is being used to support instruction	3
works in partnership with business community to fund technology use	3
demonstrates to community how data is used to improve student achievement	2
develops budgets that support the total cost of ownership	2
encourages staff to exceed minimum technology standards	2
mentors administrators in positive technology leadership	2
provides support for instructional technology focus	2
seeks community expertise in solving technology challenges	2
sets expectations for staff in use of technology	2
advocates with all school publics on behalf of students and teachers	1
assess curriculum rich uses of technology	1
assesses technology staff development effectiveness	1
assures that technology projects are either completed successfully or terminated	1
conducts periodic technology needs assessments	1
creates opportunities for parent use of technology	1
defuses roadblocks leading to technology implementation	1
delegates responsibilities as a leader of leaders	1
encourages pilot programs for new technologies	1
encourages staff to take risks	1
evaluates the impact of technology before jumping into something	1
facilitates home/school/community communication	1
gets "out of the way"	1
guides the district toward clear commitment to student learning through use of all technologies	1
involves technical staff in cabinet level decisions	1
leads technology related staff development sessions	1
maintains visibility throughout the district with matters dealing with technology	1
protects innovation from cannibalism	1
provides technology access for students in and out of school	1
raises level of awareness about technology in public and private meetings	1
stays abreast of current technologies	1
supports innovation	1
supports the district technology committee	1
visits classrooms using technology	1
works in partnership with other school districts to promote the efficient use of technology	1

Table 4

Results of Delphi I: Indicators of a School Superintendent's Disposition as a Technology Leader

Item	Number of responses
recognition programs evident for both staff and student technology use	16
technology is included as a performance item for all staff relative to their positions	11
resources available for technology professional development	8
staff is evaluated on use of technology to guide instruction	5
evidence of innovative ways to increase technology use	4
school/community partnerships are evident in support of technology use in the district	4
staff can articulate how district superintendent models use of technology	4
evidence of a vision for technology exists	3
impact of technology use on instructional practice is measured	3
strengths and weaknesses of district technology posture are articulated by staff	3
risk taking is evident in the district	2
technology is funded at an adequate level	2
technology use is visible throughout the system	2
a "direct report" staff member is the chair of a technology advisory committee	1
a district technology leader can be identified by staff	1
a positive technology attitude permeates the district	1
atmosphere of innovation permeates the school system	1
best technology practices are shared through the district	1
both innovative and basic levels of technology use are encouraged	1
community members believe that use of technology in school is safe	1
curriculum rich uses of technology are included in curriculum planning	1
district has a cabinet level chief technology officer	1
district has a mechanism in place to ensure adoption of new technologies is not disruptive to learning	1
district seeks national and state awards in the area of technology accomplishment	1
evidence of accountability from superintendent level	1
evidence of system wide continual improvement in the form of strategic committees from all stakeholder groups	1
evidence of technology cost/benefit analysis ongoing	1
evidence that technology leaders are accountable for implementation	1
expectation that ALL staff will participate in change indicatives (not driven by time to retirement).	1
extra curricular clubs and activities are in existence	1
flexibility is evident in the district	1
instructional staff (not technical staff) leads movement toward new technologies	1
local higher education institutions are polled to ensure district graduates possess adequate technology skills	1
regular reports to school board on technology posture	1
school board members model use of technology	1
school sites have technology aides	1
technology and learning are always considered in program planning	1
technology integration is a condition for employment	1
technology is used as a tool in support of district operations	1
technology master plan is current	1
technology plan includes performance expectations for administrators	1

Table 4 (continued)

Results of Delphi I: Indicators of a School Superintendent's Disposition as a Technology Leader

Item	Number of responses
technology staff has an instructional focus	1
technology standards are in place for students	1
the district has a help desk support plan	1

Delphi II

The Delphi II instrument (Appendix D) was developed from the input gleaned from the Delphi I survey. Panelists were asked to rate each survey item within the three domains of knowledge, performances, and dispositions of school superintendents as effective technology leaders. Each item was randomly presented on the instrument. A five-point Likert scale was added to each item with the following values: (a) 1= not important, (b) 2=slightly important, (c) 3= important, (d) 4=very important, and (e) 5=extremely important. The panel was considered to have reached consensus when at least 80% of the panel responded to each item in the three highest values on the scale. The response rate was 100% for the Delphi II instrument.

Knowledge

All panelists rated 27 items of 41 total possible responses (see Table 5). Twenty-eight panelists rated 11 items, 27 panelists rated two items, and all 29 panelists answered one item. One panel member requested clarification on item 40, “how constructivism relates to technology integration.” A response was provided via email and the panelist responded to the item.

Knowledge items in which the panel was in unanimous agreement were: (a) how technology could be used to track performance, (b) the relationship of the district technology plan to the district strategic plan, (c) how to establish budget priorities, and (d) the relationship of technology to the curriculum. Each of these items was rated as having 100% consensus.

Table 5

Results of Delphi II: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to What a School Superintendent Should Know in Order to be an Effective Technology Leader

Item	<i>N</i>	<i>M^a</i>	<i>SD</i>	<i>%^b</i>
1. the central role of professional development to achieving a return on technology investment	29	4.31	0.81	96.5
2. internet search strategies	29	2.52	1.02	51.6
3. how technology can link schools and community	28	4.00	0.9	92.9
4. how technology can be used to track performance	27	4.11	0.85	100.0
5. how mediated learning distributed across space and time complements face to face learning	28	3.21	0.92	78.5
6. intermediate technology skills with productivity tools (email, wp, db, ss, presentation)	29	3.07	1.03	72.4
7. funding sources available for technology	29	3.69	1.28	79.3
8. ethical aspects of technology use in schools	29	3.79	0.86	93.1
9. differences between instructional uses of technology and business uses of technology	29	3.55	1.06	86.2
10. the relationship of the district technology plan to the districts strategic plan	29	4.52	0.51	100.0
11. current research on educational technology	29	3.38	0.82	93.1
12. the relationship of socio economic factors as limits to technology availability	29	3.28	0.88	79.3
13. how to identify properly qualified technology staff	29	3.59	0.95	86.2
14. basic skills in data analysis to support data driven decision making	29	3.90	0.86	93.1
15. basic skills in matching specific technologies to teaching and learning	29	3.17	1.00	68.9
16. potential longevity of an instructional technology	28	2.93	0.90	64.3
17. the conceptual relationship between technology and business efficiency of the school district	28	3.25	1.04	82.2
18. the current status of instructional delivery methodologies throughout the district	29	3.52	0.83	89.6
19. how to create a culture of technology investment	29	3.90	0.77	96.5
20. how to establish technology budget priorities	29	3.79	0.68	100.0
21. how to develop a vision for technology	29	4.45	0.78	96.5
22. identification of total cost of ownership factors	28	3.25	1.08	82.1
23. goals for technology use in the district	28	4.39	0.79	96.4
24. how to identify pitfalls associated with adding new technologies to school programs	29	3.52	0.78	96.6
25. the relationship of technology to success in industry	29	2.79	1.08	55.1
26. dangers of an Information Technology staff subverting the educational value of a network	27	2.89	1.28	55.5
27. the relationship of technology to curriculum	29	4.31	0.66	100.0
28. basic technology skills with productivity tools (email, wp, db, ss, presentation)	28	3.36	1.13	82.2
29. basic "technical" terms	29	3.1	1.18	72.4
30. management skills for a technology rich environment	29	3.41	0.91	86.2
31. limitations of technology	28	3.79	0.79	96.4
32. how to assess staff readiness for technology use	29	3.38	0.94	86.2
33. importance of network security	29	3.83	1.10	86.2

(table continues)

Table 5 (continued)

Results of Delphi II: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to Items a School Superintendent Should Know to be an Effective Technology Leader

Item	<i>N</i>	<i>M^a</i>	<i>SD</i>	<i>%^b</i>
34. how to think out of the box	28	3.96	1.17	85.8
35. basic networking concepts	29	2.55	0.99	51.6
36. how to mobilize staff toward technology goals	29	4.00	1.00	93.1
37. how to strategically link inputs and outputs	29	3.41	1.15	79.2
38. how to work cooperatively with people	25	4.44	0.87	96
39. the importance of “hard copy” printed materials in support of curriculum goals	28	2.68	1.25	50.0
40. how constructivism relates to technology integration	28	3.11	1.20	71.4
41. the relationship of 21st century workplace to fluency in various information technologies	29	3.31	1.00	82.7

^a Rating scale used was 1= not important, 2=slightly important, 3 = important, 4 = very important, and 5 = extremely important.

^b Percentage of Responses in the three most favorable categories of the rating scale (important, very important, or extremely important).

There were 14 items that did not meet the 80% criteria established as the minimum level considered for consensus. The lowest rated items on the Delphi II knowledge instrument included skill based items such as “internet search strategies” and “basic networking concepts.” Items with the highest mean and lowest standard deviation are indicative of the degree of consensus by panel members pertaining to each item. The top two items with the highest mean and lowest standard deviation in the area of superintendent knowledge were “the relationship of the district technology plan to the district strategic plan” and “the relationship of technology to curriculum.”

Item 7, “funding sources available for technology,” was rated at 79.3%. The panel did not come to consensus on the need for the superintendent to know specific funding sources available in support of technology, but members were unanimous in their belief that a superintendent needs to know “how to establish technology budget priorities” as shown in item 20. This can be interpreted as recognition of the notion that it is more important for a superintendent to understand the mechanics and requirements of establishing a technology budget than to be know specific funding sources for technology.

The mean range of all knowledge responses was 2.52 for “internet search strategies” to 4.52 for “the relationship of the district technology plan to the district strategic plan.” This item was reflective of a standard deviation score .51 which was the lowest score in the knowledge domain. The widest standard deviation on knowledge items was 1.28, “funding sources available for technology.” While this panel agreed that each of these items was at least slightly important, responses indicate that the panel

believed it was more important for a superintendent to have what Rogers (2003) referred to as “principles knowledge” or an understanding of the underlying principles associated with adoption of an innovation.

Performances

Performances pertained to actual actions by a school superintendent in a technology leadership role. All 29 panelists responded to 25 survey items while 28 responded to 12 items (see Table 6). Twenty-seven panelists responded to two items while total panelists responding to one survey item each were 26 and 24 respectively.

One hundred percent consensus was reached on the following performance items: (a) uses data to support decisions, (b) supports innovation, (c) encourages staff to exceed minimum technology standards, and (d) provides support for an instructional technology focus. These items represent a utilitarian focus on technology in schools in which technology is seen as an innovative tool to support learning and informed decision making as well as an innovation that requires staff to pursue and maintain currency.

The panel rated 14 items below the 80% consensus level. The lowest rated items included: (a) leads technology related staff development sessions, (b) gets out of the way, (c) participates in technology related conferences, and (d) conducts periodic technology needs assessments.

The mean for round-two performance items ranged from 1.97 to 4.58. Standard deviation ranged from .58 for “encourages staff to exceed minimum technology standards” to 1.33 for “protects innovation from cannibalism.” The highest rated consensus items on this round indicate that superintendents should take an active role

Table 6

Results of Delphi II: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to Actions Performed by a School Superintendent Who is an Effective Technology Leader

Item	<i>N</i>	<i>M^a</i>	<i>SD</i>	<i>%^b</i>
1. demonstrates to community how data is used to improve student achievement	29	3.93	1.10	89.6
2. participates in technology related conferences	29	2.76	0.95	65.5
3. defuses roadblocks leading to technology implementation	29	4.00	0.85	96.5
4. leads technology related staff development sessions	29	1.97	1.12	27.5
5. assures that technology projects are either completed successfully or terminated	29	3.41	1.24	75.8
6. conducts periodic technology needs assessments	29	2.97	1.24	65.5
7. assesses technology staff development effectiveness	29	3.28	1.19	79.2
8. supports the district technology committee	29	4.14	0.95	96.5
9. assesses technology integration	29	3.24	1.24	72.4
10. questions how technology is being used to support instruction	28	4.07	1.09	89.3
11. uses data to support decisions	26	4.58	0.64	100.0
12. supports professional development in the area of technology	29	4.34	0.72	96.5
13. supports innovation	28	4.36	0.78	100.0
14. stays abreast of current technologies	29	3.17	0.85	79.3
15. gets "out of the way"	27	2.56	1.22	48.1
16. evaluates the impact of technology before jumping into something	28	3.61	0.96	89.3
17. evaluates staff on use of data for school improvement	29	3.66	1.14	82.7
18. works in partnership with business community to fund technology use	29	3.72	1.07	86.2
19. encourages staff to take risks	29	3.83	0.93	96.5
20. encourages staff to exceed minimum technology standards	29	3.86	0.58	100.0
21. encourages pilot programs for new technologies	28	3.86	0.89	89.3
22. develops budgets that support the total cost of ownership	29	4.07	0.92	93.1
23. visits classrooms using technology	29	3.48	0.99	86.2
24. guides the district toward clear commitment to student learning through use of all technologies	28	3.75	0.97	96.4
25. raises level of awareness about technology in public and private meetings	28	3.54	0.92	85.7
26. advocates with all school publics on behalf of students and teachers	28	4.39	0.88	96.4
27. provides technology access for students in and out of school	29	3.24	0.99	79.3
28. provides support for instructional technology focus	28	3.75	0.65	100
29. protects innovation from cannibalism	24	3.25	1.33	66.7
30. delegates responsibilities as a leader of leaders	26	4.12	1.11	88.4
31. models use of technology	29	3.69	0.85	96.5
32. mentors administrators in positive technology leadership	29	3.72	1.00	89.6

(table continues)

Table 6 (continued)

Results of Delphi II: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to Actions Performed by a School Superintendent Who is Considered to be an Effective Technology Leader

Item	<i>N</i>	<i>M^a</i>	<i>SD</i>	<i>%^b</i>
33. creates opportunities for parent use of technology	29	3.03	0.98	72.3
34. facilitates home/school/community communication	28	4.04	0.92	96.5
35. involves technical staff in cabinet level decisions	29	3.17	1.14	65.5
36. seeks community expertise in solving technology challenges	28	3.46	0.88	89.3
37. works in partnership with other school districts to promote the efficient use of technology	29	3.14	0.92	79.3
38. ensures adequate technology resources are available to accomplish integration of technology into learning	29	4.10	0.86	96.5
39. assess curriculum rich uses of technology	28	3.11	1.10	74.9
40. sets expectations for staff in use of technology	28	3.93	1.02	96.4
41. maintains visibility throughout the district with matters dealing with technology	29	3.72	1.03	93.1

^a Rating scale used was 1= not important, 2=slightly important, 3 = important, 4 = very important, and 5 = extremely important.

^b Percentage of Responses in the three most favorable categories of the rating scale (important, very important, or extremely important).

with regard to promoting (not necessarily personally conducting) staff development, fostering home school community communication through the use of technology, and personally modeling the use of technology

Dispositions

Dispositions reflect a superintendent's proclivity toward technology. For this portion of the study the panelist were asked to rate organizational indicators of a superintendent's disposition as an effective technology leader. All panelists provided responses to 27 items on the instrument. Sixteen items were rated by 28 panelists and one item was rated by 27 panelists (see Table 7).

The mean ranged from 2.62 for "district seeks national and state awards in the area of technology accomplishment" to 4.55 for "evidence of a vision for technology exists." The panel reached unanimous consensus on eight items. The items can be grouped into the categories of technology planning and vision, accountability for technology decisions and implementations, and provision of adequate funding for technology programs.

The panel rated eight items below the 80% consensus level. These items included areas associated with recognition programs for technology use, staffing, and technology requirements as a condition for employment. The minimum standard deviation was .57 for three items including: (a) best technology practices are shared throughout the district, (b) resources are available for technology professional development, and (c) technology is funded at an adequate level. Maximum standard deviation was 1.27 for "district has a

Table 7

Results of Delphi II: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to Indicators of a School Superintendent's Disposition as an Effective Technology Leader

Item	<i>N</i>	<i>M^a</i>	<i>SD</i>	<i>%^b</i>
1. technology integration is a condition for employment	29	3.03	1.09	65.5
2. community members believe that use of technology in school is safe	28	3.71	0.85	96.4
3. both innovative and basic levels of technology use are encouraged	29	4.10	0.82	96.5
4. school board members model use of technology	29	2.69	1.20	55.1
5. atmosphere of innovation permeates the school system	29	3.97	1.09	86.2
6. a district technology leader can be identified by staff	28	3.89	1.13	85.7
7. technology master plan is current	28	4.21	0.69	100.0
8. evidence of accountability from superintendent level	28	4.25	0.75	100.0
9. regular reports to school board on technology posture	28	3.71	0.90	89.3
10. school sites have technology aides	28	3.43	1.23	82.1
11. staff is evaluated on use of technology to guide instruction	29	3.69	0.85	93.1
12. district seeks national and state awards in the area of technology accomplishment	29	2.62	1.05	51.6
13. recognition programs evident for both staff and student technology use	28	3.11	1.17	67.8
14. instructional staff (not technical staff) leads movement toward new technologies	29	3.83	1.04	89.6
15. impact of technology use on instructional practice is measured	29	3.86	1.06	89.6
16. flexibility is evident in the district	28	4.00	0.86	96.4
17. technology standards are in place for students	29	3.86	1.19	86.2
18. expectation that ALL staff will participate in change indicatives (not driven by time to retirement).	28	3.86	1.15	85.7
19. evidence that technology leaders are accountable for implementation	28	3.71	0.76	100.0
20. evidence of system wide continual improvement in the form of strategic committees from all stakeholder groups	29	3.90	0.90	89.6
31. evidence of innovative ways to increase technology use	29	3.52	0.95	86.2
32. district has a mechanism in place to ensure adoption of new technologies is not disruptive to learning	29	3.90	0.98	89.6
33. evidence of a vision for technology exists	29	4.55	0.69	100.0
34. school/community partnerships are evident in support of technology use in the district	28	3.79	0.83	92.9
35. best technology practices are shared through the district	29	4.48	0.57	100.0
36. technology staff has an instructional focus	28	4.46	0.84	96.4
37. resources available for technology professional development	29	4.45	0.57	100
38. local higher education institutions are polled to ensure district graduates possess adequate technology skills	29	3.14	1.03	75.8
39. technology plan includes performance expectations for administrators	29	3.93	0.70	100.0
40. the district has a help desk support plan	29	3.93	1.03	89.6

(table continues)

Table 7 (continued)

Results of Delphi II: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to Indicators of a School Superintendent's Disposition as an Effective Technology Leader

Item	<i>N</i>	<i>M^a</i>	<i>SD</i>	<i>%^b</i>
41. technology is included as a performance item for all staff relative to their positions	29	3.66	1.01	89.6
42. technology is funded at an adequate level	29	4.52	0.57	100.0
43. strengths and weaknesses of district technology posture are articulated by staff	28	3.46	0.96	85.7
44. staff can articulate how district superintendent models use of technology	29	2.97	1.15	58.5
45. district has a cabinet level chief technology officer	29	3.59	1.27	75.8
46. technology is used as a tool in support of district operations	29	4.07	0.88	93.1
47. technology and learning are always considered in program planning	29	4.14	0.83	96.5
48. curriculum rich uses of technology are included in curriculum planning	28	4.29	0.81	96.4
49. a "direct report" staff member is the chair of a technology advisory committee	27	3.22	0.97	70.3
50. a positive technology attitude permeates the district	29	4.17	0.97	93.1
51. technology use is visible throughout the system	29	4.17	0.80	96.5
52. extra curricular clubs and activities are in existence	28	3.00	1.02	82.1
53. risk taking is evident in the district	28	3.68	1.06	89.2
54. evidence of technology cost/benefit analysis ongoing	29	3.90	0.77	96.5

^a Rating scale used was 1= not important, 2=slightly important, 3 = important, 4 = very important, and 5 = extremely important.

^b Percentage of Responses in the three most favorable categories of the rating scale (important, very important, or extremely important).

cabinet level chief technology officer.” The wide deviation from the mean for this item indicated the panel’s inability to reach a high degree of consensus on this item.

Eighty-two percent of the disposition items on the Delphi II instrument were rated above the 80% consensus level. This was the highest level of consensus for each of the domains.

Delphi III

On the Delphi III instrument panelists were provided with items rated on the Delphi II, the frequency distribution for each item, the total number of responses for each item, their response to each item from round two, and the overall percentage of responses rated as important, very important, or extremely important. Each panelist was asked to review their response on each item taking into consideration responses from other panel members on each item. Responses that did not meet the 80% criterion appeared on the instrument, but were shown as text with a strikethrough. The mean, standard deviation, and overall percentage of each item are presented here. All 29 panelists responded in this round.

Knowledge

The panel reached consensus on 27 of 41 items that should be known by a school superintendent considered to be an effective technology leader. There was no change in the number of items in which the panel reached consensus between rounds two and three. However the panel reached 100% consensus on five additional items: (a) the current status of instructional delivery methodologies, (b) basic skills in data analysis, (c) goals

for technology in the district, (d) the central role of professional development, and (e) how to mobilize staff toward technology goals (see Table 8).

The mean for knowledge items on the Delphi III instrument ranged from 2.52 to 4.62 and the standard deviation ranged from .49 to 1.28. Each of the knowledge items could be associated with themes of professional knowledge, technology integration, technical skills, and technology specific management skills. The results of this round showed the most important knowledge item for a superintendent was “the relationship of the district technology plan to the district strategic plan.” The panel demonstrated, by their consensus, that school leaders must understand and have a vision for how technology will be integrated into the school setting if it is to be utilized and successful.

Items classified as professional knowledge on the Delphi III instrument included: (a) understanding the conceptual relationship between technology and district business efficiency, (b) how to identify pitfalls associated with adding new technologies to school programs, (c) current research on educational technology, and (d) the relationship of the 21st century workplace to fluency in various information technologies. The ability to master each of these items assumes underlying “principles knowledge” (Rogers, 2003). Certain elements of “awareness knowledge” and “how to” knowledge must be understood before one could be proficient in each of these areas.

Selected technology integration knowledge items identified by the panel included: (a) the relationship of technology to the curriculum, (b) how technology can link schools and community, and (d) the current status of instructional delivery methods.

Table 8

Results of Delphi III: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to What School Superintendents Should Know to be an Effective Technology Leader

Item	<i>N</i>	<i>M^a</i>	<i>SD</i>	<i>%^b</i>
1. the central role of professional development to achieving a return on technology investment	29	4.48	0.57	100.0
2. internet search strategies				
3. how technology can link schools and community	28	4.04	0.88	92.8
4. how technology can be used to track performance	27	4.33	0.88	96.3
5. how mediated learning distributed across space and time complements face to face learning				
6. intermediate technology skills with productivity tools (email, wp, db, ss, presentation)				
7. funding sources available for technology				
8. ethical aspects of technology use in schools	29	3.97	0.78	96.5
9. differences between instructional uses of technology and business uses of technology	29	3.59	1.05	89.6
10. the relationship of the district technology plan to the districts strategic plan	29	4.62	0.49	100.0
11. current research on educational technology	29	3.45	0.83	93.1
12. the relationship of socio-economic factors as limits to technology availability				
13. how to identify properly qualified technology staff	29	3.76	0.79	93.1
14. basic skills in data analysis to support data driven decision making	29	4.07	0.70	100.0
15. basic skills in matching specific technologies to teaching and learning				
16. potential longevity of an instructional technology				
17. the conceptual relationship between technology and business efficiency of the school district	28	3.36	0.87	89.3
18. the current status of instructional delivery methodologies throughout the district	29	3.76	0.69	100.0
19. how to create a culture of technology investment	29	3.90	0.77	93.1
20. how to establish technology budget priorities	29	4.00	0.53	100.0
21. how to develop a vision for technology	29	4.55	0.57	100.0
22. identification of total cost of ownership factors	29	3.52	0.99	93.1
23. goals for technology use in the district	29	4.52	0.57	100.0
24. how to identify pitfalls associated with adding new technologies to school programs	29	3.48	0.78	96.5
25. the relationship of technology to success in industry				
26. dangers of an Information Technology staff subverting the educational value of a network				
27. the relationship of technology to curriculum	29	4.45	0.57	100.0
28. basic technology skills with productivity tools (email, wp, db, ss, presentation)	29	3.28	1.00	82.8
29. basic "technical" terms				
30. management skills for a technology rich environment	29	3.59	0.73	93.1
31. limitations of technology	29	3.93	0.70	96.5
32. how to assess staff readiness for technology use	29	3.45	0.87	93.1
33. importance of network security	29	3.86	1.06	86.2

(table continues)

Table 8 (continued)

Results of Delphi II: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to Items a School Superintendent Should Know to be an Effective Technology Leader

Item	<i>N</i>	<i>M^a</i>	<i>SD</i>	<i>%^b</i>
34. how to think out of the box	28	4.29	0.98	92.8
35. basic networking concepts				
36. how to mobilize staff toward technology goals	29	4.21	0.62	100.0
37. how to strategically link inputs and outputs				
38. how to work cooperatively with people	25	4.52	0.87	96.0
39. the importance of "hard copy" printed materials in support of curriculum goals				
40. how constructivism relates to technology integration				
41. the relationship of 21st century workplace to fluency in various information technologies	29	3.52	0.78	96.6

^a Rating scale used was 1= not important, 2=slightly important, 3 = important, 4 = very important, and 5 = extremely important.

^b Percentage of responses in the three most favorable categories of the rating scale (important, very important, or extremely important).

Each of these items underscores the importance of the need for technology to be fully integrated as a seamless tool across multiple school settings.

The panel responses indicated consensus that superintendents need a technical skill set in order to be effective as technology leaders. Knowledge items such as basic “skills with productivity tools,” “basic skills in data analysis,” and “knowledge of network security” all require a degree of technical skills and knowledge. The panel did not come to consensus on other technical skills such as basic networking concepts, intermediate skills with productivity tools, and basic technical terms. In terms of technology specific management skills panel consensus showed that it was important for superintendents to know how to create a culture for technology investment, how to develop a vision for technology, and should know how to leverage professional development in achieving a return on technology investment.

Performances

“Uses data to support decisions” was identified as the top performance action by the panel for a superintendent who is considered to be an effective technology leader. This item had the highest mean value at 4.76 and the lowest standard deviation calculated at .44 (see Table 9). The mean for all items ranged from 1.12 to 4.76 while the range of standard deviations was from .44 to 1.33.

The panel reached 100% consensus on 15 performance items, which represented an increase of 10 from the Delphi II performance instrument. The number of items for which the panel could not reach a consensus remained at 14 between Delphi II and

Table 9

Results of Delphi III: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to Actions Performed by a School Superintendent Considered an Effective Technology Leader

Item	<i>N</i>	<i>M^a</i>	<i>SD</i>	<i>%^b</i>
1. demonstrates to community how data is used to improve student achievement	29	4.14	0.92	93.1
2. participates in technology related conferences				
3. defuses roadblocks leading to technology implementation	29	4.17	0.60	100.0
4. leads technology related staff development sessions				
5. assures that technology projects are either completed successfully or terminated				
6. conducts periodic technology needs assessments				
7. assesses technology staff development effectiveness				
8. supports the district technology committee	29	4.31	0.60	100.0
9. assesses technology integration				
10. questions how technology is being used to support instruction	29	4.31	0.81	96.5
11. uses data to support decisions	29	4.76	0.44	100.0
12. supports professional development in the area of technology	29	4.55	0.51	100.0
13. supports innovation	29	4.45	0.74	100.0
14. stays abreast of current technologies				
15. gets "out of the way"				
16. evaluates the impact of technology before jumping into something	29	3.97	0.63	96.5
17. evaluates staff on use of data for school improvement	29	3.76	0.99	89.6
18. works in partnership with business community to fund technology use	29	3.76	0.95	89.6
19. encourages staff to take risks	29	3.86	0.83	100.0
20. encourages staff to exceed minimum technology standards	29	3.90	0.49	100.0
21. encourages pilot programs for new technologies	29	4.00	0.65	96.5
22. develops budgets that support the total cost of ownership	29	4.24	0.58	100.0
23. visits classrooms using technology	29	3.59	1.02	89.6
24. guides the district toward clear commitment to student learning through use of all technologies	28	3.79	0.79	100.0
25. raises level of awareness about technology in public and private meetings	29	3.79	0.68	100.0
26. advocates with all school publics on behalf of students and teachers	28	4.54	0.69	100.0
27. provides technology access for students in and out of school				
28. provides support for instructional technology focus	28	3.93	0.60	100.0
29. protects innovation from cannibalism				
30. delegates responsibilities as a leader of leaders	28	4.36	0.91	92.8
31. models use of technology	29	3.93	0.75	99.9
32. mentors administrators in positive technology leadership	29	3.79	0.82	96.5

(table continues)

Table 9 (continued)

Results of Delphi II: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to Actions Performed by a School Superintendent Considered an Effective Technology Leader

Item	<i>N</i>	<i>M^a</i>	<i>SD</i>	<i>%^b</i>
33. creates opportunities for parent use of technology				
34. facilitates home/school/community communication	29	4.17	0.85	96.5
35. involves technical staff in cabinet level decisions				
36. seeks community expertise in solving technology challenges	29	3.45	0.78	93
37. works in partnership with other school districts to promote the efficient use of technology				
38. ensures adequate technology resources are available to accomplish integration of technology into learning	29	4.17	0.54	100.0
39. assess curriculum rich uses of technology				
40. sets expectations for staff in use of technology	29	4.10	0.77	100.0
41. maintains visibility throughout the district with matters dealing with technology	29	3.76	0.87	96.5

^a Rating scale used was 1= not important, 2=slightly important, 3 = important, 4 = very important, and 5 = extremely important.

^b Percentage of Responses in the three most favorable categories of the rating scale (important, very important, or extremely important).

Delphi III. The most important performance indicators for school superintendents as reported by this panel included items that may be categorized as support of the human technology infrastructure, technology related mentoring, and managing technology.

Supporting the human technology infrastructure included the provision of support and leadership to instructional and technical staff, as well as the school community to ensure the most efficient and effective use of resources. Items illustrative of this notion included “defuses roadblocks leading to technology implementation,” and “supports the district technology committee.” Additional items in this area included “questions how technology is being used to support instruction,” and “supports professional development in the area of technology.”

Technology related mentoring was illustrated by items that included: (a) encouraging staff to exceed minimum standards, (b) mentoring administrators in technology related leadership, (c) encouraging staff to take risks, and (d) leads by example through modeling technology use. The panel reached consensus on the importance of mentoring activities as indicative of school superintendents as effective technology leaders.

Performances associated with managing technology were identified as important, very important, and extremely important. Panel responses associated with this area of technology leadership included those related to using data to support decisions, providing support for an instructional technology focus, developing technology budgets supporting total cost of ownership, and setting expectations for staff in the use of technology.

Managing technology is a broad endeavor that includes the basic tenets of management, but with a technology “twist.” There may be many implied tasks associated with such technology management requirements for which superintendents must be prepared.

Managing with technology includes those items related to data driven decision making.

Dispositions

In the dispositions domain, panelists were asked to review their responses to the previous round in relation to the aggregate results of responses from the other panel members. Of the 44 dispositional attributes of superintendents as effective technology leaders, 34 were identified by 80% of the panelists in the three most favorable categories of the Delphi II rating scale (see Table 10). Delphi III results showed one additional dispositional indicator “extra curricular clubs and activities” that did not meet the 80% criterion. Panel members did not reach consensus on indicators of dispositions in terms of technology proficiency as a condition for employment, awards programs, “direct report” staff members, and staff awareness of a superintendent’s ability to model technology.

The panel reached consensus at the 100% level on dispositional indicators related to planning, accountability, instructional focus, professional development, and technology management. The means for all items in this domain ranged from 2.62 for “district seeks national and state awards in the area of technology accomplishment” to 4.68 for “technology staff has an instructional focus.” The standard deviations ranged from .57 for “technology is funded at an adequate level,” to 1.27 for “district has a cabinet level chief technology officer.” The results indicated that the panel members, through their responses, agreed that the most important indicators of a

Table 10

Results of Delphi III: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to Indicators of a School Superintendent's Disposition as an Effective Technology Leader

Item	N	M ^a	SD	% ^b
1. technology integration is a condition for employment				
2. community members believe that use of technology in school is safe	29	3.66	0.86	96.6
3. both innovative and basic levels of technology use are encouraged	29	4.10	0.77	96.5
4. school board members model use of technology				
5. atmosphere of innovation permeates the school system	29	4.14	0.99	89.6
6. a district technology leader can be identified by staff	28	4.07	0.90	92.9
7. technology master plan is current	28	4.32	0.61	100.0
8. evidence of accountability from superintendent level	29	4.28	0.70	100.0
9. regular reports to school board on technology posture	29	3.72	0.84	89.7
10. school sites have technology aides	28	3.50	1.20	85.6
11. staff is evaluated on use of technology to guide instruction	29	3.76	0.79	96.5
12. district seeks national and state awards in the area of technology accomplishment				
13. recognition programs evident for both staff and student technology use				
14. instructional staff (not technical staff) leads movement toward new technologies	29	3.86	1.03	89.7
15. impact of technology use on instructional practice is measured	29	3.93	0.96	96.5
16. flexibility is evident in the district	29	3.97	0.87	96.5
17. technology standards are in place for students	29	4.00	1.13	89.6
18. expectation that ALL staff will participate in change indicatives (not driven by time to retirement).	28	3.93	1.12	89.3
19. evidence that technology leaders are accountable for implementation	29	3.86	0.79	100.0
20. evidence of system wide continual improvement in the form of strategic committees from all stakeholder groups	29	3.83	0.97	93.0
21. evidence of innovative ways to increase technology use	29	3.48	0.87	86.1
22. district has a mechanism in place to ensure adoption of new technologies is not disruptive to learning	29	3.93	0.96	89.6
23. evidence of a vision for technology exists	29	4.59	0.63	100.0
24. school/community partnerships are evident in support of technology use in the district	29	3.69	0.97	89.6
25. best technology practices are shared through the district	29	4.41	0.63	100.0
26. technology staff has an instructional focus	28	4.68	0.82	96.5
27. resources available for technology professional development	29	4.45	0.63	100.0
28. local higher education institutions are polled to ensure district graduates possess adequate technology skills				
29. technology plan includes performance expectations for administrators	29	4.03	0.68	100.0
30. the district has a help desk support plan	29	3.93	1.10	89.6

(table continues)

Table 10 (continued)

Results of Delphi III: Means, Standard Deviations, and Percentages of Panelists Rating Items as Important, Very Important, or Extremely Important Pertaining to Indicators of a School Superintendent's Disposition as an Effective Technology Leader

Item	<i>N</i>	<i>M^a</i>	<i>SD</i>	<i>%^b</i>
31. technology is included as a performance item for all staff relative to their positions	29	3.69	0.97	93.1
32. technology is funded at an adequate level	29	4.55	0.57	100.0
33. strengths and weaknesses of district technology posture are articulated by staff	28	3.57	0.88	85.7
34. staff can articulate how district superintendent models use of technology				
35. district has a cabinet level chief technology officer				
36. technology is used as a tool in support of district operations	29	4.10	0.86	93.1
37. technology and learning are always considered in program planning	29	4.21	0.77	96.5
38. curriculum rich uses of technology are included in curriculum planning	29	4.31	0.71	96.5
39. a "direct report" staff member is the chair of a technology advisory committee				
40. a positive technology attitude permeates the district	29	4.17	0.89	93.1
41. technology use is visible throughout the system	29	4.14	0.69	96.6
42. extra curricular clubs and activities are in existence				
43. risk taking is evident in the district	29	3.76	0.99	93.0
44. evidence of technology cost/benefit analysis ongoing	29	4.00	0.65	100.0

^a Rating scale used was 1= not important, 2=slightly important, 3 = important, 4 = very important, and 5 = extremely important.

^b Percentage of Responses in the three most favorable categories of the rating scale (important, very important, or extremely important).

superintendent's disposition toward technology are that school staff is clear that technology is in place to support instruction and that technology needs to be adequately funded. Panel responses varied widely on the issue of a cabinet level position as an indicator of a superintendent's disposition as an effective technology leader. The panel did not reach consensus on this item. It should be noted however that the panel reached consensus on the dispositional indicator of "a district technology leader can be identified by staff."

The themes emerging as dispositional indicators of superintendents as effective technology leaders were: (a) accountability; (b) adequacy of resources; (c) staff knowledge; (d) community relationships; (e) evidence of technology planning, vision, and innovation; and (f) technology visibility.

Items that are reflective of accountability included, "staff is evaluated on use of technology to guide instruction" and "impact of technology use on instructional practice is measured." Adequacy of resources is indicated by panel consensus on items such as "technology is funded at an adequate level" and "resources available for technology professional development." The theme of community relationships is illustrated by panel consensus on items such as "community members believe that use of technology in school is safe" and "school/community partnerships are evident in support of technology use in the district." Items associated with technology planning, vision, and innovation included: (a) technology master plan is current, (b) atmosphere of innovation permeates the school system, (c) both innovative and basic levels of technology use are encouraged, and (d) evidence of a vision for technology exists.

Summary

The Delphi technique was used to define the role of the school superintendent as an effective technology leader in terms of knowledge, performances, and dispositions. A panel of 29 experts agreed to participate in a three-round survey process. Panelists were selected based upon their roles as technology stakeholders and their diverse perspectives on technology leadership in education. All 29 panelists participated in three rounds of the study.

Delphi I included three open ended statements for which panelists were asked to provide responses: (a) to be an effective school technology leader, a superintendent should know, (b) to be an effective school technology leader a superintendent performs the following, and (c) the following are indicators of a superintendent's disposition (attitude) toward technology. From responses to each of the open ended questions, 41 knowledge items, 41 performance items, and 44 disposition items emerged. Responses to the Delphi I instrument were used to develop the Delphi II instrument.

Delphi II was constructed using responses from the Delphi I instrument. Each item was randomly presented on the instrument. A five-point Likert scale was added to each item with the following values for each item: (a) 1= not important, (b) 2=slightly important, (c) 3= important, (d) 4=very important, and (e) 5=extremely important. Panelists were asked to rate each of the items related to knowledge, performances, and dispositions of superintendents as effective technology leaders. In the knowledge domain, "the relationship of the district technology plan to the district strategic plan," was the most favorable response. In terms of performances results

indicated data driven decision making to be the most important action for superintendents considered to be effective technology leaders. The highest rated dispositional indicator of a school superintendent as an effective technology leader was “technology is funded at an adequate level.”

For the Delphi III instrument, panelists were provided with the frequency distribution, total number of responses, overall percentage of items rated in the three most favorable categories, and their response for each item on the Delphi II instrument. Consensus was considered achieved when 80% of the panel members rated an item in the three most favorable categories of important, very important, or extremely important. In the domains of knowledge and performances, panelists reached consensus on 27 items. Consensus in the dispositions domain was reached on 35 of 44 items.

CHAPTER 5
CONCLUSIONS, DISCUSSION, IMPLICATIONS FOR
PRACTICE, AND RECOMMENDATIONS FOR FUTURE RESEARCH

The role of the school superintendent has evolved over the years to meet changing educational demands. Since the establishment of the position in the mid 1800s the superintendent's role has changed dramatically (Carter & Cunningham, 1997). No longer expected to have only an educational administrative focus, the position requires that superintendents serve as instructional leaders as well chief executive officers. With technology innovations making their way into our schools over the last decade, superintendents have been placed in the fast-changing often-complex world of technology leadership. They are accountable for all that their organizations do or fail to do in all areas of school administration.

A three-round Delphi was conducted to define the role of the school superintendent as an effective technology leader in terms of necessary knowledge, performances, and dispositions. Twenty-nine expert panelists with diverse perspectives on school technology and leadership participated in the study. Panelists consisted of members representing the following groups: (a) nationally recognized technology professionals, (b) parents, (c) principals, (d) school board members, (e) school district technology professionals, (f) school superintendents, (g) state education leaders, (h) teachers, and (i) university faculty.

Conclusions and Discussion

The role of the school superintendent as a technology leader can be defined as the multifaceted accumulation of technical know how, the performance of definitive technical and leadership related actions, and the exemplification of personal dispositions that are reflected throughout the school community. Specific knowledge, performance, and dispositional indicators for school superintendents considered as effective technology leaders were developed in the conduct of this study. There are no studies found in the literature that have been conducted on these parameters relative to superintendents as technology leaders.

A superintendent that is considered to be an effective technology leader is one who: (a) possesses the necessary technology knowledge, (b) performs actions that are beneficial to school community growth and development through the use of technology, and (c) demonstrates those dispositions that are indicative of a positive and growth-oriented posture toward technology within an organization.

Findings in the knowledge domain were associated within the main themes of professional knowledge, technology integration, technical skills, and technology specific management skills. The expert panel reached consensus on 27 of 41 items in the knowledge domain. Results of the study indicated a specific set of leadership knowledge requirements exist in the school technology arena for which superintendents should be prepared.

Performance items were those actions seen by the panel as actually being carried out by school superintendents seen as effective in technology leadership. The top rated

consensus item was related to data driven decision-making. Emergent themes in the performance area were categorized as support of the human infrastructure, technology related mentoring, managing technology, and management with technology.

Dispositional indicators were developed that consisted of organizational evidences of a school superintendent's disposition as an effective technology leader. The main themes emerging as dispositional indicators of superintendents as effective technology leaders were categorized as: (a) accountability; (b) adequacy of resources; (c) staff knowledge; (d) community relationships; (e) evidence of technology planning, vision and innovation; and (f) technology visibility.

The Delphi technique proved to be a valuable albeit time consuming proposition. The experience allowed a degree of qualitative interaction through phone and email discussion with panelists along with a quantitative analysis on each of the three survey rounds. The administrative overhead associated with survey preparation, distribution, and monitoring required great attention to detail and perseverance of all panelists as well as the facilitator. The 100% response rate on all three survey rounds is attributed to panel member interest in the topic and persistence on the part of the researcher.

Implications for Practice

This section contains recommendations for best practices for school superintendents who are considered to be effective technology leaders. The recommendations will be useful for those planning superintendent or school leader preparation programs, school board members involved in the selection of superintendents for leadership positions in the area of technology leadership, state technology leadership

committees, superintendents interested in technology professional development, or any other stakeholder concerned with technology leadership in a school setting. The domains associated with knowledge, performance, and dispositions are presented here based on data that were collected as a part of this study.

Knowledge

Knowledge items are those items that should be known by a superintendent who is effective in the area of technology leadership. The 27 consensus items in this domain were further categorized into the following themes: (a) professional knowledge, (b) technology integration, (c) technical skills, (d) technology specific management skills, and (e) knowledge factors associated with total cost of ownership.

Professional knowledge

Acquiring and maintaining “currency” in the professional knowledge domain is ongoing. In the area of technology leadership, keeping up with professional knowledge requires continual “updates” in the form of knowing current research, new technologies, and best teaching practices. Within the theme of professional knowledge, it is incumbent upon school superintendents to clearly articulate the elements of their vision for technology in a school district. This vision should include definitive evidence recognizing that technology professional development is the cornerstone of teacher success with technology in the classroom, and should also reflect the superintendent’s knowledge of the current status of instructional delivery methods throughout the district. Knowledge of data driven decision-making requirements is also key to superintendent success as an effective technology leader. Attendance at professional seminars or postgraduate

coursework regarding data driven decision-making would benefit superintendents interested in developing or refining their skills in this area.

The area of technology leadership in university level preparation programs is clearly necessary for the development of future school leaders. Program such as the School Technology Leadership Initiative (STLI) at the University of Minnesota offer valuable resources for future school leaders in the development of skills and professional knowledge required for administrators in the area of technology leadership. All university level leadership preparation programs should provide a thorough and systematic approach to preparing school leaders for the technology related leadership challenges they will face in practice.

Technology Integration

In the area of technology integration, school superintendents should know and be able to identify the relationship between technology and the curriculum. This requires knowledge of what good technology integration “looks like.” This knowledge can come from a variety of sources such as: (a) the completion of technology integration exercises in university preparation programs; (b) district sponsored technology expos, camps, or mini conferences; (c) attendance at teacher integration conferences; and (d) any forum in which technology integration is the focus. Knowledge of technology integration should include the understanding that use of technology in any classroom is a means to an end.

Technical Skills

Superintendents should possess a basic set of technical skills. These skills should include basic skills in the use of productivity software such as word processors,

presentation software, spreadsheets, and databases. School superintendents who possess these skills are able to better understand the needs of those in their charge and are also in a better position to model technology use throughout the division. The notion of leadership by example is prominent here.

Technology Specific Management Skills

Within the theme of “technology specific management skills,” superintendents should be able to articulate the relationship of the district’s strategic plan to the district’s technology plan. This should include knowledge of the total cost of technology ownership, the conceptual relationship between technology and business efficiency, and how to identify pitfalls associated with adding new technologies to school programs. The management of placing new technologies into instructional or business functions of the district needs to be associated with a specific “end state” in mind. Superintendents should be able to articulate why a particular new technology is being adopted before authorizing the movement toward it. Change for the sake of change can cause multiple layers of dysfunction throughout the district.

Total Cost of Ownership

Total cost of ownership issues are associated with knowledge of factors such as the ability to conduct or oversee a technology lease/purchase analysis, recognition that technology must be replaced on a cyclical basis, and the articulation of human infrastructure costs associated with technology purchases (cost of engineering support, professional development training, vendor support, and other costs associated with cost over time). The adoption of each new technology in a school district should include a

cost/benefit analysis (even if simply discussed) as well as consideration of total life cycle costs.

Performances

Performances include actions that are performed by superintendents considered to be effective technology leaders. The actions can be in the form of either physical actions such as modeling the use of a particular technology or management actions such as “guides the district toward a clear commitment to student learning through the use of all technologies.” Emergent themes in the performance area were categorized as support of the human infrastructure, technology related mentoring, managing technology, and management with technology.

Support of the Human Infrastructure

Support of the human infrastructure related to technology in a school district is a widely inclusive endeavor associated with providing monetary resources, supporting adequate training, and understanding personnel needs and qualifications across the entire organizational structure. Technology in a school district is a shared functional resource that is not easily managed in a traditional hierarchical fashion. Because the technology challenge is “owned” by everyone, not just the technician, the network engineer, the data group, the lead technology teacher, or even the classroom teacher, provisions must be made to ensure each component of the human infrastructure receives periodic “care and feeding.” This can be accomplished through professional portfolios in which skills are demonstrated and documented based upon an individual’s position in the organization. Cross training can also play an important role in support for the human infrastructure. By

understanding what is required of people in other positions, sensitivities to capabilities and limitations become apparent, and the organization benefits.

Technology Related Mentoring

Technology related mentoring was clearly viewed by this panel as an important consensus item. With an emphasis on data driven decision-making superintendents are expected to demonstrate a high degree of skill in using and manipulating data in favor of instructional decisions for the benefit of students and in making district related business decisions. This entails familiarity with not only the “technical” aspects of manipulating software, but also the ability to simply ask the right question or request what data should be captured by a student information management system. Simply relying on “data people” to design report templates or generate custom reports without providing specific guidance on what information is required is not enough. To be considered an effective technology leader, a superintendent should be able to mentor subordinates in the use of data and other technology related tools.

Managing Technology

Managing technology refers to those consensus items specifically associated with how technology is implemented throughout a school district. The notion of total cost of ownership was evident in both the knowledge domain as previously mentioned as well as the performance domain. Superintendents need to be able to forecast (or direct the forecasting) of all costs associated with adoption of a new technology. Items that should be included in the forecast are: (a) potential longevity of the new technology, (b) cost of training personnel both in terms of potential productivity time lost and actual cost for

training, (c) compatibility with other systems, and (d) potential disruption to learning or current operations within the district in the adoption of new technologies.

Strategies to minimize disruptions and maximize technology investment include: (a) communicating the vision of the new technology to all stakeholders; (b) conducting pilot programs; (c) ensuring vendor support is available, particularly in the acquisition of complex systems; (d) rolling out new systems while old systems are still functioning; and (e) conducting post rollout follow-up with all stakeholders to trouble shoot lingering issues.

Management With Technology

The “management with technology” theme refers to panel consensus items associated with a superintendent’s ability to perform management functions through the use of technology. This includes the use of tools such as email, personal digital assistants (PDAs), presentation systems, and other common productivity tools. Additionally, management with technology includes the consensus items associated with data driven decision-making.

Dispositions

Dispositions included those organizational indicators of a superintendent’s proclivities toward technology. Dispositional indicators from this study are applicable in the formulation of district or superintendent assessments in the area of technology leadership. Superintendents can use the dispositional indicators as self-assessment guidelines on their effectiveness in the area of school technology leadership. Overarching areas emerging in the area of dispositional indicators were: (a) accountability; (b)

adequacy of resources; (c) staff knowledge; (d) community relationships; (e) evidence of technology planning, vision and innovation; and (f) technology visibility.

Accountability

Measuring the impact of technology on instructional practice is vital in the technology cost/benefit equation. This may be accomplished through agenda items on teacher round tables, use of school and community based technology committees, periodic school improvement surveys, or by any other means designed to garner staff or community input regarding the impact of technology on district goals. Accountability measures include clearly articulated guidelines for staff in the acquisition and use of technology. Guidelines should include a clear expectation that all technology should be acquired only after a description of the need is clearly articulated. Staff evaluations should include consideration of technology acquisition and benefits to instructional or business functions.

Adequacy of Resources

Though difficult to define without adhering strictly to a count of people, things, and money, adequacy of technology resources ultimately includes availability of a wide variety of physical (hardware) and human infrastructure. What is “adequate” in terms of technology resources can vary largely between districts, teachers, or even students. What is important here is that members of organizations are asked for their input on adequacy of technology resources so that a technology posture can be planned, developed, and maintained.

Staff Knowledge

A clear indicator of a superintendent's disposition toward technology is staff knowledge of the district's technology posture. This includes teacher knowledge of when classroom computers will be upgraded, the procedure for piloting a specific piece of instructional software, or being able to identify a building technology leader. Another dispositional indicator of staff knowledge is knowing the mechanism for sharing best technology practices throughout the district. This can be in the form of technology professional development sessions or even a district level web presence of technology best practices.

Community Relationships

In the area of community relations, dispositional indicators of superintendents include clear evidence of community partnerships in education. Superintendent's who are effective technology leaders seek the assistance of the community in the pursuit of the total education of the student. An example of that relationship includes internships in technology related positions. This assists students in preparation for technology related careers while giving potential employers a chance to determine if the school curriculum is preparing students to meet their needs.

Evidence of Technology Planning, Vision, Innovation, and Visibility

Technology planning must encompass vision not only in a futuristic sense, but also in a superintendent's ability to create a personal vision (Manesse, 1986) for technology's role within a district and then lead the organization toward it. Creation of a vision related to technology use and innovation can be the product of inputs from

personal, internal organizational, and external organizational influences. Evidence of a technology vision can be in the form of periodic reports to the school board from the superintendent, staff, advisory committees charged with overseeing the implementation of the vision or by other designees assigned by the superintendent. Periodic reports signal the importance of technology's role and keep all school publics apprised of progress toward meeting the vision.

In terms of visibility, technology should be visible enough to be used seamlessly throughout the district whether in the classroom, a media center, a business office, or any location in which access to information and productivity tools is necessary. Visibility can be in the form portable keyboards for students, assistive devices for students with special needs, software applications to assist in the finance area, or disaggregation software used for data driven decision-making. Visibility indicators that have a negative connotation on technology leadership include stockpiles of hardware and software in schools or district spaces that is clearly not being used or even worse, remains in original shrink-wrapped packaging that has never been opened. This signals poor planning and implementation. If technology is placed in a school district, it should be placed as part of a visionary plan that includes a supporting infrastructure.

Recommendations for Future Research

Although findings in the knowledge and performance domains complement existing standards, there are implied tasks associated with each that require some degree of previous knowledge or skill by a superintendent who is considered effective as a technology leader. For example the implied tasks associated with the consensus item

“mentors administrators in positive technology leadership” might include previous skill in knowing what technology integration looks like in the classroom, or skill with a database tool such that the superintendent could provide mentorship on data driven decision making to administrators in their charge. Another example includes the knowledge item “identification of pitfalls associated with adding new technologies to school programs.” Implied tasks related to this item include some knowledge of the current status of technology throughout the division, understanding the importance of technology support, and familiarity with the innovation adoption cycle (Rogers, 2003). Association of implied tasks with each of the knowledge, performance, and disposition items identified is well beyond the scope of this study and is well suited for future research.

As discussed earlier, national standards developed for administrators through the Collaborative for Technology Standards for School Administrators (TSSA) contain six standards statements with corresponding performance indicators for each. The results of this study in the areas of knowledge and performances complement the standards in that each of the consensus items herein can be generally applied to either the broad standards statements or the performance indicators. The findings associated with dispositional indicators of superintendents as effective technology leaders are not directly associated with the TSSA standards. Rather, dispositional indicators lend themselves more toward development of assessment indicators of superintendents as effective in technology leadership. Future research can be focused on development of an assessment instrument for superintendents as effective technology leaders. The instrument can be in form of a

traditional tool used by visiting survey teams, or may be in a web-based format designed as a self-administered assessment by individual superintendents or school boards.

Studies cited earlier (Cuban et al., 2001; Hester, 2002; Zhao & Cziko, 2001) dealt with factors associated with teacher use or nonuse of technology in the classroom.

Superintendent leadership as a factor affecting teacher adoption and use of technology is an area in which further study is warranted. The findings here regarding knowledge, performances, and dispositions can be used to facilitate such research.

The completion of this study was dependent upon the anonymous input of a panel of experts. The study was limited to input by a panel of 29 expert stakeholders with diverse perspectives on education. The study did not address school district size, geographic location, ethnicity, or other demographic considerations. Instead, input from a broad audience was sought in an effort to obtain a balanced set of data regarding superintendent technology leadership. Potential future research could be aimed at using the results of this study as a starting point for determination of “role differentiation” based upon selected demographic characteristics.

Technology will continue as an integral part of our schools for the foreseeable future. If superintendents and other school leaders are to maximize its effectiveness, they must be active learners in this fast changing arena or run the risk of being “left behind.” The notion of technology leadership is one that needs attention if our schools are to be successful in the exploitation of technology in favor of students and learning. I subscribe to the notion that what is important to a leader in an organization, gets done. It follows then that “what” is known, becomes important. It is incumbent upon those charged with

the leadership of our schools to recognize the importance of innovation in the form of technology and prepare themselves for its use.

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APPENDIX A
IRB Request for Study

Request for Exemption of Research Involving Human Subjects
[please print or type responses below]

Principal Investigator (~~Faculty~~ or Faculty Advisor and primary contact): Stephen R. Parson (parson@vt.edu)

Co-Investigators (~~Faculty~~ or Student) David R. Mirra (dmirra@vt.edu)

Department(s): ELPS Mail Code: 0302 E-mail: parson@vt.edu Phone: (703) 538-8478 Project Title: The Role of the Superintendent as a Technology Leader # of Human Subjects 30

Source of Funding Support: ___ Departmental Research Sponsored Research (OSP No.: _____)
 All investigators of this project are qualified through completion of the formal training program or web-based training programs provided by the Virginia Tech Office of Research Compliance.

Note: To qualify for Exemption, the research must be (a) of minimal risk to the subjects, (b) must not involve any of the special classes of subjects, and (c) must be in one or more of the following categories. A full description of these categories may be found in the Exempt Research section of the Virginia Tech “*IRB Protocol Submission Instructions Document*” or in the federal regulations [45 CFR 46.101(b)(1-6)].
(<http://ohrp.osophs.dhhs.gov/humansubjects/guidance/45cfr46.htm#46.101>)

Please mark/check the appropriate category or categories below which qualify the proposed project for exemption:

- 1. Research will be conducted in established or commonly accepted educational settings, involving normal educational practices [see item (1), page 6 of the “Instructions” document].
- 2. Research will involve the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, **unless** the subjects can be identified directly or through identifiers linked to the subjects **and** disclosure of responses could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects’ financial standing, employability or reputation [see item (2), page 6 –“Instructions”].
- 3. Research will involve the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under item 2) above if the subjects are elected or appointed public officials or candidates for public office; **or** Federal statute(s) require(s) that the confidentiality or other personally identifiable information will be maintained [see item (3), page 6 of the “Instructions” document].
- 4. Research will involve the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens if these sources are publicly available or if the information is recorded by the investigator in such a manner

that subjects cannot be identified directly or through identifiers linked to the subjects [see item (4), page 7 of the “Instructions” document].

- [] 5. Research and demonstration projects designed to study, evaluate, or otherwise examine public benefit or service programs, procedures for obtaining benefits or proposed changes in such programs [see item (5), page 7 of the “Instructions” document].
- [] 6. Taste and food quality evaluation and consumer acceptance studies [see item (6), page 7-“Instructions].

_____	<u>Stephen R. Parson</u>	_____
Investigator(s)	Print name	Date
_____	<u>David R. Mirra</u>	_____
Investigator(s)	Print name	Date

_____	_____
Departmental Reviewer	Print name
Date	

Chair, Institutional Review Board
Date

IRB Approval #03-503
November, 2003

APPENDIX B
Internal Committee

Superintendent

Dr. Jean Murray

Superintendent, Stafford County Public Schools

Stafford, Virginia

University Faculty

Dr. Steve Parson

Professor, Educational Leadership and Policy Studies

Virginia Polytechnic Institute and State University

Blacksburg, Virginia

School Level Technology Administrator

Dr. Andrea Bengier

Assistant Superintendent for Instruction and Technology

Stafford County Public Schools

Stafford, Virginia

Principal

Dr. Ann Abel

Watauga Elementary

Abingdon, Virginia

APPENDIX C

Delphi I

Virginia Tech
Delphi Study Round 1

December 8, 2003

PLEASE COMPLETE AND RETURN ALL GREEN FORMS

Thank you for agreeing to serve as a panel member for the study associated with determination of specific knowledge, performances, and dispositions necessary for school superintendents to serve as effective technology leaders. As we have discussed, you will be participating in a three round Delphi study that is focused on the following research questions: (a) What does a school superintendent need to know about technology to be an effective technology leader? (b) What actions should be performed by a school superintendent to be considered an effective technology leader? and (c) What are specific indicators of a school superintendent's disposition as an effective technology leader?

Included with this letter are three open-ended statements that constitute the first round (Delphi I). The remaining two surveys will be web based and will contain compiled answers from all panel members.

Your responses will always be anonymous to the panel and will not be published. Your name and title will appear in the final report as a study participant.

Results of this study will be available for inclusion in university preparation programs for school leaders.

The following timeline has been established for the study:

Return Delphi I	November 28
Return Delphi II	January 28
Return Delphi III	February 26

David R. Mirra
Doctoral Candidate Virginia Tech
13 Dacey Lane
Stafford, VA 22554
dmirra@vt.edu
FAX (540) 658-5988

Steve R. Parson, Professor
Educational Leadership
7045 Haycock Street
Falls Church, VA 22043
parson@vt.edu

Participation Agreement Form

Please complete and return in the self addressed stamped envelope.

From: _____

To: David R. Mirra
13 Dacey Lane
Stafford, Virginia 22556
PHONE (540) 752-1122(H) Work (540) 658-6741 Fax (540) 658-6699
dmirra@vt.edu

Date:

_____ Yes, I would be pleased to serve as a member of your Select Panel in the Delphi study concerning *The Role of the Public School Superintendent as a Technology Leader*. I understand this will be a three-round process.

_____ No, I regret that I will not be able to participate in this study.
Comments: Type your comments here.

Signature _____

Please **return** this **completed form** as soon as possible. The Round I Instrument may be included or faxed backed to me.

Instructions for Delphi I
Return by date: December 28, 2003

Panel Member Name: _____

Panel Member Organizational Affiliation: _____

This study is aimed at achieving consensus on specific requirements for school superintendents to function as effective technology leaders. The areas in which the study is focused are: (a) knowledge, (b) performances, and (c) dispositions. Please include as many indicators as possible without overlapping among categories. The following definitions are offered to assist you:

Knowledge: Specific information that should be known by a school superintendent to be an effective leader in the area of technology.

Performances: Actions that should be taken by a school superintendent to be considered an effective leader in the area of technology.

Dispositions: An organizational evidence of what is valued by a school superintendent who is considered to be an effective technology leader.

Examples (Can be used as participant responses as applicable)

Knowledge

To be an effective school technology leader, a superintendent should know:

- how technology relates to instruction
- basic network infrastructure terminology
- how constructivism relates to technology integration

Performances

To be an effective school technology leader, a superintendent should perform the following:

- serve as the chair of a community-based technology advisory committee
- active participation in all professional development programs
- evaluate staff on the use of data in school improvement planning

Dispositions

The following are indicators of school superintendent's disposition (attitude) as an effective technology leader:

- division-wide awards program that honors teachers as innovators
- community "exposition" to increase community awareness of the division's technology posture
- technology is included as a performance item for administrators, teachers, and other staff with clear and understandable criteria

Delphi I

Open-ended statement 1

Knowledge

Directions: Please provide as many responses as appropriate. Use phrases if possible.

Examples (can be used as your responses if applicable)

To be an effective school technology leader, a superintendent should know:

- how technology relates to instruction
- basic network infrastructure terminology
- how constructivism relates to technology integration

To be an effective school technology leader, a superintendent should know:
(Specific information that should be known by a school superintendent to be an effective leader in the area of technology.)

- 1.
- 2.
- 3.
- 4.
- 5.

Please continue below or on back as appropriate.

Delphi I

Open-ended statement 2

Performances

Directions: Please provide as many responses as appropriate. Use phrases if possible.

Examples (can be used as your responses if applicable)

To be an effective school technology leader, a superintendent should perform the following:

- serve as the chair of a community-based technology advisory committee
- active participation in all professional development programs
- evaluate staff on the use of data in school improvement planning

To be an effective school technology leader, a superintendent should perform the following:

(Actions that should be taken by a school superintendent to be considered an effective leader in the area of technology.)

- 1.
- 2.
- 3.
- 4.
- 5.

Please continue below or on back as appropriate.

Delphi I

Open-ended statement 3

Dispositions

Directions: Please provide as many responses as appropriate. Use phrases if possible.

Examples (can be used as your responses if applicable)

The following are indicators of a school superintendent's disposition (attitude) as an effective technology leader:

- division-wide awards program that honors teachers as innovators
- community "exposition" to increase community awareness of the division's technology posture
- technology is included as a performance item for administrators, teachers, and other staff with clear and understandable criteria

The following are indicators of school superintendent's disposition (attitude) as an effective technology leader: (An organizational evidence of what is valued by a school superintendent who is considered to be an effective technology leader).

- 1.
- 2.
- 3.
- 4.
- 5.

Please continue below or on back as appropriate.

Place this and all other completed forms in the provided envelope and return to:

Dave Mirra
13 Dacey Lane
Stafford, Virginia 22556

APPENDIX D
Delphi II Instrument

Virginia Tech
Delphi Study Round II

January 7, 2004

Dear panel member,

Thank you for your response to the first round (Delphi I) questions on knowledge, performances and dispositions of school superintendents as effective technology leaders. You are participating as one of 29 expert panel members from throughout the nation. Your input remains extremely valuable to the study.

Enclosed is the Delphi II instrument. Please read the instructions on each page of the instrument carefully. Circle the appropriate responses for each item and return the forms in the self addressed stamped envelope no later than **JANURY 28, 2004**.

Upon tabulation of the results, the Delphi III instrument will be returned to you with both your individual results compared to the group response for each item. On the final round of the Delphi, you can adjust your input based upon your consideration of the group's mean response value for each item.

You can also fax your input to me if more convenient.

FAX: 540-658-5988
PHONE: 540-658-6741

David R. Mirra
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Stephen R. Parson, Associate Professor
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Educational Leadership and Policy Studies
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Falls Church, VA 22043

Delphi 2 Question 1 Knowledge

The following knowledge items are the aggregate results of all panel member responses to the Delphi I question on knowledge. Please use the following scale to rate the level of importance regarding what a superintendent should **KNOW** about technology to be an effective technology leader. Circle the response that most applies.

1=not important 2=slightly important 3=important 4=very important 5=extremely important

To be an effective school technology leader a superintendent should know...

1. the central role of professional development to achieving a return on technology investment	1 2 3 4 5	23. goals for technology use in the district	1 2 3 4 5
2. internet search strategies	1 2 3 4 5	24. how to identify pitfalls associated with adding new technologies to school programs	1 2 3 4 5
3. how technology can link schools and community	1 2 3 4 5	25. the relationship of technology to success in industry	1 2 3 4 5
4. how technology can be used to track performance	1 2 3 4 5	26. dangers of an Information Technology staff subverting the educational value of a network	1 2 3 4 5
5. how mediated learning distributed across space and time complements face to face learning	1 2 3 4 5	27. the relationship of technology to curriculum	1 2 3 4 5
6. intermediate technology skills with productivity tools (email, wp, db, ss, presentation)	1 2 3 4 5	28. basic technology skills with productivity tools (email, wp, db, ss, presentation)	1 2 3 4 5
7. funding sources available for technology	1 2 3 4 5	29. basic "technical" terms	1 2 3 4 5
8. ethical aspects of technology use in schools	1 2 3 4 5	30. management skills for a technology rich environment	1 2 3 4 5
9. differences between instructional uses of technology and business uses of technology	1 2 3 4 5	31. limitations of technology	1 2 3 4 5
10. the relationship of the district technology plan to the districts strategic plan	1 2 3 4 5	32. how to assess staff readiness for technology use	1 2 3 4 5
11. current research on educational technology	1 2 3 4 5	33. importance of network security	1 2 3 4 5
12. the relationship of socio economic factors as limits to technology availability	1 2 3 4 5	34. how to think out of the box	1 2 3 4 5
13. how to identify properly qualified technology staff	1 2 3 4 5	35. basic networking concepts	1 2 3 4 5
14. basic skills in data analysis to support data driven decision making	1 2 3 4 5	36. how to mobilize staff toward technology goals	1 2 3 4 5
15. basic skills in matching specific technologies to teaching and learning	1 2 3 4 5	37. how to strategically link inputs and outputs	1 2 3 4 5
16. potential longevity of an instructional technology	1 2 3 4 5	38. how to work cooperatively with people	1 2 3 4 5
17. the conceptual relationship between technology and business efficiency of the school district	1 2 3 4 5	39. the importance of "hard copy" printed materials in support of curriculum goals	1 2 3 4 5
18. the current status of instructional delivery methodologies throughout the district	1 2 3 4 5	40. how constructivism relates to technology integration	1 2 3 4 5
19. how to create a culture of technology investment	1 2 3 4 5	41. the relationship of 21st century workplace to fluency in various information technologies	1 2 3 4 5
20. how to establish technology budget priorities	1 2 3 4 5		
21. how to develop a vision for technology	1 2 3 4 5		
22. identification of total cost of ownership factors	1 2 3 4 5		

Delphi 2 Question 2 Performances

The following performance items are the aggregate results of all panel member responses to the Delphi I question on performance. Please use the following scale to rate the level of importance with regard to what actions should be **performed** by a superintendent in order to be an effective technology leader. Circle your response.

1=not important 2=slightly important 3=important 4=very important 5=extremely important

To be an effective school technology leader a superintendent PERFORMS the following actions...

1. demonstrates to community how data is used to improve student achievement	1 2 3 4 5	23. visits classrooms using technology	1 2 3 4 5
2. participates in technology related conferences	1 2 3 4 5	24. guides the district toward clear commitment to student learning through use of all technologies	1 2 3 4 5
3. defuses roadblocks leading to technology implementation	1 2 3 4 5	25. raises level of awareness about technology in public and private meetings	1 2 3 4 5
4. leads technology related staff development sessions	1 2 3 4 5	26. advocates with all school publics on behalf of students and teachers	1 2 3 4 5
5. assures that technology projects are either completed successfully or terminated	1 2 3 4 5	27. provides technology access for students in and out of school	1 2 3 4 5
6. conducts periodic technology needs assessments	1 2 3 4 5	28. provides support for instructional technology focus	1 2 3 4 5
7. assesses technology staff development effectiveness	1 2 3 4 5	29. protects innovation from cannibalism	1 2 3 4 5
8. supports the district technology committee	1 2 3 4 5	30. delegates responsibilities as a leader of leaders	1 2 3 4 5
9. assesses technology integration	1 2 3 4 5	31. models use of technology	1 2 3 4 5
10. questions how technology is being used to support instruction	1 2 3 4 5	32. mentors administrators in positive technology leadership	1 2 3 4 5
11. uses data to support decisions	1 2 3 4 5	33. creates opportunities for parent use of technology	1 2 3 4 5
12. supports professional development in the area of technology	1 2 3 4 5	34. facilitates home/school/community communication	1 2 3 4 5
13. supports innovation	1 2 3 4 5	35. involves technical staff in cabinet level decisions	1 2 3 4 5
14. stays abreast of current technologies	1 2 3 4 5	36. seeks community expertise in solving technology challenges	1 2 3 4 5
15. gets "out of the way"	1 2 3 4 5	37. works in partnership with other school districts to promote the efficient use of technology	1 2 3 4 5
16. evaluates the impact of technology before jumping into something	1 2 3 4 5	38. ensures adequate technology resources are available to accomplish integration of technology into learning	1 2 3 4 5
17. evaluates staff on use of data for school improvement	1 2 3 4 5	39. assess curriculum rich uses of technology	1 2 3 4 5
18. works in partnership with business community to fund technology use	1 2 3 4 5	40. sets expectations for staff in use of technology	1 2 3 4 5
19. encourages staff to take risks	1 2 3 4 5	41. maintains visibility throughout the district with matters dealing with technology	1 2 3 4 5
20. encourages staff to exceed minimum technology standards	1 2 3 4 5		
21. encourages pilot programs for new technologies	1 2 3 4 5		
22. develops budgets supporting total cost of ownership	1 2 3 4 5		

Delphi 2 Question 3 Dispositions

Circle the response that most applies. 1=not important 2=slightly important 3=important 4=very important 5=extremely important

The following are indicators of a school superintendent's disposition (attitude) as an effective technology leader...

1. technology integration is a condition for employment	1 2 3 4 5	23. evidence of a vision for technology exists	1 2 3 4 5
2. community members believe that use of technology in school is safe	1 2 3 4 5	24. school/community partnerships are evident in support of technology use in the district	1 2 3 4 5
3. innovative AND basic technology use are encouraged	1 2 3 4 5	25. best technology practices are shared in the district	1 2 3 4 5
4. school board members model use of technology	1 2 3 4 5	26. technology staff has an instructional focus	1 2 3 4 5
5. atmosphere of innovation permeates the school system	1 2 3 4 5	27. resources available for technology professional development	1 2 3 4 5
6. a district technology leader can be identified by staff	1 2 3 4 5	28. local higher education institutions are polled to ensure district graduates possess adequate technology skills	1 2 3 4 5
7. technology master plan is current	1 2 3 4 5	29. tech plan includes performance expectations for administrators	1 2 3 4 5
8. evidence of accountability from superintendent level	1 2 3 4 5	30. the district has a help desk support plan	1 2 3 4 5
9. regular reports to school board on technology posture	1 2 3 4 5	31. technology is included as a performance item for all staff relative to their positions	1 2 3 4 5
10. school sites have technology aides	1 2 3 4 5	32. technology is funded at an adequate level	1 2 3 4 5
11. staff is evaluated on use of technology to guide instruction	1 2 3 4 5	33. strengths and weaknesses of district technology posture are articulated by staff	1 2 3 4 5
12. district seeks national and state awards in the area of technology accomplishment	1 2 3 4 5	34. staff can articulate how district superintendent models use of technology	1 2 3 4 5
13. recognition programs evident for both staff and student technology use	1 2 3 4 5	35. district has a cabinet level chief technology officer	1 2 3 4 5
14. instructional staff (not technical staff) leads movement toward new technologies	1 2 3 4 5	36. technology is used as a tool in support of district operations	1 2 3 4 5
15. impact of technology use on instructional practice is measured	1 2 3 4 5	37. technology and learning are always considered in program planning	1 2 3 4 5
16. flexibility is evident in the district	1 2 3 4 5	38. curriculum rich uses of technology are included in curriculum planning	1 2 3 4 5
17. technology standards are in place for students	1 2 3 4 5	39. a "direct report" staff member is the chair of a technology advisory committee	1 2 3 4 5
18. expectation that ALL staff will participate in change initiatives (not driven by time to retirement).	1 2 3 4 5	40. a positive technology attitude permeates the district	1 2 3 4 5
19. evidence that technology leaders are accountable for implementation	1 2 3 4 5	41. technology use is visible throughout the system	1 2 3 4 5
20. evidence of system wide continual improvement in the form of strategic committees from all stakeholder groups	1 2 3 4 5	42. extra curricular clubs and activities are in existence	1 2 3 4 5
21. evidence of innovative ways to increase technology use	1 2 3 4 5	43. risk taking is evident in the district	1 2 3 4 5
22. district has a mechanism in place to ensure adoption of new technologies is not disruptive to learning	1 2 3 4 5	44. evidence of technology cost/benefit analysis ongoing	1 2 3 4 5

APPENDIX E

Delphi III Instrument

Virginia Tech
Delphi Study Round III

February 10, 2004

Dear panel member,

Thank you for your response to the second round (Delphi II) questions on knowledge, performances, and dispositions of school superintendents as effective technology leaders. Your input remains extremely valuable to the study.

Enclosed is the Delphi III instrument. It is the final survey for this study. Listed for each item is the frequency distribution, total number of responses for each item, and the overall percentage of responses for each item on Delphi II that were marked as a 3, 4, or 5 (important, very important, extremely important). Items in which responses did not meet the 80% criteria are marked with a ~~strike through~~ on the response sheet.

Please read the instructions on each page of the instrument carefully. Circle your revised responses (if any) for each item and return the forms in the self-addressed, stamped envelope no later than **FEBRUARY 26, 2004**.

You can also fax your input to me if more convenient.
FAX: 540-658-5988
PHONE: 540-658-6741

Please complete the enclosed "Publication and Receipt of Results Form." The information you provide will be included in the listing of study participants. Your individual responses will remain confidential.

Your participation throughout this process has been helpful and is greatly appreciated.

David R. Mirra
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13 Dacey Lane
Stafford, VA 22554
dmirra@vt.edu

Stephen R. Parson, Associate Professor
Virginia Tech
Educational Leadership and Policy Studies
7045 Haycock Street
Falls Church, VA 22043

Knowledge Instrument

The compiled list of knowledge items, frequency distribution, total number of responses for each item, overall percentages, and your responses from Round II are listed below. Please consider the panel responses to provide your final response to the statements below regarding what a superintendent should **KNOW** about technology in order to be an effective technology leader. Circle the response that most applies. Do not answer statements with a ~~strikethrough~~ as they did not meet the 80% criteria.

1=not important 2=slightly important 3=important 4=very important 5=extremely important

Frequency
Distribution

To be an effective school technology leader a superintendent should know...	Frequency Distribution					Total	Overall 1%	Your Response	Revised Response (if any)	Comments
	1	2	3	4	5					
1. the central role of professional development to achieving a return on technology investment	0	1	3	11	14	29	96.5		1 2 3 4 5	
2. internet search strategies	5	9	11	3	1	29	51.6		1 2 3 4 5	
3. how technology can link schools and community	0	2	5	12	9	28	92.9		1 2 3 4 5	
4. how technology can be used to track performance	0	0	8	8	11	27	100		1 2 3 4 5	not just track but improve
5. how mediated learning distributed across space and time complements face to face learning	0	6	13	6	3	28	78.5		1 2 3 4 5	
6. intermediate technology skills with productivity tools (email, wp, db, ss, presentation)	2	6	11	8	2	29	72.4		1 2 3 4 5	
7. funding sources available for technology	2	4	5	8	10	29	79.3		1 2 3 4 5	
8. ethical aspects of technology use in schools	0	2	8	13	6	29	93.1		1 2 3 4 5	
9. differences between instructional uses of technology and business uses of technology	1	3	10	9	6	29	86.2		1 2 3 4 5	
10. the relationship of the district technology plan to the districts strategic plan	0	0	0	14	15	29	100		1 2 3 4 5	
11. current research on educational technology	1	1	15	10	2	29	93.1		1 2 3 4 5	
12. the relationship of socio economic factors as limits to technology availability	0	6	11	10	2	29	79.3		1 2 3 4 5	
13. how to identify properly qualified technology staff	1	3	6	16	3	29	86.2		1 2 3 4 5	
14. basic skills in data analysis to support data driven decision making	0	2	6	14	7	29	93.1		1 2 3 4 5	prevalent in my district

Knowledge Instrument (continued)

Frequency
Distribution

To be an effective school technology leader a superintendent should know...	1	2	3	4	5	Total	Overall %	Your Response	Revised Response (if any)	Comments
15. basic skills in matching specific technologies to teaching and learning	0	9	9	8	3	29	68.9		1 2 3 4 5	
16. potential longevity of an instructional technology	0	10	12	4	2	28	64.3		1 2 3 4 5	
17. the conceptual relationship between technology and business efficiency of the school district	1	4	15	3	5	28	82.2		1 2 3 4 5	
18. the current status of instructional delivery methodologies throughout the district	0	3	11	12	3	29	89.6		1 2 3 4 5	
19. how to create a culture of technology investment	0	1	7	15	6	29	96.5		1 2 3 4 5	
20. how to establish technology budget priorities	0	0	10	15	4	29	100		1 2 3 4 5	
21. how to develop a vision for technology	0	1	2	9	17	29	96.5		1 2 3 4 5	
22. identification of total cost of ownership factors	2	3	13	6	4	28	82.1		1 2 3 4 5	
23. goals for technology use in the district	0	1	2	10	15	28	96.4		1 2 3 4 5	
24. how to identify pitfalls associated with adding new technologies to school programs	0	1	16	8	4	29	96.6		1 2 3 4 5	
25. the relationship of technology to success in industry	2	11	10	3	3	29	55.1		1 2 3 4 5	
26. dangers of an Information Technology staff subverting the educational value of a network	3	9	8	2	5	27	55.5		1 2 3 4 5	
27. the relationship of technology to curriculum	0	0	3	14	12	29	100		1 2 3 4 5	
28. basic technology skills with productivity tools (email, wp, db, ss, presentation)	2	3	11	7	5	28	82.2		1 2 3 4 5	
29. basic "technical" terms	3	5	11	6	4	29	72.4		1 2 3 4 5	
30. management skills for a technology rich environment	1	3	10	13	2	29	86.2		1 2 3 4 5	
31. limitations of technology	0	1	9	13	5	28	96.4		1 2 3 4 5	
32. how to assess staff readiness for technology use	1	3	12	10	3	29	86.2		1 2 3 4 5	
33. importance of network security	0	4	8	6	11	29	86.2		1 2 3 4 5	

Knowledge Instrument (continued)

Frequency
Distribution

To be an effective school technology leader a superintendent should know...	1	2	3	4	5	Total	Overall %	Your Response	Revised Response (if any)	Comments
34. how to think out of the box	1	3	4	8	12	28	85.8		1 2 3 4 5	generic
35. basic networking concepts	4	10	11	3	1	29	51.6		1 2 3 4 5	
36. how to mobilize staff toward technology goals	1	1	5	12	10	29	93.1		1 2 3 4 5	
37. how to strategically link inputs and outputs	1	5	11	5	7	29	79.2		1 2 3 4 5	
38. how to work cooperatively with people	0	1	3	5	16	25	96		1 2 3 4 5	not related to technology
39. the importance of "hard copy" printed materials in support of curriculum goals	5	9	7	4	3	28	50		1 2 3 4 5	
40. how constructivism relates to technology integration	3	5	10	6	4	28	71.4		1 2 3 4 5	
41. the relationship of 21st century workplace to fluency in various information technologies	1	4	13	7	4	29	82.7		1 2 3 4 5	

Performance Instrument

The compiled list of performance items, frequency distribution, total number of responses for each item, overall percentages and your responses from Round II are listed below. Please consider the panel responses to provide your final response to the statements. Please use the following scale to rate the level of importance with regard to what actions should be **performed** by a superintendent in order to be an effective technology leader. Circle the response that most applies. Do not answer statements with a ~~strike through~~ as they did not meet the 80% criteria.

1=not important 2=slightly important 3=important 4=very important 5=extremely important

Frequency Distribution

To be an effective school technology leader a superintendent PERFORMS the following actions...	1	2	3	4	5	Total	Overall %	Your Response	Revised Response (if any)	Comments
1. demonstrates to community how data is used to improve student achievement	1	2	6	9	11	29	89.6		1 2 3 4 5	
2. participates in technology related conferences	3	7	14	4	1	29	65.5		1 2 3 4 5	
3. defuses roadblocks leading to technology implementation	0	1	7	12	9	29	96.5		1 2 3 4 5	
4. leads technology related staff development sessions	13	8	5	2	1	29	27.5		1 2 3 4 5	
5. assures that technology projects are either completed successfully or terminated	2	5	8	7	7	29	75.8		1 2 3 4 5	
6. conducts periodic technology needs assessments	5	5	7	10	2	29	65.5		1 2 3 4 5	
7. assesses technology staff development effectiveness	3	3	11	7	5	29	79.2		1 2 3 4 5	
8. supports the district technology committee	1	0	5	11	12	29	96.5		1 2 3 4 5	
9. assesses technology integration	3	5	8	8	5	29	72.4		1 2 3 4 5	
10. questions how technology is being used to support instruction	1	2	3	10	12	28	89.3		1 2 3 4 5	must evaluate this
11. uses data to support decisions	0	0	2	7	17	26	100		1 2 3 4 5	
12. supports professional development in the area of technology	0	1	1	14	13	29	96.5		1 2 3 4 5	w/o this teachers do not get trained
13. supports innovation	0	0	5	8	15	28	100		1 2 3 4 5	
14. stays abreast of current technologies	0	6	14	7	2	29	79.3		1 2 3 4 5	
15. gets "out of the way"	6	8	7	4	2	27	48.1		1 2 3 4 5	
16. evaluates the impact of technology before jumping into something	1	2	8	13	4	28	89.3		1 2 3 4 5	
17. evaluates staff on use of data for school improvement	1	4	7	9	8	29	82.7		1 2 3 4 5	

Performance Instrument (continued)

To be To be an effective school technology leader a superintendent PERFORMS the following actions...	Frequency Distribution					Total	Overall %	Your Response	Revised Response (if any)	Comments
	1	2	3	4	5					
18. works in partnership with business community to fund technology use	1	3	6	12	7	29	86.2		1 2 3 4 5	
19. encourages staff to take risks	0	1	12	7	9	29	96.5		1 2 3 4 5	generic
20. encourages staff to exceed minimum technology standards	0	0	7	19	3	29	100		1 2 3 4 5	
21. encourages pilot programs for new technologies	0	3	4	15	6	28	89.3		1 2 3 4 5	
22. develops budgets that support the total cost of ownership	1	1	2	16	9	29	93.1		1 2 3 4 5	
23. visits classrooms using technology	0	4	13	6	6	29	86.2		1 2 3 4 5	
24. guides the district toward clear commitment to student learning through use of all technologies	1	0	11	9	7	28	96.4		1 2 3 4 5	not sure what this means
25. raises level of awareness about technology in public and private meetings	0	4	9	11	4	28	85.7		1 2 3 4 5	
26. advocates with all school publics on behalf of students and teachers	0	1	4	6	17	28	96.4		1 2 3 4 5	not technology related
27. provides technology access for students in and out of school	1	5	12	8	3	29	79.3		1 2 3 4 5	
28. provides support for instructional technology focus	0	0	10	15	3	28	100		1 2 3 4 5	
29. protects innovation from cannibalism	2	6	6	4	6	24	66.7		1 2 3 4 5	
30. delegates responsibilities as a leader of leaders	0	3	5	4	14	26	88.4		1 2 3 4 5	
31. models use of technology	0	1	13	9	6	29	96.5		1 2 3 4 5	
32. mentors administrators in positive technology leadership	1	2	7	13	6	29	89.6		1 2 3 4 5	
33. creates opportunities for parent use of technology	2	6	11	9	1	29	72.3		1 2 3 4 5	
34. facilitates home/school/community communication	0	1	8	8	11	28	96.5		1 2 3 4 5	
35. involves technical staff in cabinet level decisions	1	9	7	8	4	29	65.5		1 2 3 4 5	
36. seeks community expertise in solving technology challenges	0	3	13	8	4	28	89.3		1 2 3 4 5	

Performance Instrument (continued)

To be To be an effective school technology leader a superintendent PERFORMS the following actions...	Frequency Distribution					Total	Overall %	Your Response	Revised Response (if any)	Comments
	1	2	3	4	5					
37. works in partnership with other school districts to promote the efficient use of technology	1	5	14	7	2	29	79.3		1 2 3 4 5	
38. ensures adequate technology resources are available to accomplish integration of technology into learning	1	0	3	16	9	29	96.5		1 2 3 4 5	
39. assess curriculum rich uses of technology	3	4	10	9	2	28	74.9		1 2 3 4 5	
40. sets expectations for staff in use of technology	1	0	9	8	10	28	96.4		1 2 3 4 5	
41. maintains visibility throughout the district with matters dealing with technology	1	1	11	8	8	29	93.1		1 2 3 4 5	

Dispositions Instrument

The compiled list of disposition items, frequency distribution, total number of responses for each item, overall percentages, and your responses from Round II are listed below. Please consider the panel responses to provide your final response to the statements below to rate the level of importance with regard to what dispositions are indicators of a superintendent who is an effective technology leader. Circle the response that most applies. Do not answer statements with a ~~strike through~~ as they did not meet the 80% criteria.

1=not important 2=slightly important 3=important 4=very important 5=extremely important

Frequency Distribution

The following are indicators of a school superintendent's disposition (attitude) as a technology leader...	1	2	3	4	5	Total	Overall 1%	Your Response	Revised Response (if any)	Comments
1. technology integration is a condition for employment	1	9	11	4	4	29	65.5		1 2 3 4 5	
2. community members believe that use of technology in school is safe	0	1	12	9	6	28	96.4		1 2 3 4 5	
3. both innovative and basic levels of technology use are encouraged	0	1	5	13	10	29	96.5		1 2 3 4 5	
4. school board members model use of technology	6	7	7	8	1	29	55.1		1 2 3 4 5	
5. atmosphere of innovation permeates the school system	0	4	5	8	12	29	86.2		1 2 3 4 5	
6. a district technology leader can be identified by staff	1	3	4	10	10	28	85.7		1 2 3 4 5	
7. technology master plan is current	0	0	4	14	10	28	100		1 2 3 4 5	
8. evidence of accountability from superintendent level	0	0	5	11	12	28	100		1 2 3 4 5	
9. regular reports to school board on technology posture	0	3	7	13	5	28	89.3		1 2 3 4 5	
10. school sites have technology aides	3	2	9	8	6	28	82.1		1 2 3 4 5	works well in my district
11. staff is evaluated on use of technology to guide instruction	0	2	10	12	5	29	93.1		1 2 3 4 5	
12. district seeks national and state awards in the area of technology accomplishment	4	10	9	5	1	29	51.6		1 2 3 4 5	
13. recognition programs evident for both staff and student technology use	3	6	6	11	2	28	67.8		1 2 3 4 5	
14. instructional staff (not technical staff) leads movement toward new technologies	0	3	9	7	10	29	89.6		1 2 3 4 5	
15. impact of technology use on instructional practice is measured	1	2	6	11	9	29	89.6		1 2 3 4 5	
16. flexibility is evident in the district	0	1	7	11	9	28	96.4		1 2 3 4 5	

Dispositions Instrument (continued)

The following are indicators of a school superintendent's disposition (attitude) as a technology leader...	Frequency Distribution					Total	Overall %	Your Response	Revised Response (if any)	Comments
	1	2	3	4	5					
17. technology standards are in place for students	2	2	4	11	10	29	86.2		1 2 3 4 5	
18. expectation that ALL staff will participate in change indicatives (not driven by time to retirement).	1	3	5	9	10	28	85.7		1 2 3 4 5	
19. evidence that technology leaders are accountable for implementation	0	0	13	10	5	28	100		1 2 3 4 5	
20. evidence of system wide continual improvement in the form of strategic committees from all stakeholder groups	0	3	4	15	7	29	89.6		1 2 3 4 5	
21. evidence of innovative ways to increase technology use	1	3	8	14	3	29	86.2		1 2 3 4 5	
22. district has a mechanism in place to ensure adoption of new technologies is not disruptive to learning	0	3	6	11	9	29	89.6		1 2 3 4 5	you can assume adoption will be disruptive
23. evidence of a vision for technology exists	0	0	3	7	19	29	100		1 2 3 4 5	
24. school/community partnerships are evident in support of technology use in the district	0	2	7	14	5	28	92.9		1 2 3 4 5	
25. best technology practices are shared through the district	0	0	1	13	15	29	100		1 2 3 4 5	
26. technology staff has an instructional focus	0	1	3	6	18	28	96.4		1 2 3 4 5	
27. resources available for technology professional development	0	0	1	14	14	29	100		1 2 3 4 5	
28. local higher education institutions are polled to ensure district graduates possess adequate technology skills	2	5	11	9	2	29	75.8		1 2 3 4 5	
29. technology plan includes performance expectations for administrators	0	0	8	15	6	29	100		1 2 3 4 5	
30. the district has a help desk support plan	1	2	4	13	9	29	89.6		1 2 3 4 5	works well in my district
31. technology is included as a performance item for all staff relative to their positions	1	2	9	11	6	29	89.6		1 2 3 4 5	

Dispositions Instrument (continued)

Frequency
Distribution

The following are indicators of a school superintendent's disposition (attitude) as a technology leader...	1	2	3	4	5	Total	Overall %	Your Response	Revised Response (if any)	Comments
32. technology is funded at an adequate level	0	0	1	12	16	29	100		1 2 3 4 5	
33. strengths and weaknesses of district technology posture are articulated by staff	1	3	9	12	3	28	85.7		1 2 3 4 5	
34. staff can articulate how district superintendent models use of technology	2	10	7	7	3	29	58.5		1 2 3 4 5	
35. district has a cabinet level chief technology officer	1	6	7	5	10	29	75.8		1 2 3 4 5	
36. technology is used as a tool in support of district operations	0	2	4	13	10	29	93.1		1 2 3 4 5	
37. technology and learning are always considered in program planning	0	1	5	12	11	29	96.5		1 2 3 4 5	
38. curriculum rich uses of technology are included in curriculum planning	0	1	3	11	13	28	96.4		1 2 3 4 5	
39. a "direct report" staff member is the chair of a technology advisory committee	0	8	7	10	2	27	70.3		1 2 3 4 5	
40. a positive technology attitude permeates the district	0	2	5	8	14	29	93.1		1 2 3 4 5	cultivated over time
41. technology use is visible throughout the system	0	1	4	13	11	29	96.5		1 2 3 4 5	
42. extra curricular clubs and activities are in existence	3	2	18	2	3	28	82.1		1 2 3 4 5	
43. risk taking is evident in the district	1	2	9	9	7	28	89.2		1 2 3 4 5	
44. evidence of technology cost/benefit analysis ongoing	0	1	7	15	6	29	96.5		1 2 3 4 5	

Publication and Receipt of Results Form

Return with Round III Instrument

Dear Panel Member,

Please provide your personal information as you would like it published in the study.

Name:

Title:

Organizational affiliation:

Other Details:

Yes, I would like a copy of the study. Please circle your choice.

email

CD

US Mail (hard copy)

No, I do not want to be sent a copy of the study.

Thank you for your participation throughout the process!

VITA

Date: April 2004

David R. Mirra

Stafford County Public Schools
Department of Technology
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Stafford, Virginia, 22554
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13 Dacey Lane
Stafford, Virginia 22556
Home Phone: 540-752-1122
Cell: 540-842-2869

PERSONAL INFORMATION

Born: March 9, 1952
Wilkes-Barre, Pennsylvania
Marital Status: Married: Wife, Kathy, Middle school teacher
Children: Daughter, Jessica; Son, Mark

EDUCATION

Ed.D., Educational Leadership and Policy Studies, 2004, Virginia Polytechnic Institute and State University, Blacksburg, Virginia

M.S., Education: Instructional and Assistive Technology/Special Education, 1998, George Mason University, Fairfax, Virginia

M.S., Systems Management, 1982, University of Southern California, Los Angeles, California

B.S., Education, 1974, East Stroudsburg State College, East Stroudsburg, Pennsylvania

HONORS AND AWARDS

Virginia Region 3 Technology Leadership Award 2002

Recipient of the 1998 Academic Excellence and Leadership Award in Instructional Technology, George Mason University, Fairfax, Virginia

ASSOCIATION MEMBERSHIPS

- Virginia Society for Technology in Education (VSTE)
- University Council for Educational Administration
- Virginia Technology Advisory Committee (VETAC) Executive Committee

PROFESSIONAL EXPERIENCE

Director of Instructional Technology and Information Services

Stafford County Public Schools

Stafford, VA

November 2003 – Present (April, 2004)

Responsible for all aspects of technology service delivery to Stafford County Public Schools to include:

- development of training programs for all staff in the use and integration of technology tools in the district. Training provided included administrator training on data based decision tools, teacher training on new technologies such as electronic gradebooks, instructional technology, and staff training on web based applications
- directing an initiative to move to wireless mobile laptop carts throughout the district
- management of the design, development, installation, implementation, and employment of a wireless Wide Area Network connecting 15/26 sites throughout the district
- facilitating the participation of district in an innovative Virtual High School program in partnership with George Mason University and two other participating school districts
- directing the planning and implementation of a complete district wide network upgrade resulting in T1 bandwidth to all sites

Supervisor of Instructional and Assistive Technology

Stafford County Public Schools

Stafford, VA

November 2001 – November 2003

Responsible for all aspects of Instructional and Assistive Technology in a school division with over 22,000 students and 2000 faculty to include:

- establishment and maintenance of division wide technology training program for all faculty and administrators.
- evaluation and purchase of all instructional software for the school division
- establishment of a unique regionally utilized assistive technology program and training lab for teacher training and student assessment in use of assistive technology

Technology Supervisor

Fredericksburg City Public Schools

Fredericksburg, VA

October 1999 – November 2001

Responsible for all aspects of technology computer technology service delivery to the school division to include:

- planning and management of a system wide upgrade from ISDN network service to T-1 service
- development and execution of a computer upgrade plan to provide upgrades to all systems within the division within a three year time frame
- institution of a technology leadership program resulting in 80% of teacher population attaining state required technology competencies
- development of a student intern maintenance program that assists in the development of student technology skills and accomplishment of various network and client maintenance issues.
- Installation and management of anti-virus software system wide
- Serving as a resource for assistive technology needs throughout the division
- Management of an email server dedicated to user-friendly mail system division wide.

Assistive Technology Specialist

Stafford County Public Schools

Stafford, Virginia

August 1996 - September 1999

Developed, implemented, and managed a program of assistive technology service delivery to a school division of 20,000 students

RESEARCH INTERESTS

I am interested in the development of school leaders as effective technology leaders. Specifically, I am interested in developing programs of instruction that include both technical and specific management skills appropriate in today's school leadership environment.

CURRENT RESEARCH

My dissertation was based upon development of the role of the school superintendent as a technology leader in terms of knowledge, performances, and dispositions. The study findings include recommendations for development of both technical and management skills necessary for superintendents to function as effective technology leaders.

TEACHING EXPERIENCE

EDIT 517 Introduction to Assistive Technology, George Mason University

A four credit graduate course required for all students with an assistive technology major

EDIT 0901 Integration of Technology into the Curriculum, Mary Washington College: James Monroe Center for Continuing Education

EDIT 0907 Introduction to Assistive Technology, Mary Washington College and James Monroe Center for Graduate Continuing Education

Developed, proposed, and implemented this course both at Mary Washington College and the James Monroe Center for Graduate and Professional Studies

EDIT 501 Leadership Issues in Instructional Technology, James Monroe Center for Graduate and Professional Studies.

All courses were taught while serving in an adjunct faculty capacity. I am prepared to teach the following courses:

- Introduction to Assistive Technology
- Advanced topics in Assistive Technology
- Current Trends in Instructional Technology
- Technology Integration for K-12 Staff
- Technology for School Administrators: Leading from the Front

MILITARY EXPERIENCE

Marine Corps Officer 1975-1996

Positions held: Pilot, Flight Instructor, Staff Officer, Leadership Instructor

Highest Rank held: Lieutenant Colonel

PROFESSIONAL PRESENTATIONS

“Assistive Technology in the University Environment,” Mary Washington College Faculty Academy, April 2001.

“Technology and the Reluctant Writer,” Mary Washington College Faculty Academy, April 2000.

“Assistive Technology: It’s the Law,” Virginia Society for Technology in Education, Roanoke, Virginia March 2000.

“Establishing an Assistive Technology Program: A Case Study of Stafford County Public Schools in Virginia,” Closing the Gap, Minneapolis, Minnesota, February 2000.

“Technology in Education, All Aboard the Bullet Train: Lead, Follow, or Get Out of the Way...please,” Virginia Society for Technology in Education, Roanoke, Virginia May 1998, 1999.

“Wonderful Way Cool Writing Strategies,” Virginia Society for Technology in Education, Roanoke, Virginia, May 1998.

PROFESSIONAL SERVICE

Founding editor for the Assistive Technology Department of the Virginia Society for Technology in Education (VSTE) Journal, 1999-2000.

PUBLICATIONS AND PAPERS

Mirra (2000). Typing Different: The dvorak layout, *Virginia Society for Technology in Education Journal*, 14 (2), 4-9.

Mirra (1998). Assistive Technology and IDEA 97: Implications for Educators, *Virginia Society for Technology in Education Journal*, 13 (1), 7-10.

REFERENCES

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