Credentialing Public Education's Technology Specialist Workforce: A Delphi Study

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ABSTRACT

Technology Specialists employed by public school systems throughout the United States currently have no education credential that recognizes their skill set. Through a Delphi process, an expert panel of Technology Coordinators from public schools throughout the United States prioritized a list of knowledge and skills deemed necessary for Technology Specialists to be productive in an educational arena. This list of items was the basis for the creation of a Conceptual Model of Prioritized Knowledge, Skills, and Credentials Required of Technology Specialists.

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Chapter I

INTRODUCTION

The Rise of Technology in Public Education

From a historical perspective, the successful launch of the Soviet Union's satellite, Sputnik, into space in 1957 helped foster a radical change in educational pedagogy (Wissehr, 2011). The United States' (U.S.) perceived loss of technological superiority from the satellite's launch ushered the Congressional National Defense Education Act (NDEA) in 1958 that promoted science, technology, and math education (Wissehr, 2011). This act, with mainly a vocational perspective, provided support and money for technology advancements and was soon followed by the Vocational Education Act of 1963 which provided seed money for states to include new technology in schools (McGlauflin, 2011). Championed by Carl D. Perkins, the Vocational Education Act of 1963 (P.L. 88-210) provided state grants to develop and maintain vocational-technical education programs for occupations that were currently in demand (National Research Council (U.S.) Committee on Vocational Education Research and Development, 1976). Within two years, the Elementary and Secondary Education Act of 1965, and more specifically its Title II portion, provisioned money for the purchase of library materials and other instructional supplies such as audio/visual equipment (Elementary and Secondary Education Act of 1965, 2004). Some computer equipment, specifically mainframe and mini-mainframe, was purchased using federal funds from this Act.

However, these devices were used for administrative tasks (McGlauflin, 2011). By the late 1960s many universities were offering classes in computer programming languages while many vocational training programs began to include computer maintenance as a potential occupation.

The precursor to the personal computer, the Apple I, was introduced to schools in the mid-1970s and was quickly followed in the early 1980s by the introduction of the personal computer (PC). These computers complemented typical drill and practice learning methodology often used in classrooms (Cruz, 2011; McGlauflin, 2011). Due to the expansion of the use of computer technology in public education in the 1990s, multimedia PCs were often available in schools at a ratio of six students per one computer (National Science Board, 2002).

The Technology Specialist

This proliferation of technology use in public education increased the need for additional personnel with assigned responsibilities, including the selection and purchase of technical equipment, its implementation, and then its continued support and maintenance (Carter, 2000). Identified as Technology Specialists, these non-certified persons were often the sole individual charged with integrating the computer hardware in public education classrooms (Cameron, 1999). Technology Specialists may also be referred to as Technology Support Specialists. Initially, Technology Specialists, often former classroom teachers, were hired to provide simple and routine maintenance to the technology found in classrooms that included PCs and printers (Carter, 2000). Several factors including the continued funding for technology, the ubiquity of the Internet, and the surge of classroom technologies increased the need for Technology Specialists. New

and additional technologies purchased for classroom use, the expansion of the school's and district's network infrastructures, and the pursuit of a one computer to one student ratio increased the need for Technology Specialists while also demanding that their skill set was uniquely honed to the delivery of expert knowledge concerning the implementation and support of technology (U.S. Department of Education, 2002). The work demands of these specialists, which now included both an administrative and pedagogical focus, gave rise to the hiring of more competent specialists with a unique skill set that included not only an understanding of technology and technology integration but also an understanding of the educational environment (Cameron, 1999; Carter, 2000).

Seen as late-comers to the cadre of district and school support personnel, the need for Technology Specialists first appeared in public education during the late 1990s after federal technology-focused initiatives, based on the initial and subsequent national technology plan for public education, began to channel seed money to state departments of education. According to the National Center for Education Statistics, 56% of teachers indicated that they had technical assistance available for help with computer use in 1999 (U.S. Department of Education, 2002). State educational agencies directed these federal funds to local education entities through both competitive and non-competitive grants "with the goal of using technology more effectively to enhance student achievement" (Crampton, 2007, p. 477).

During the initial phases of building a school district network infrastructure, networking specialists from the business and private enterprise sector were contracted to help implement and then further protect the fiscal investment of infrastructure electronics at the local and district level (Carter, 2000). As technology expenditures for classroom

technologies continued, such as purchases of computers, printers, and multimedia equipment, local school systems began to hire technicians whose job responsibilities included on-site installation and repair of classroom technology (Bushweller, 1996). Initial attempts at providing the much needed support were assigned to someone whose role was to serve as a Technology Specialist in addition to a variety of other jobs that could range from administrative tasks to telephone repair (Ronnkvist, Dexter, & Anderson, 2000). Because school districts lacked an understanding of the total cost of ownership (TCO) of technology, often these technicians were teachers with an interest in technology and were only slightly more skilled than teachers with little experience or no technology skills (Beem, 2002; Carter, 2000; Kaestner, 2007). However, because these teacher-technicians served two masters, either their classroom teaching duties or their school's technical support needs ultimately suffered (Caspary, Kusserow, Lavin, & Movassaghi, 1999). Later, legislation, as cited in Crampton (2007), considered that technology did play a role in enhancing student achievement. Between 2000 and 2010 enrollment in public education rose by eight percent to a total of 49 million students (United States Department of Education, 2011). In addition, the number of public education teachers also rose by eight percent (United States Department of Education, 2011). By 2008, 100% of public schools had Internet-connected, instructional computers, thus improving the ratio of students to computers to approximately 3 to 1 (Gray, Thomas, & Lewis, 2010). While public education experienced an increase in both numbers of students and teachers, and an improved ratio of computers to students, the U.S. Department of Education's bureau of statistics reported in 2008 that the number of Technology Specialists grew to 31% of public schools employing full-time staff whose

only responsibility was technology support or technology integration (Gray, Thomas, & Lewis, 2010).

Technology's Impact on Learning

After extended years of funding support from federal and state initiatives, researchers began to question whether technology advocates were initially right in touting the expected benefits of the use of technology in the classroom. As Chapman suggested, "no widespread consensus has been reached on whether computers and the Internet will have a large, small, positive, negative, or inconsequential effect on learning in young people" (Chapman, 2000, p. 308). In 2006, Cisco (Cisco Systems, Inc., San Jose, CA) commissioned the Metiri Group (Culver City, CA) to produce "Technology in Schools: What the Research Says" that was to identify the impact of educational technology on student learning (Fadel, 2006). The results of the report lamented a less than optimistic success rate of the benefits of technology and instead offered the thought that "advocates have over-promised the ability of education to extract a learning return on technology investments in schools" (Fadel, 2006, p. 2). In his Michigan Education Report article titled "Technically Foolish – why technology has made our public schools less efficient," Frederick M. Hess suggested that there was "no reputable analysis suggesting that the billions invested in technology have enhanced the productivity or performance of America's schools" (Hess, 2006). Additional research indicated that "simply providing access does not ensure that technology will effectively enhance teaching and learning" (Noeth & Volkov, 2004, p. vi). Though literature existed that was critical of the limited use of technology in the public education classroom, additional viewpoints provided a more positive role that technology might play in the classroom. Richard M. Beattie, in

his article “Four Ways to Ensure Quality Tech Support in Schools,” recognized that technology would reach its potential in K-12 education only when a school system’s technology experts became “intimately involved in using a school’s precious technology dollars to match the school’s mission and serve its unique student body” (Beattie, 2000, p. 1). Likewise, Caspary, Kusserow, Lavin, and Movassaghi (1999), wrote that:

> The success of technology programs appears to be related to a school's ability to develop a program that best fits its needs. The inherent changes in technology make the problem of technical expertise in schools more acute, and could justify a centralized body with sufficient expertise to act as an information clearinghouse and an advisory body. (p. 19)

Contemporary Funding Issues

Toward the end of the first decade of the twenty-first century the results of an economic recession caused financial hardships on many public agencies including school systems (Bryant, 2011). The results of that economic recession placed a never before seen hardship on local school systems as lost revenues from both the state and local budget created constraints leading to a reduction in force (RIF) policy and reduced funding for most, if not all, aspects of a school’s instruction (Long, 2011). The purchase of technology and the employment of technology support personnel were not shielded from these budget cuts (Vogt, 2009). Instead, during the times of these extreme budget cuts, the purchase and continued upkeep of technology, including the school system’s infrastructure and classroom equipment, became a point of scrutiny (Dubie, 2009). School administrators began to concern themselves whether the purchase of a certain technology was warranted and how its purchase would impact instructional strategies

(Gosmire & Grady, 2007). Furthermore, because instructional positions were often in jeopardy of being cut, in part due to the reduced school budget, leaders began to weigh the impact of reducing non-certified, at-will, and service personnel instead of reducing instructional positions. Suddenly school Technology Specialists were thrust into positions of pleading the need for technology along with their purpose of employment, which proved to be difficult because they lacked an understanding of the pedagogical process (Kellogg & Nelson, 2011). Having little or no knowledge about the educational process became a noticeable deficiency for technology specialists, as they were unable to associate technology integration to instructional worth and to also quantify their employment value during budget shortfalls. The culmination of these events necessitated the need for Technology Specialists to solidify their worth as an education professional possibly by seeking state-level certification. Credentialization would be used both as a means to bolster the worth of the Technology Specialist as an education professional while also providing a pathway to better educate others about the effective value of technology in education. To the educational community, credentialing the Technology Specialist would better ensure the selection, purchase, and integration of technology beneficial to the school and school system. To date, professionally endorsed preparation activities for the credentialing of Technology Specialists have not been decided (Madsen, 2005).

Need for the Study

While private industry information technology (IT) certifications were readily available and widely accepted within the business sector of the U.S. economy, these certifications were seldom recognized in the educational arena. The private business

sector, which also employed technical specialists, recognized an additional need as technology purchases and integration became more prolific and equated with productivity within the work environment (Miller, 1999). A need for competent and skilled specialists often became a requirement for many businesses (Venator, 2006). Lacking the expertise "in-house" to assess the capabilities of these specialists, many businesses began to recognize the credentialing process that was created and defined by third-party certification agencies (Haber, 1994). These agencies, which were not affiliated with any educational institution, took the responsibility for issuing portable "private certifications" to those individuals having performed adequately on an assessment designed to test the specialist on a specific software package or electronic component (Chapman, 2000). Common private professional certifications included the CompTIA A+, CompTIA N+, CompTIA Linux+, Microsoft Certified Technology Specialist (MCTS), Microsoft Certified Systems Engineer (MCSE), Hewlett Packard Master Accredited Systems Engineer (Master ASE), Certified Novell Engineer (CNE), and Certified Wireless Network Administrator (CWNA). Individuals possessing one or several private IT certifications showed, through assessment, their competency to provide expert support and maintenance on those technologies and also an understanding of the benefit that a certain technology would provide for an industry (Wenzel, 2010).

The role of the Technology Specialist was quickly becoming a prominent position within school systems and was now too important to have no standard to measure the desired competency or the level and types of knowledge necessary to properly fill the position.

Some states were beginning to consider steps and processes that should be taken to ensure that persons hired for the position of Technology Specialist possessed adequate knowledge and skills necessary to perform the jobs associated with this position. In particular, the state of North Carolina has defined competencies that Technology Support Specialists should have that enable them to serve as a technical expert (North Carolina Office of State Personnel, 2004). Likewise, the Orange Unified School District in California provided a list of qualifications, education, and preferred work experiences for potential Technology Specialists but did not require a specific IT or education credential (Orange Unified School District, 2004).

In this study, an informal electronic mail-based inquiry of several states was conducted to determine if any states were considering a credentializing process for Technology Specialists. State Department of Education personnel from fourteen states responded, indicating that their states were interested but to date were neither requiring a credential nor beginning to consider appropriate levels of knowledge and qualifications needed by Technology Specialists. Many expressed that the qualification requirements for Technology Specialists was left to the local school system. Nonetheless, many expressed an interest indicating that the requirements of the Technology Specialist's position were evolving to now include both technical and educational components.

Professionalization of this field was needed in order to first, remain consistent within the field of credentializing employees of public education and second, to ensure that those selected for a position would have the level of skill and knowledge necessary to ensure effective productivity.

Statement of the Problem

The role and position of Technology Specialists employed within a public school system often varies because either no current job description exists or because the position has evolved from a collection of previous unestablished duties and responsibilities given to school personnel with other seemingly more important responsibilities. Furthermore, as the availability and use of technology plays a greater role in the reform, operation, and instruction of schools and classrooms, Technology Specialists must evolve to meet the demands and challenges of these new paradigms (Ledesma, 2006). Given the need to often adopt four competing lenses, which according to Davidson (2003), included that of "a technician, the classroom teacher, the specialist, and the administrator" (p. 736), for the position of Technology Specialists to continue without a professional certification poses a problem because there are no standards to measure competency or the level or type of knowledge and skills necessary to fulfill the responsibilities of this important position.

Purpose of the Study

The purpose of this study is to develop a conceptual model that will guide the development of professional credentialing of Technology Specialists for productive employment in public educational institutions. This model will identify the recommended knowledge and skills that Technology Specialists must be required to know and perform and the qualifications or credentials that should be held.

Research Questions

The following questions will guide this research study:

1. What certifications do state education agencies currently require for

Technology Specialists?

2. What educational content and skills are necessary for Technology Specialists to become contributing members of an educational organization?
3. What professionally granted qualifications or credentials should a Technology Specialist possess?

Limitations, Assumptions, and Design Controls

Data collected for use in this study will be limited to the K-12 public school districts of the U.S. and will therefore have little to no value towards suggesting the need of credentialing Technology Specialists in other educational arenas such as private schools or post-secondary institutions of higher learning. This study is limited to public schools in the U.S.

A review of the existing literature indicated that very little research has been completed about the need to credential Technology Specialists. Much of the research was completed prior to the year 2000 and may not have current relevance. Furthermore, due to the rapid change of technology in both industry and education, the results of this study may not be relevant for more than a short period of time.

Significance of the Study

Given the adoption rate of technology into almost every aspect of life, the U.S. is moving towards an Internet-based economy (Min, 2001). The result of this economic model will demand an increased need to train and employ a competent technology support workforce skilled at implementing and supporting an efficient technology infrastructure model capable of working in concert with society. Similarly, technology's role in the function of the public education systems will have the same demands as

dictated by the societal model. Thus, correctly determining the specific technologies necessary for schools to further the educational process and to help with the administrative and instructional functions of a school district are dependent upon post-secondary trained and certificated technology professionals having both a technical and educational skill set. The successful marriage of technical and educational skill sets will provide the professionalization that these technology experts require to negotiate, purchase, and finally implement the effective technological infrastructure that is required within their school system.

Operational Definition of Terms

Academic Coach: These school-level, certified master teachers are employed because of their classroom success and extensive experience at developing effective educational strategies to help students achieve.

Human Capital: The economic value of a person's experiences, knowledge, and skills.

Infrastructure Electronics: The components responsible for the movement and management of data packets on a network or the Internet. Examples include routers, switches, and wireless access points.

Instructional Support Specialist: The same as an Academic Coach.

Instructional Technology Specialist: Often a school-level certified position; these individuals often possess a degree in media yet are trained to work with classroom teachers to integrate technology into existing pedagogy. Those employed in this position are typically unable to provide more than basic level technology support for technical problems.

Private Industry Certification: The rapid advancement of technology has, at times, been supported by individuals lacking the competency necessary to provide correct implementation and support. Private Industry Certification is a means to separate the incompetent from the competent technologist by certifying those individuals having achieved a successful score on an assessment that tests the knowledge level of a software package or some electronic device.

Reduction in Force (RIF): A policy adopted by public schools systems that allows a board of education to determine that a reduction in the number of certified staff members is necessary to accommodate for a declining enrollment in a grade or grades or changes in fiscal support.

Technology Coordinator: The Chief Information Officer for a school system. This individual's position on the system's organization chart may vary from state to state but is most often considered a district level administrator answering directly to the Superintendent.

Technology Experts: Persons with extensive knowledge in one or many areas of the technology industry. Often, these individuals have sufficient understanding of technology implementation and are considered experts because of their ability to forecast the role that technology will play in business, education, home, or the social sector of society.

Technology Specialist or Technology Support Specialist: Considered to be the individual most knowledgeable of the technology found within a school system. Typically, this individual possesses knowledge about end-user equipment and best practices for integrating technology into the classroom. The Technology Specialist may

or may not have private industry certification. The Technology Specialist may also be referenced as a Technology Support Specialist.

Total Cost of Ownership (TCO): An estimate of the direct and indirect costs associated with equipment or assets over its useful life.

Workforce Education: An educational process whose motif includes a component of field work and study.

Chapter II

REVIEW OF LITERATURE

The purpose of this review is to offer an overview of literature published relative to the access and support available for technology in the K-12 environment, the emergence of educational technology personnel in public education, the need for a credentializing procedure for school technology support personnel, and the Delphi methodology.

Technology Access and Technical Support

Surveys by the Pew Research Center, the National Center for Education Statistics (NCES), and the Center for Research on Information Technology and Organizations (CRITO) have measured the presence of technology availability in the K-12 environment (Becker, 2001; Parsad & Jones, 2005). These studies note that the majority of teachers have access to technology in their classrooms but would benefit from additional training on the use of technology and additional technical support (James, 2009). Further examinations of these studies led to a variety of research studies focused on determining the degree to which technology had become successfully integrated into the classroom (Cuban, 2001; Cuban, Kirkpatrick, & Peck, 2001). In 1998, Leggett and Persichitte identified five critical categories, Time, Expertise, Access, Resources, and Support (TEARS), which must be considered in order to successfully implement technology in the classroom (Leggett & Persichitte, 1998). Their research called for the identification

of support personnel who are "sufficiently competent and knowledgeable in hardware, software, and equipment maintenance, and who are also available to work directly with teachers" (p. 34). Furthermore, they suggested that "technical support also includes the identification and utilization of appropriate strategies, methods, and materials related to technology integration" (p. 34).

The Emergence of the Technologist in Public Education

The demand for technology availability in the public educational system was spurred by numerous reports produced by federal entities such as the Office of Technology Assessment, U.S. Congress, the U.S. Department of Education, and the National Information Infrastructure Advisory Council (NIIAC) (U.S. Department of Education, 2000). Most of these reports called for increased access to technology; additional software and computer content; professional development training on the use of technology in the classroom; the need for increased funding for technology; additional research; evaluation and assessment; and policy and regulation review concerning the use of technology in schools (Culp, Honey, & Mandinach, 2003). While the majority of these reports focused on the acquisition and infusion of technology into schools, by the late-1990s technology accessibility included the technical support and training necessary to "make use of technology to both create and consume information and ideas" (Culp, Honey, & Mandinach, 2003, p. 11). During this time both state and local educational agencies were cautioned to budget for and provide ongoing technical support in order to help with the construction of the school system's infrastructure and the "substantial ongoing maintenance and support" (McKinsey & Company, 1995, p. 3). Seen as a means to secure the continued use of technology in schools and classrooms, the development of

a relationship between those teachers using technology and the district's or school's technology support personnel provided a vital link between the success or failure of technology adoption (Koszalka, 2004).

As the technology continued to change and become more complex, a need for continued training existed for those individuals responsible for its support. Butler and Sellbom (2002) noted that many technology support personnel did not understand the need for a rapid response when dealing with technology-related problems in the classroom which continued to be a barrier to the adoption of technology by the classroom teacher. As stated by Luca Botturi, "good practitioners should be able to make sound and consistent decisions based on data and information that goes beyond the techy buzzword of the day" (Botturi, 2009, p. 285). Leggett and Persichitte (1998) concluded that inadequate technical support continues to be a barrier to technology integration in the K-12 classroom noting that these personnel must be capable of maintaining the technology but also knowledgeable about pedagogical issues including the use of appropriate instructional methods (Antonacci, 2002). As technology availability and integration into the classroom have increased, its role has changed from a tool to a means to transform education (Culp, Honey, & Mandinach, 2003).

The Instructional Technology Specialist

The need for mass training strategies has existed since the Second World War during which new technologies including film, radio, and other media were used to train the U.S. military (Zhu & Wright, 2006). Used as a means to provide training on the proper use of these new technologies, the role of the Instructional Technologist emerged. Also identified as media specialists, instructional designers, or simply IT specialists,

these service personnel concentrated on the design and training of materials related to the use of a certain technology (Zhu & Wright, 2006). However, the selection, installation, and maintenance of the technology used continued to be the responsibility of the Technology Specialist.

The Need for Credentialing Procedures in Education

The role of the Technology Specialist demands a level of expertise that is obtained from either an extended amount of time "in the field" learning to install and manage technical equipment through trial and error, or from an alternate vocational pathway acquiring theory from the traditional classroom (Carter, 2000). Regardless of the learning path, the Technology Specialist's role is a misunderstood and underappreciated necessity in the educational environment (Marcovitz, 1998). Kerckhoff and Bell (1998) noted that credentials other than the high school diploma and degrees in higher education are undervalued, are overlooked, under respected, and not recognized nationally. Within the K-12 educational environment a paradox surrounds the position of the Technology Specialist since the title indicates a level of occupational expertise that, with rare exception, is taken for granted, undocumented, and unmeasured (Marcovitz, 1998). Appreciating that this position has evolved to now include technology maintenance, staff and professional development instruction, and leadership aspects, this "ambiguous position," labeled by Patrick Ledesma (2006), will have more credibility if the Technology Specialist has either previous classroom experience or an understanding of classroom instruction (Ledesma, 2006). Thus the hiring practices of Technology Specialists is incongruent with practices for hiring other school employees since a

person's educational credentials are used to perceive human capital and productivity levels (Bills, 1988).

The 2001 No Child Left Behind Act (NCLB) (U.S. Department of Education, 2001) drew attention to achievement gaps associated with lower socioeconomic conditions and inexperienced or uncertified teachers. Suggesting that states attract new teachers with the introduction of alternative educational certification programs might attract a higher quality of teacher candidates (Boyd, Goldhaber, Lankford, & Wyckoff, 2007).

Human Capital Theory

An efficient and highly effective educational workforce is dependent upon the skills, traits, and characteristics of the workers that make up that organization (Olaniyan & Okemakinde, 2008). Thus the measure of a workplace's value, in economic terms, is directly correlated to the value of its labor force (Olaniyan & Okemakinde, 2008). The synergy of a worker's traits including one's knowledge level, skills, certifications, and qualifications is called Human Capital (Lewis, 1954). In a sense, the value of an organization is measured by the performance of its workers. Therefore, to increase the value of an organization it becomes mandatory to invest in those people that constitute the workforce (Sweetland, 1996). The education of an organization's workers is considered the most effective investment into human capital (Becker, 2008). Avenues such as secondary- and higher-level educational organizations, vocational education, and workplace learning are appropriate means to increase the level of education among workers (Corazzine, 1967; Mincer, 1974).

The advancement of an organization or the increase of an organization's economic value has a reciprocal need for its workers to equally increase their human capital (Olaniyan & Okemakinde, 2008). The requirement for an increase in human capital requires a workforce capable of demonstrating and documenting its abilities and competencies. Organizations dependent upon highly skilled workers often require their workers to provide a certification or credential from a third-party agency capable of authenticating the skills and knowledge level of the professional. Gibbons and Waldman (2004) identify this as task-specific human capital (Gibbons & Waldman, 2004). The requirement of a certification is standard practice in educational institutions at all levels including primary, secondary, and collegiate-level organizations. Dore (1976) referenced educational performance, measured by levels of certification, as serving as "signals of underlying ability" (Dore, 1976, p. 80).

The Delphi Technique

The iterative process of the Delphi Technique is useful as a means to bring consensus to a group of experts' opinions (Stitt-Gohdes & Crews, 2004). Utilizing a series of questionnaires, opinions are gathered from individuals recognized as experts in their respective fields on topics for which little to no current research exists (Clayton, 1997).

Crucial to the strength and validity of the study, the selection of those experts chosen to participate in the study must be carefully weighed based on their expansive knowledge, qualifications, and experiences in a given subject (Turoff & Linstone, 2002).

Olshfski and Joseph (1991) used the Delphi Technique to assess training needs of business executives because of the "unpredictability of the executives' world" (Okshfski

& Joseph, 1991, p. 297). Information gathered from this study was used to determine the educational needs of young executives and to identify useful content for an executive training program. An expert panel of 18 executives completed three rounds of the Delphi study.

Balaraman and Venkatakrishnan (1980) identified an expert panel of engineers and technologists from the public and private sectors of industry, research and educational organizations, government, and defense organizations to participate in a four-round Delphi study to identify the goals and then prioritize the goals of undergraduate engineering education in India (Balaraman & Venkatakrishnan, 1980). Forty goals for engineering education were identified by the panel of experts. Thus the Delphi Technique has been used to successfully identify curriculum needs.

Through a series of questionnaires used for gathering data from a group of respondents recognized as subject-matter experts in their respective fields, the Delphi Technique, or Delphi Process, is frequently used for systematically gathering anonymous opinions and providing feedback until a consensus is reached by the group of participants. The Delphi Process involves a series of questionnaires, each of which is subsequently built from the results of the previous questionnaire until consensus is reached (Skulmoski, Hartman, & Krahn, 2007). Often the Delphi Technique is used in a variety of fields ranging from policy development to the utilization of resources to the speculation of ideas for the purpose of "convergence of opinion on a specific real-world issue" (Hsu & Sandford, 2007, p. 1). Turoff and Linstone suggested the following conditions might lead to the choice of a researcher's decision to use the Delphi:

- The problem does not lend itself to precise analytical techniques but can benefit from subjective judgments on a collective basis.
- The individuals needed to contribute to the examination of a broad or complex problem have no history of adequate communication and may represent diverse backgrounds with respect to experience or expertise.
- More individuals are needed than can effectively interact in a face-to-face exchange
- Time and cost make frequent group meetings infeasible.
- The efficiency of face-to-face meetings can be increased by a supplemental group communication process.
- Disagreements among individuals are so severe or politically unpalatable that the communication process must be refereed and/or anonymity assured.
- The heterogeneity of the participants must be preserved to assure validity of the results, i.e., avoidance of domination by quantity or by strength of personality ("bandwagon effect") (Turoff & Linstone, 2002, p. 4).

The Delphi Technique is used in this study because it allows a group of informed participants, without meeting face to face, to comment through a series of moderator controlled questionnaires and gain a consensus on a specified topic which has not been thoroughly researched (Paul, 2008). The use of the Delphi Technique in educational research and settings is considered "particularly useful" (Yousuf, 2007, p. 2).

The origin of the Delphi Technique dates back to the 1950s when researchers from the Rand Corporation (Santa Monica, CA) worked on defense research for the U.S. (Gordon, 2003). Initially used as a classified military research method, the Delphi

technique evolved through a series of stages until, during the late 1970s, it became recognized as a "well suited research instrument when there is incomplete knowledge about a problem or phenomenon" (Skulmoski, Hartman, & Krahn, 2007). Only requiring two components, anonymous responses and controlled statistically driven feedback, a panel of experts is requested to rank choices from a continuum of answers which are then analyzed to provide a group response (Gordon, 2003; Hsu & Sandford, 2007, p. 2). Used iteratively, the group responses are provided as feedback, after being statistically summarized by the survey moderator, to the panel of experts who are allowed to revise previous answers after reviewing the anonymous responses of the group (Edwards et al., 2011). This technique allows the group's expert opinion to echo "judgments on factual matters where precise information is unavailable" (Skutsch, 1973, p. 1). Anonymity of the group members' responses is an essential component of the Delphi process because it encourages a group response thus minimizing those who might dominate the communication process and encourages participants who might otherwise conform to the group (Dalkey, 1969).

Summary of the Related Literature

The value and purpose of the Technology Specialist in the K-12 education sector continues to grow in importance as the integration of technology becomes a stronger component of classroom teaching (Carter, 2000). Although minimal literature and research exists about the intended purposes of the Technology Specialist's role, agreement does exist identifying the need for identifying personnel to help with the integration of technology into the classroom (Marcovitz, 1998).

Since all other school personnel deemed to be "professional" status are required to obtain a certification, the Technology Specialist continues to be an exception to this rule. This study is intended to identify the educational content and skills necessary for Technology Specialists to become contributing members of an educational organization and the certification status these Specialists should possess.

Chapter III

RESEARCH METHODOLOGY

This study sought a consensus that identified and then structured a set of professional qualifications or competencies that could be integrated into a conceptual model that would guide the development of professional credentialing of Technology Specialists in public education. Both quantitative and qualitative research instruments were used to answer the research questions. The Delphi Technique was utilized for this study because it provided a means to bring consensus to a group of experts' opinions (Stitt-Gohdes & Crews, 2004). Presented in this chapter are the theoretical framework by which to interpret the findings of this study, the research design including the methods and procedures utilized in the collection and analysis of the first research question, the use of the Delphi Technique, population and panel selection, subject matter expert (SME) review, instrumentation, data gathering procedures, analysis of the data, and reporting of the findings for research questions two and three.

Theoretical Framework

To date, Technology Specialists do not have a standard to measure their skill and knowledge levels for employment in K-12 public school systems. Equally so, no pathway exists for these professionals to document or measure, through the acquisition of a certificate or credential, their worth, or human capital, to educational institutions. This study sought to develop a model that described the human capital of Technology

Specialists. The human capital of these specialists would be measured by their knowledge level, skills, qualifications, and credentials (Olaniyan & Okemakinde, 2008). Therefore, Human Capital Theory was used as the theoretical framework from which to interpret the findings and guide the conclusions of this study. An efficient and highly effective educational workforce is dependent upon the skills, traits, and characteristics of the workers that make up that organization (Becker, 2008). Thus, the measure of a workplace's value, in economic terms, is directly correlated to the value of its labor force. The synergy of a worker's traits, including one's knowledge level, skills, certifications, and qualifications, is called Human Capital (Lewis, 1954).

Survey Methodology for Research Question One

Research Question One considered which certifications, if any, were required by state agencies of public school Technology Specialists. An e-mail was sent to solicit information from the most appropriate person at each state-level agency responsible for the certification of educational personnel. This solicitation and gathering of information described the national current state of affairs of the credentialing of Technology Specialists.

Data Collection for Research Question One

Using the World Wide Web, I identified the state-level professional certification agency for public K-12 schools in each state. Each state's certification Web site was searched using an Internet browser to locate an e-mail address of a person that could provide information about the certification process of education professionals. An e-mail message was sent to the state-level persons responsible for overseeing certification asking whether or not their state required that Technology Specialists possess a credential and, if

so, which credential was required (see Appendix A). Because some states either did not respond to the request for information or because no agency or individual was capable of supplying the requested information the World Wide Web was used to search that state's certification Web page and collect information about certification processes for Technology Specialists in each state. Collection of data from each state certification agency was recorded into a Microsoft Excel (Version 2010, Microsoft Corp., Redmond, WA) spreadsheet for analysis.

Instrumentation for Research Question One

On April 28, 2012, an e-mail message was used to communicate with a state-level person in every state responsible for overseeing certification (see Appendix A). This e-mail message identified the researcher, provided a description of the study, and included a definition for the Technology Specialist position. Furthermore, the e-mail message asked the certification agency to respond within one week, indicating whether or not Technology Specialists were required to possess a certification and, if so, to identify the certification. A second e-mail message was sent to each state's certification professional that did not respond within the first week.

The Delphi Technique

As mentioned previously in the literature review, this study utilized the Delphi Technique as a means to gather information from a selection of panelists recognized as experts in their professions.

The Delphi Process, according to Beech (1999) has the following stages:

1. Selection of panel (respondents) and allocation of identification numbers.

2. Construction and distribution of a first questionnaire (Round One). Completion and return of the Round One questionnaire.
3. Collation and categorization of suggestions and construction of second questionnaire (Round Two).
4. Distribution of a second questionnaire (Round Two). Completion and return of Round Two questionnaire.
5. Collation of individual and group scores for each suggestion.
6. Construction of a third questionnaire (Round Three), which is similar to the Round Two questionnaire but with individual and group scores for each suggestion from Round Two incorporated.
7. Distribution of a third questionnaire (Round Three). Completion and return of Round Three questionnaire.
8. Recollation of individual and group scores for each suggestion.
9. Possible further rounds of voting and possible requests for rationale and comments for more extreme scores.
10. Achievement of group consensus with calculation of summary statistics: maximum, minimum, and range of scores for each suggestion.
11. Distribution and use of findings (p. 284).

The success of the Delphi Technique is dependent upon the panel of experts and the quality of the questions on each questionnaire (Gordon, 2003). Arguing that, in the absence of scientific laws to help explain inexact science, combining the testimony of several experts into a statement provides a "legitimate and useful input in generating forecasts" (Günaydin, 2009). Often, a search of available literature could be used to

identify persons who had published about the subject in question (Gordon, 2003). Likewise, personal experiences or being a stakeholder would qualify an individual as an expert (Loo, 2002). Clayton (1997) identified an expert as "someone who possesses the knowledge and experience necessary to participate in a Delphi" (Clayton, 1997, p. 377). Considering that the validity and soundness of the Delphi rests on the selection of experts, incorrect selection procedures would reduce the technique's effectiveness and, according to the literature, invite criticisms as to the use of the technique (Turoff & Linstone, 2002). Thus, determining the problem of study and the participants' characteristics are critical first steps before embarking on a Delphi study (Duke, 2009; Stitt-Gohdes & Crews, 2004). A homogeneous panel size of 15 to 30 experts is considered acceptable while 5 to 10 experts would be used to field a heterogeneous panel (Clayton, 1997).

A Delphi study begins by sending a questionnaire to selected panel members. Questions for the initial Delphi survey round should be considerate of the experiences of the panelists. Equally so, an extensive literature review should be completed to ensure that the survey questions issues relevant to making a decision about the study's topic (Okshfski & Joseph, 1991). Once the initial survey has been constructed the questionnaires are distributed to and completed by the expert panel. The results of the completed first round are summarized by the researcher and analyzed to determine items that should be retained for the next survey round. These retained items are used to construct a second questionnaire that is sent to the panelists. During the second round, panel members are requested to determine a level of importance of the topics formulated by the initial questionnaire. This process is continued, usually three or four times, until a

group consensus of the criteria is achieved (Okshfski & Joseph, 1991; Turoff & Linstone, 1975).

Survey Methodology for Research Questions Two and Three

Population and Panel Selection

This study's panel consisted of Technology Coordinators from the K-12 school environment. Technology Coordinators were school leaders having a role in the administration of technology that included forecasting the mission and goals of technology in the school system and technology use policies. Technology Coordinators often began their tenure in the area of technology, hired first to be support personnel, called Technology Specialists, tasked with integrating technical equipment into the classroom (Marcovitz, 1998) . Occasionally, these Coordinators also held a teaching certificate or other education-related credential and had past experiences as a classroom teacher. As a result of their past experiences and work history Technology Coordinators possessed a "real-world" understanding of the technical needs of the classroom teacher but also understood the role that the hardware specialist, the Technology Specialist, must play in the selection, acquisition, and integration of technology at the district and local levels of a school system. Additionally, while these Coordinators, who are usually considered to be members of the district's leadership staff, understood the role of the Specialist, they further understood the district's needs, the goals and direction of the district's leadership staff and had, as an added role, the need to survey the technology needs of the district's administrative, teacher, and ancillary support staff (Davidson, 2003).

The criteria for the selection of the panel of Technology Coordinators invited to participate were that they possessed either an education or professional credential such as a teaching certificate, educational specialist certificate, or an educational leadership certificate. Those Technology Coordinators who did not possess an education or professional credential but instead had a professional IT certificate such as CompTIA's A+ certification, Microsoft's Certified Systems Engineer (MCSE) certification, or Planet 3 Wireless' Certified Wireless Technology Specialist (CWTS) were also invited to participate in the study. The selection criteria also required that those Technology Coordinators invited to participate must have been currently employed in a K-12 school system as a district-level Technology Coordinator within the U.S. for a minimum of three years.

To solicit the participation of Technology Coordinators from each state the World Wide Web was used to locate the name and e-mail address of each state's Technology Director. Each state's Technology Director received an e-mail message identifying the research, describing the study, and requesting the names and e-mail addresses of district-level Technology Coordinator's whom they would recommend to participate in the study from their state (see Appendix B). Utilizing information gathered from this process, an attempt was made to solicit participation from sixty (60) Technology Coordinators from different states (see Appendix B). After receiving the names and e-mail addresses of the recommended Technology Coordinators an e-mail message was sent soliciting their involvement as expert panelists in the Delphi Study (see Appendix C). A homogeneous panel size of 15 to 30 experts was considered acceptable (Clayton, 1997). Considering that Technology Coordinators were experts in the field of technology, the group was

considered to be homogeneous. To compensate for attrition an initial group of 54 experts (N = 54) were selected for participation on the panel.

Subject-Matter Expert Review of the First Round Instrument and Solicitation Letter

Prior to sending the e-mail invitation to participate and also prior to sending the first survey round, both the e-mail invitation and initial survey questions for round one were reviewed by three Georgia public school Technology Coordinators in an effort to seek subject-matter expert feedback concerning the readability, construct validity, and face validity for the e-mail letter and items included on the surveys. Three Technology Coordinators were asked to review and critique the e-mail letters that were sent to each state's Technology Director (see Appendix B) and to review the directions and items from the first round of the Delphi study (see Appendix G). These Technology Coordinators did not participate in the actual study.

All three reviewers responded that the e-mail letter was correctly worded and indicated that the draft's directions were specific and that potential participants would understand the instructions. One reviewer indicated that the first survey's items asked the right questions and that most of the survey items described his daily functions. Another reviewer indicated that the first survey was adequate but questioned the clarity of the second question's meaning of a specialist degree. An alternate definition was not suggested. The third reviewer suggested that the survey items beginning with the word "direct" should be re-worded to say "visit." After the subject-matter expert review was completed the solicitation e-mail letter and round one instrument were finalized with modifications as suggested above (see Appendix C).

Instrumentation

The success of the Delphi Technique was dependent upon the panel of experts and the quality of the questions in each questionnaire (Gordon, 2003). The first round Delphi survey had two sections (see Appendix G). The first section collected demographic information from the panel members, including (a) current position, (b) current educational credentials, (c) current IT credentials, (d) years of experience as a district-level Technology Coordinator, and (e) gender. Only the first survey collected demographic information. Demographic information was used to further ensure that the selected participants met the criteria for participation in this study, except that gender was gathered solely for future research purposes.

The second section of the first Delphi questionnaire contained one question which asked the panelists to select from a provided list of skills, qualifications, and credentials those characteristics that should be used to develop a conceptual model for professionally credentialing Technology Specialists.

Due to the limited availability of literature that identified and discussed the skills, qualifications, and credentials that might be used to qualify the position of Technology Specialist, job announcements collected from K-12 public school Web sites advertising employment availability for a Technology Specialist were used as a means to glean sought-after characteristics considered by school systems to be required of Technology Specialists. Thirteen job announcements from several states were gathered (see Appendix F). The compiled list of preferred job characteristics served as the basis for the initial questionnaire and starting point for the panelists to consider when answering the second question of the first round of the Delphi study. Those items not checked by any of the

Delphi panelists were not included in the second survey. Through an open-ended question participants of the study were also given an opportunity to provide additional items to be considered for the next survey round.

The second round survey (see Appendix H) listed the series of items that were checked and/or submitted by the panelists during the first survey round. Using a Likert-type scale, the panel of experts were instructed to consider and rate the items using a range from 1 (Strongly Disagree) to 7 (Strongly Agree). While the 5-point scale is common, the literature suggested that a 7-point scale would provide greater granularity and also reduce bias (Jamieson, 2004; Mathieson & Doane, 2003). Additionally, Likert-type scale responses were of value because of their ease of use for both the panelists and the researcher (Hasson & Arnetz, 2005). Reviewing each compiled list, panelists used the Likert-type scale to rate each item, indicating to what degree each item should be included in the lists of knowledge, skills, certifications, and qualifications that should be held by Technology Specialists.

The data from round two were then analyzed using descriptive statistics that yielded the frequency counts, percentages, means, and standard deviations. The results from round two were reported and presented to the panel members for the third round of the Delphi study (see Appendix I). Turoff and Linstone (2002) suggested that a "gap" would become obvious suggesting those items that should not be included in the following round.

Round three required panel members to use a forced-ranking scale to rank the items from the list in terms of importance based on their expert opinions. In essence, what was considered most important for Technology Specialist credentializing was to be

ranked first, the next most important item was to be ranked second, continuing on until each item had been ranked from first until last.

E-mail was the only source of communication between the panel participants and the researcher. The survey was a Web-based instrument. During the second subset of the first round, participants were presented a list of items which might be considered for inclusion in the following round. The panelists selected, using a check-box, those items which, based on personal experiences and qualifications, should be included in the following round. All responses for round two were presented as radio buttons to eliminate the ability for panelists to choose more than a single answer to each survey question. For the third and final round, panelists were presented with a two-column list that enabled them to select an item from a randomized column of items which, when selected, moved to a second column in order of ranking from highest importance to lowest importance based on their expert opinion.

Data Collection Procedure

For the purposes of this study, LimeSurvey (www.limesurvey.org), a Web-based survey instrument, was used to produce each round of the Delphi study and collect and record information from the panel of experts. At the completion of each survey round data were collected into a Microsoft Excel spreadsheet for further analysis. A uniform resource locator (URL) was sent via e-mail to all participants of the Delphi study indicating the location of the survey on the World Wide Web.

An invitation-to-participate e-mail message that acknowledged the panelist's expertise in the area of educational technology and presented the need for this study was sent to each potential panelist. Invited panel participants were informed of the need to

complete all rounds of the iterative study. Literature from previous research suggested that providing the study results to the panelists would help minimize attrition (Hsu & Sandford, 2007). As an incentive to complete all three survey rounds a final report showing those items which achieved consensus was offered to each panelist. A request to reply informing the researcher of the intent to participate was also requested. Potential survey panelists were given four days to reply indicating their desire to participate. All of the selected panelists were assigned survey-assigned tokens to ensure that their responses remained anonymous. Limesurvey was capable of tracing each token so that it could be determined which tokens completed all three survey rounds.

Each of the volunteer panelists received a follow-up e-mail message containing a URL to the Delphi survey's home page on the World Wide Web (see Appendix D). The e-mail message indicated the date during which the survey would become accessible for panel responses. Each survey was available for one week.

The daily return rate was monitored and periodic e-mail messages to continue participation were sent to each participant in an effort to reduce attrition (see Appendix E). The survey software was capable of responding to only those individuals who had not completed their survey. Each survey round was available for one week. At a minimum, a reminder e-mail message was sent on the third day of each round reminding the participants that the next questionnaire was ready for their response. The e-mail address assigned to the survey instrument was monitored each day to ensure that the survey messages were not rejected by the participant's e-mail system. During the initial survey round, it became necessary to communicate with some of the panel participants because their e-mail systems considered e-mail messages with the word "survey" in the

subject line to automatically be rejected. The total time for the completion of all three survey rounds was approximately eight weeks.

The following is a specific description of the procedures used for the survey and the Delphi study. The initial e-mail message requesting certification requirements for Technology Specialists was sent April 28, 2012. State certification agencies were asked to respond by May 5, 2012. A second, follow-up e-mail message request was sent May 8, 2012, to those states not responding to the first message. Agencies were requested to respond to the second e-mail by May 11, 2012. Information provided by each state was recorded in a Microsoft Excel spreadsheet.

For the Delphi portion of this study the first e-mail message requesting the recommendation of Technology Coordinators in each state was sent April 28, 2012, to each state's Technology Director. State Technology Directors were asked to respond by May 4, 2012. A second e-mail message was sent May 8, 2012, in which Directors were asked to provide the information by May 11, 2012. Information provided by each state director was recorded in a Microsoft Excel spreadsheet.

The invitation to participate in the Delphi study e-mail message was sent to the recommended Technology Coordinators on May 17, 2012. Invited Technology Coordinators willing to participate in the study were asked to respond by May 23, 2012.

The URL for the first Delphi survey round was sent to 54 participants on June 12, 2012. A second, system-generated e-mail message request was sent June 15, 2012, to panelists that had not completed the first survey round. A third e-mail message was sent by the researcher on June 18, 2012, to those panelists who had not responded questioning if the original e-mail message request had been received. Several panelists responded

saying they had not received the initial message containing the URL because their e-mail servers rejected the e-mail message. In this case, a fourth e-mail message was sent to each panelist that had not received the initial e-mail message.

The URL for the second Delphi survey round was sent to 45 participants on June 24, 2012. A second, system-generated e-mail message was sent on June 27, 2012, to those panelists who had not completed the second survey round.

The URL for the third and final Delphi survey round was sent to 40 participants on July 5, 2012. A second, system-generated e-mail message was sent on July 11, 2012, to those panelists who had not completed the third survey round. The last response by a panel member occurred on August 3, 2012. The total number of days for the collection of data from all three survey rounds was 53.

Analysis of the Data

During the first round of the Delphi study the panelists, based on their personal experience and knowledge, were asked to select those items from the provided list that reflected the knowledge, skills, certifications, and qualifications that Technology Specialists should be required to possess and to add other items. The panelists' responses were recorded in a Microsoft Excel spreadsheet for further analysis. Quantitative analysis was used to determine the number and frequency of the selected items that were then used in the second round. Each open-ended response was assessed using a qualitative content analysis to clarify redundant items submitted by the participants (Elo & Kyngäs, 2008). Unique items, as well as those items duplicated by the panelists, were combined to produce one synthesized list that reflected the items submitted from the panelists. The synthesized list of selected items (N = 72) was presented for rating in the

second round. Each panelist reviewed the list of items from the first round and rated each item using a 7-point scale of importance. Non-parametric descriptive statistics, including frequency counts and percentages, were used to analyze the panel ratings from this round. Means and standard deviations for each item were also calculated and ordered in a descending list. This list was used only for comparative purposes and was not used for calculating whether an item should be used in the third survey round. The literature suggested that a definite cluster or "gap" would be evident for the items rated by the panelists (Turoff & Linstone, 2002). It was expected that a clear point would be exhibited between the polarized distributions and that items below the "gap" would be removed and not considered in the future survey rounds. Utilizing frequency counts and percentages it was determined that items receiving a "strongly agree" or "agree" by at least 50% of the panel members should be included in the list of items to be ranked during the third round.

In the third round the panelists were provided a list of items that were selected from the second round. Again, panelists received a list of those items representing the knowledge, skills, credentials, and qualifications that they considered that a Technology Specialist must possess. Panel members were then asked to rank the list of items from most important to least important.

The ranked items from the third round of the survey were analyzed using non-parametric descriptive statistics. Summation analysis identified those items with the lowest score, thus indicating the highest ranking. The lowest scores prioritized those items the panelists considered to be the most important. From the analysis a "Conceptual

Model of Recommended Skills, Credentials, and Qualifications for Technology Specialists" was created. This conceptual model is presented in Chapter 4.

Reporting of the Findings

Descriptive statistics were used to measure and analyze the data collected during this study. Considering the need to document the analysis of both quantitative and qualitative data, tables were used for reporting purposes.

Certification Survey Data

Information collected from e-mail responses from each state's certification agency were reported using a table that displayed each state and whether a credential was required of Technology Specialists. This information is displayed in Table 1.

Population and Panel Demographic Data

Population and panel demographic data collected during the first survey round were reported using tables that displayed summation information about panel participation by state and comparative analysis of the panelists' professional and IT certifications. This information is displayed in Tables 2, 3, 4, and 5.

Round One

Information collected during round one was reported using tables that displayed those items selected or synthesized by the panelists. Tables were used to display the summation of those items selected by the panelists that would be included in the second round. This information is displayed in Table 6.

Round Two

Information collected from round two was reported in tables that included the frequency counts for each item, item percentages, means, and standard deviations. This information is displayed in Tables 7 and 8.

Round Three

Information collected from the third round was presented in tables showing the items and the summation ranking from lowest score to highest score for each item. This information is displayed in Table 9.

Institutional Review Board Exemption

This research protocol was exempt from Institutional Review Board oversight under Exemption Category 2 (see Appendix J).

Chapter IV

FINDINGS

Data were collected to answer three research questions: 1) What certifications do state educational agencies currently require for Technology Specialists, 2) What educational content and skills are necessary for Technology Specialists to become contributing members of an educational organization, and 3) What professionally granted qualifications or credentials should a Technology Specialist possess? Both quantitative and qualitative research methods were used to conduct and analyze the study. Presented in this chapter are the state certification agency responses and demographic characteristics for the participants of this Delphi study along with the results from the first, second, and third survey rounds. Additionally, the results of the analyses of the data from each round are presented.

Technology Specialist Certifications Required By States

A request for certification requirements letter was sent to a state-agency certification professional in all 50 states on April 28, 2011, with a follow-up letter sent on May 8, 2012. Twenty-eight state certification agencies (56%) responded to the e-mail request for information concerning the credentialing of Technology Specialists. Resultant data collected for each state are shown in Table 1. Twenty-eight (100%) of the responding agencies indicated that currently no certification is required for Technology Specialists employed in K-12 public school systems in their state. The

World Wide Web was used to search state certification agency Web sites to analyze certification requirements for Technology Specialists for the 22 states that either did not respond to the request or did not use e-mail to answer questions about certification. The results from the Web site analysis also revealed that no certification requirement was found for Technology Specialists. At this time no state agency requires Technology Specialists to possess any required credential in order to be employed in a local K-12 public school system.

Table 1

State Agency Responses and Web Site Analysis Concerning Technology Specialist Certifications

State	E-mail Response	Web Site
Alaska (AK)	No certification is required.	
Alabama (AL)		No information posted.
Arkansas (AR)	No certification is required.	
Arizona (AZ)	No certification is required.	
California (CA)		No information posted
Colorado (CO)		No information posted
Connecticut (CT)	No certification is required.	
Delaware (DE)		No information posted
Florida (FL)	No certification is required.	
Georgia (GA)	No certification is required.	
Hawaii (HI)	No certification is required.	
Iowa (IA)	No certification is required.	
Idaho (ID)	No certification is required.	
Illinois (IL)	No certification is required.	
Indiana (IN)	No certification is required.	
Kansas (KS)		No information posted
Kentucky (KY)	No certification is required.	
Louisiana (LA)	No certification is required.	
Massachusetts (MA)		No information posted
Maryland (MD)		No information posted

Table 1 Continued

Maine (ME)	No certification is required.	
Michigan (MI)	No certification is required.	
Minnesota (MN)		No information posted
Missouri (MO)	No certification is required.	
Mississippi (MS)	No certification is required.	
Montana (MT)	No certification is required.	
North Carolina (NC)		No information posted
North Dakota (ND)	No certification is required.	
Nebraska (NE)	No certification is required.	
New Hampshire (NH)	No certification is required.	
New Jersey (NJ)		No information posted
New Mexico (NM)	No certification is required.	
Nevada (NV)		No information posted
New York (NY)		No information posted
Ohio (OH)		No information posted
Oklahoma (OK)		No information posted
Oregon (OR)	No certification is required.	
Pennsylvania (PA)		No information posted
Rhode Island (RI)	No certification is required.	
South Carolina (SC)	No certification is required.	
South Dakota (SD)		No information posted
Tennessee (TN)	No certification is required.	
Texas (TX)		No information posted
Utah (UT)		No information posted
Virginia (VA)		No information posted
Vermont (VT)	No certification is required.	
Washington (WA)	No certification is required.	
Wisconsin (WI)		No information posted
West Virginia (WV)		No information posted
Wyoming (WY)		No information posted

Participants of the Delphi Panel

A letter requesting recommendations of technology coordinators was sent to the state technology director in all 50 states, which yielded a list of 54 potential panel

members. Of these 54 coordinators, 45 of them representing 19 states participated in the first round (Table 2). The number of states remained the same for round two and decreased to 16 in round three. The panel membership represented states from across the country. The first survey round included panel members from 19 states, the second round included panel members from 19 states and the third and final round included panel participation from 16 states. This information is displayed in Table 2.

Table 2

States Represented by Number of Participating Technology Coordinators

State Represented	Count (Round 1)	Response Rate (%) (Round 1)	Count (Round 2)	Response Rate (%) (Round 2)	Count (Round 3)	Response Rate (%) (Round 3)
Idaho	6	13.33	4	10.00	2	6.25
Georgia	5	11.11	5	12.50	4	12.50
Arizona	4	8.89	4	10.0	4	12.50
Florida	4	8.89	4	10.0	4	12.50
Arkansas	3	6.67	3	7.50	3	9.38
Missouri	3	6.67	2	5.00	2	6.25
Washington	3	6.67	3	7.50	2	6.25
Alaska	2	4.44	2	5.00	2	6.25
Indiana	2	4.44	2	5.00	2	6.25
Kansas	2	4.44	2	5.00	1	3.13
North Carolina	2	4.44	1	2.50	0	0.00
Texas	2	4.44	1	2.50	1	3.13
Alabama	1	2.22	1	2.50	1	3.13
Colorado	1	2.22	1	2.50	0	0.00
Connecticut	1	2.22	1	2.50	1	3.13
Illinois	1	2.22	1	2.50	0	0.00
New York	1	2.22	1	2.50	1	3.13
Oklahoma	1	2.22	1	2.50	1	3.13
South Dakota	1	2.22	1	2.50	1	3.13

The panel membership reflects a representative sampling of all the regions of the U.S. (Figure 1). This regional representation provides a reasonable degree of confidence that the results of the study can be applied on a national basis. Of the round one participants, 40 completed the second round (89%), and 32 of the 40 participants from the second round completed the third and final round (71%). In all, 32 of the original 54 participants completed all three rounds. The attrition rate was 11% for the second survey round and 29% for the third survey round. Walker and Selfe (1996) suggested that a 70% response rate is necessary in order for the study to maintain rigor.

Figure 1

States Represented by Number of Participating Technology Coordinators for Round One

Figure 2

States Represented by Number of Participating Technology Coordinators for Round Two

Figure 3

States Represented by Number of Participating Technology Coordinators for Round Three

Demographic Characteristics of the Panel

All of the 45 (100%) participants identified themselves as district-level Technology Coordinators having three or more years of experience. Of the 45 participants 15 (33.33%) were female and 30 (66.67%) were male. Twenty-one (46.67%) of the panelists reported having a teaching degree, 12 (26.67%) reported having a leadership degree, 8 (17.78%) reported having a specialist degree, and 15 (33.33%) reported having a degree of "other." These data are listed in Table 3.

Table 3

Summary of Panelists' Professional Certifications

Professional Position	Count	Percentage
Teaching Degree	21	46.67
Leadership Degree	12	26.67
Specialist Degree	8	17.78
Other:	15	33.33
Bachelor of Arts	1	6.67
Masters Curriculum and Instruction	1	6.67
Research PhD Computer Science	1	6.67
Associate of Science in Information Technology (ASIT)	1	6.67
AAS Computer Communications	1	6.67
Associates Degree	1	6.67
Management Information Systems	1	6.67
Bachelor of Business Administration	1	6.67
Data Protection Quality Assurance (DPQA)	1	6.67
Masters of Computer Science	1	6.67
Educational Media and Media Specialist	1	6.67
Engineering Degree	1	6.67
Educational Technology MA	1	6.67
Business Administration	1	6.67
Computer Engineering Degree	1	6.67

The purpose of collecting demographic information about the panel was to 1) determine that the participants met the criteria necessary to participate and, 2) document the range of professional credentials of the panelists. Analysis of the data revealed that the panel members had a wide array of educational backgrounds but most commonly a teaching degree. Twenty-one (46.67%) of the panel members had a teaching degree, indicating that most members likely understood educational methodologies and had past classroom teaching experience. Equally so, the large percentage of teaching certifications supported the literature which stated that the typical career path for those in educational technology positions began first in the classroom (Carter, 2000).

Those panelists having a Leadership degree (26%) had a more comprehensive understanding of the business of education, suggesting that they had experiences with the maintenance and operations of an educational institution including budget experience. The variety of professional degrees earned through academic endeavors listed as "other" further supported the idea that school systems were beginning to "warm" to the idea that technology personnel, while considered school system employees, should be not required to fulfill the "typical" pathway that educational instructors completed. This variety also showed that some panel members had initially trained for a career not in education but subsequently decided upon a career in an educational setting.

Information Technology Certifications

Data collected about the number and type of technical certificates of the panelists revealed the level of technical expertise. While not mandatory for employment, the technical industry considers the CompTIA A+ certificate to be an "entry level" certification similar in comparison to a teaching degree required to enter the education

profession. Moreover, the CompTIA N+ and MCSE certificates would be, in comparison, considered specialist or expert much like a Specialist or Leadership degree would be considered in educational settings.

When asked if they held an IT certification, 9 panelists (20%) reported holding the CompTIA A+ certification, 7 (15.56%) reported holding the MCSE certification, 5 (11.11%) reported holding the CompTIA N+ certification, 4 (8.89%) reported holding the CNE certification, and 12 (26.67%) reported a certification of "other." These data are reflected in Table 4.

Table 4

Participants Holding an Information Technology Certification

Information Technology Certification	Count	Percentage
CompTIA A+	9	20.00
Microsoft Certified Systems Engineer (MCSE)	7	15.56
CompTIA N+	5	11.11
Certified Novell Engineer (CNE)	4	8.89
Other:	12	26.67
Certified Novell Administrator (CNA)	1	8.33
Cisco Certified Network Associate (CCNA)	2	16.67
Cisco Certified Network Professional (CCNP)	1	8.33
Certified Information Systems Security Professional (CISSP)	1	8.33
CompTIA Security+	1	8.33
Certified Information Systems Auditor (CISA)	1	8.33
Journeyman Electronic Systems (Computer)	1	8.33
Apple Distinguished Educator	1	8.33
Thinkfinity	1	8.33
Cisco Certified Convergent Network Technology (CCNT)	1	8.33
Certified Wireless Network Administrator (CWNA)	1	8.33

Noting that no single technical certification showed dominance over any other certification this observation suggested that panelists sought an IT certificate based on its

relevance to their job responsibilities. Also, IT certifications may have been acquired after a panel member first entered the field of education, which was quite different from the traditional pathway in which a teacher entered the profession by acquiring certification before accepting a job with an educational institution.

Common "vendor agnostic" certifications included CompTIA's A+ and N+ credentials while the more common vendor specific certification was the MCSE. All of the panel members possessing the A+ credential also held either the N+ or the MCSE credential. This was a similarity with those possessing educational credentials in that these seven participants had acquired additional certifications beyond the "entry level" certifications. Data analysis showed that panelists acquiring advanced IT certifications such as the MCSE (15.56%) lagged behind the panel members holding advanced leadership degrees in education (26.67%), suggesting that either the advanced IT certifications are difficult to acquire or that these certifications are of lesser value or meaning to the educational community.

Duplication of Credentials

Twelve (26.67%) of the panelists held both a professional teaching credential and also one or more other professional education degrees. Three (6.67%) of the panel members holding a Specialist degree also held a Leadership degree in addition to their teaching degree. Only two (4.44%) panel members held a Leadership degree and also had one or more other professional degrees.

Additionally, eight (17.78%) of the panel members held professional degrees other than Teacher, Specialist, or Leadership degrees and also possessed an IT credential. Nine (20%) of those who had acquired CompTIA's A+ certification also additionally

held one or more professional or IT certifications. Five (11.11%) panel members held a CompTIA N+ credential and also one or more professional or IT certifications and seven (15.56%) panel members held both the MCSE credential and one or more other professional or IT credentials. These data are listed in Table 5.

Table 5

Duplication of Credentials of Both Professional and Technical Certifications

Degree and/or IT Credential	Count	Percentage
Teacher and one or more professional degrees	12	26.67
A+ and one of more degrees or certifications	9	20.00
Other professional degree and one or more IT credentials	8	17.78
MCSE and one or more degrees or certifications	7	15.56
N+ and one or more degrees or certifications	5	11.11
Specialist and one or more professional degrees	3	6.67
Leadership and one or more IT credentials	3	6.67
Leadership and one or more professional degrees	2	4.44
Specialist and one or more IT credentials	2	4.44
Teacher and one or more IT credentials	1	2.22

Most of the survey participants held a combination of professional degrees and/or IT credentials, suggesting that specialization was of benefit for career options and for increasing knowledge level. Based on percentages, more of the panelists had multiple educational professional degrees instead of professional and IT credentials. This finding

possibly indicates that some of the panelists who initially concentrated on earning IT credentials did not consider earning an additional professional credential.

Delphi Round One Data Results

In Round One 45 participants selected items for technology specialists from the provided list of 59 possible items each deemed to be important and included in the second survey round. The frequency and percentage for each item is listed in Table 6. Note that those items receiving at least one "yes," indicating that a panelist considered the item to be important, were included in the second round. Equally so, panelists were given the opportunity to add items each considered to be important but not included in the provided list. Items added by the panelists were analyzed to determine redundancy and subsequently included in the second survey round. The panel of experts recommended 12 additional items for the second round.

Table 6

Round One Items by Frequency of Positive Responses

Item Number	Answer	Count	Percentage
41	Evaluate the effectiveness of technology solutions.	41	91.11
10	Forecast the technology needs of school personnel including classroom teachers, school administrators, and ancillary personnel (ex. Media specialist).	40	88.89
18	Adhere to copyright law.	40	88.89
36	Understand FERPA (Family Educational Rights & Privacy Act) and HIPAA (Health Insurance Portability and Accountability Act) laws and requirements.	40	88.89
3	Assist school-level administrators in determining the technology needs of classroom teachers.	39	86.67
16	Guide teachers and other technology staff with the selection of hardware and software resources that are compatible with the school's technology infrastructure.	39	86.67

Table 6 Continued

19	Understand and adhere to the educational community's code of ethics.	39	86.67
20	Assist with the planning and design of the school's technology infrastructure initiatives.	39	86.67
38	Maintain knowledge of new computer and network technology.	39	86.67
51	Participate in meetings, workshops and seminars for the purpose of conveying and/or gathering information required to perform technology-related functions.	39	86.67
33	Implement district policy on acceptable usage of computer hardware for the purpose of ensuring compliance to standards and regulations.	38	84.44
5	Collaborate with school media specialists to provide leadership in the school's use of instructional technology resources to enhance learning.	37	82.22
4	Be familiar with ISTE (International Society for Technology in Education) standards and how these standards are used.	36	80.00
30	Make technology budget recommendations to school administrators.	36	80.00
12	Maintain documentation related to the installation and configuration of building-level technology.	35	77.78
31	Ensure compliance with federal and state requirements and Board of Education policy.	35	77.78
2	Assist with the ordering of supplies for building-level technology.	34	75.56
42	Serve as a resource to school personnel requiring assistance with assistive technology topics.	34	75.56
52	Research computer hardware system solutions for the purpose of providing technical information on curriculum enhancement.	34	75.56
13	Provide routine maintenance on building-level technology.	33	73.33
14	Provide professional development and training for certified staff on the use of educational technology.	33	73.33
22	Play a leading role in the school's budgetary process to ensure funding for the technology program.	33	73.33

Table 6 Continued

23	Plan for and then provide technology-related professional development activities that meet the needs of the school's staff members.	33	73.33
59	Develop a working knowledge of technology curriculum.	33	73.33
27	Maintain hardware and arrange for timely repair.	32	71.11
6	Coordinate the use of technology-related equipment and labs in and between buildings.	31	68.89
15	Troubleshoot and resolve building-level technology infrastructure related issues.	31	68.89
24	Coordinate the activities of outside vendors, consultants and trainers.	31	68.89
9	Direct building-level administrators to purchase technology for use in K-12 classrooms.	30	66.67
17	Serve as the district contact for selecting software applications.	30	66.67
21	Evaluate the effectiveness of educational technology in use in classrooms.	30	66.67
25	Provide teachers with strategies of how technology can be used in the classroom.	30	66.67
1	Assist with the maintenance of district databases, including those storing student demographic information and student account information.	29	64.44
7	Collaborate with teachers and other instructional staff to develop curriculum materials and specific lesson plans that integrate technology.	28	62.22
35	Coordinate communication with teachers and staff about technology training opportunities outside the school, grant programs, and new technology projects.	28	62.22
69	Prepare Internet safety awareness curriculum for student use.	28	62.22
26	Facilitate staff participation in the evaluation and selection of new software, hardware, and materials to support instructional objectives.	27	60.00
32	Develop district-wide staff computer training programs for the purpose of increasing user knowledge-base of hardware integration.	27	60.00
39	Establish network security procedures.	27	60.00

Table 6 Continued

44	Collaborate with teachers to assist with planning of lessons based on norms-based standards such as project-based learning, and STEM which also incorporate technology integration.	27	60.00
8	Direct the purchase of educational software to help enhance classroom pedagogy.	26	57.78
29	Work with school administrators to create a budget.	26	57.78
43	Model the integration of technology in all curriculum areas.	26	57.78
28	Maintain repair history and file server performance statistics.	25	55.56
34	Experience with a variety of instructional models.	25	55.56
11	Maintain adherence to budget-related purchases so that technology purchased for a particular program (ex. Title I) is only used for that program.	21	46.67
54	Automate school office clerical functions to computerized time-saving routines.	21	46.67
40	Provide training on specific technology to students.	20	44.44
56	Develop a working knowledge of content area curriculum.	19	42.22
53	Hold a certified teaching license.	18	40.00
47	Help students troubleshoot computers.	17	37.78
58	Select alternative teaching strategies, materials, and technology to achieve multiple instructional purposes.	17	37.78
37	Instruct students in research skills using the Internet.	15	33.33
45	Maintain the school system's website.	14	31.11
48	Acquire the CompTIA A+ certification.	14	31.11
49	Acquire the CompTIA N+ certification.	13	28.89
50	Acquire the MSDST (Microsoft Desktop Support Technician).	11	24.44
46	Perform classroom observations to provide support to teachers through data collection.	9	20.00
57	Identify students' prior experiences, learning styles, strengths, and needs when designing a lesson plan.	9	20.00

Analysis of Round One Data

Every item that was listed received at a minimum nine selections by the panelists, resulting in no items being excluded from this round one list for the Round Two survey.

The panel of experts recommended 12 additional items for the second round. These items were:

- Establish district-wide technology standardization policies;
- Ability to align district-level technology decisions with the district's mission and vision;
- Understand funding models;
- Monitor the integration of technology as it relates to system strategic planning;
- Work with curriculum teams to ensure technology is embedded in all content areas;
- Understand E-Rate processes such as vendor bidding and selection;
- Understand the Children's Internet Protection Act (CIPA) and COPPA (Children's Online Privacy Protection Act);
- Create and maintain policies for business continuity;
- Monitor Wide Area Network (WAN) and Local Area Network (LAN);
- Facilitate transition to a 21st Century Learning environment;
- Implement 8th grade tech literacy assessment, gather data and report to the State; and
- Understand data classification and the importance of securing student data.

The recommended items combined with the selected items from the first round

were used to build the list of items for Round Two (see Appendix H). The total number of items included in the second survey was 72.

Delphi Round Two Data Results

Forty (93%) of the original 43 panel members participated in the second survey round. In Round Two panelists were asked to rate each item on a 7-point scale of importance. The item frequencies, percentages, mean, and standard deviation are listed in Table 7 and Table 8, respectively. Because the mean and standard deviation are not standard measures for Likert-type item analysis they (Table 8) were not used as a primary measure in determining whether or not to include an item in the third survey round (Allen & Seaman, 2007; Jamieson, 2004). The total item frequencies of "Strongly Agree" across the items ranged from 1 to 29 while the item frequencies for "Agree" across the items ranged from 4 to 18. Those items receiving a cumulative frequency count of 26 or higher for the sum of "Strongly Agree" and "Agree" were included in the third survey round (see Appendix I). Those items having a second round frequency sum of 25 or less, again using "Strongly Agree" and "Agree," were eliminated and not included in the final survey round. Frequency counts revealed that 50% of the panel members scored a 19 or higher in "Strongly Agree" and that 66% of the panel members scored a 26 or higher in "Strongly Agree" added with "Agree." Thus, 66% of the panelists concurred that items scoring 26 or higher should be included in the third survey round. Thirty-five items met the frequency count of 26 or higher and were included in the third and final survey round.

The criterion used to advance to the final survey round was a summation of frequency counts in the categories of "Strongly Agree" and "Agree" for each item that totaled 26 or higher. Table 7 displays the frequency and percentages from Round Two.

Those items in Table 7 with an asterisk total 26 or higher when combining the “Strongly Agree” and “Agree” ratings.

Table 7

Delphi Round Two Results by Rating and Frequency / Percentage

Item Number	Item	Strongly Agree f / %	Agree f/%	Somewhat Agree f/%	Neutral f/%	Somewhat Disagree f/%	Disagree f/%	Strongly Disagree f/%
68*	Adhere to copyright law.	29/72.5	8/20.0	2/5.0	0/0	0/0	1/2.5	0/0
54*	Ability to facilitate transition to a 21st Century Learning environment.	28/70.0	8/20.0	3/7.5	0/0	0/0	1/2.5	0/0
40*	Understanding of the Children's Internet Protection Act (CIPA) and COPPA (Children's Online Privacy Protection Act).	27/67.5	8/20.0	1/2.5	1/2.5	1/ 2.5	1/2.5	1/2.5
51*	Understand FERPA (Family Educational Rights & Privacy Act) and HIPAA (Health Insurance Portability and Accountability Act) laws and requirements.	27/67.5	10/25.0	1/2.5	2/5.0	0/0	0/0	0/0
61*	Understand and adhere to the educational community's code of ethics.	26/65.0	9/22.5	2/5.0	1/2.5	0/0	0/0	2/5.0
63*	Ensure compliance with federal and state requirements and Board of Education policy.	26/65.0	6/15.0	6/15.0	1/2.5	1/2.5	0/0	0/0
49*	Maintain knowledge of new computer and network technology.	24/60.0	7/17.5	1/2.5	3/7.5	0/0	1/2.5	1/2.5
7*	Ability to align district level technology decisions with the district's mission and vision.	23/57.5	11/27.5	3/7.5	1/2.5	1/2.5	0/0	1/2.5
57*	Develop a working knowledge of technology curriculum.	23/57.5	9/22.5	4/10.0	1/2.5	0/0	3/7.5	0/0

Table 7 Continued

46*	Ability to connect instruction to technology.	22/55.0	5/12.5	4/10.0	6/15.0	2/5.0	0/0	1/2.5
47*	Provide professional development and training for certified staff on the use of educational technology.	22/55.0	7/17.5	7/17.5	1/2.5	0/0	2/5.0	1/2.5
59*	Facilitate staff participation in the evaluation and selection of new software, hardware, and materials to support instructional objectives.	22/55.0	7/17.5	5/12.5	2/5.0	0/0	2/5.0	2/5.0
69*	Play a leading role in the school's budgetary process to ensure funding for the technology program.	22/55.0	10/25.0	4/10.0	2/5.0	1/2.5	1/2.5	0/0
44*	Provide teachers with strategies of how technology can be used to in the classroom.	21/52.5	5/12.5	9/22.5	1/2.5	2/5.0	2/5.0	0/0
60*	Plan for and then provide technology-related professional development activities that meet the needs of the school's staff members.	21/52.5	9/22.5	4/10.0	2/5.0	2/5.0	1/2.5	1/2.5
53*	Assist with the planning and design of the school's technology infrastructure initiatives.	20/50.0	8/20.0	8/20.0	4/10.0	0/0	0/0	0/0
66*	Assist school-level administrators in determining the technology needs of classroom teachers.	20/50.0	9/22.5	7/17.5	2/5.0	1/2.5	0/0	1/2.5
70*	Have a strong understanding of data classification and the importance of securing student data.	20/50.0	11/27.5	3/7.5	5/12.5	0/0	0/0	1/2.5
71	Direct the purchase of educational software to help enhance classroom pedagogy.	20/50.0	5/12.5	8/20.0	3/7.5	3/7.5	1/2.5	0/0

Table 7 Continued

13	Collaborate with teachers and other instructional staff to develop curriculum materials and specific lesson plans that integrate technology.	19/47.5	6/17.5	6/17.5	2/5.0	3/7.5	1/2.5	3/7.5
21*	Guide teachers and other technology staff with the selection of hardware and software resources that are compatible with the school's technology infrastructure.	19/47.5	13/32.5	6/15.0	0/0	0/0	0/0	2/5.0
29*	Work with curriculum teams to ensure technology is embedded in all content areas.	19/47.5	8/20.0	5/12.5	3/7.5	3/7.5	2/5.0	0/0
36	Model the integration of technology in all curriculum areas.	19/47.5	6/15.0	7/17.5	6/15.0	1/2.5	1/2.5	0/0
58*	Make technology budget recommendations to school administrators.	19/47.5	12/30.0	5/12.5	1/2.5	0/0	2/5.0	1/2.5
6*	Establish district-wide technology standardization policies.	18/45.0	12/30.0	4/10.0	3/7.5	1/2.5	1/2.5	1/2.5
24*	Evaluate the effectiveness of educational technology in use in classrooms.	18/45.0	8/20.0	4/10.0	2/5.0	5/12.5	0/0	3/7.5
26*	Implement district policy on acceptable usage of computer hardware for the purpose of ensuring compliance to standards and regulations.	18/45.0	13/32.5	5/12.5	1/2.5	3/7.5	0/0	0/0
33*	Evaluate the effectiveness of technology solutions.	18/45.0	13/32.5	5/12.5	1/2.5	1/2.5	0/0	2/5.0
15*	Collaborate with school media specialists to provide leadership in the school's use of instructional technology resources to enhance learning.	17/42.5	9/22.5	10/25.0	3/7.5	0/0	1/2.5	0/0

Table 7 Continued

35*	Participate in meetings, workshops and seminars for the purpose of conveying and/or gathering information required to perform technology-related functions.	17/42.5	16/40.0	3/7.5	3/7.5	0/0	0/0	1/2.5
8*	Forecast the technology needs of school personnel including classroom teachers, school administrators, and ancillary personnel (ex. Media specialist).	16/40.0	16/40.0	6/15.0	0/0	2/5.0	0/0	0/0
23*	Monitor the integration of technology as it relates to system strategic planning.	16/40.0	16/40.0	5/12.5	2/5.0	0/0	0/0	1/2.5
50	Wide Area Network (WAN) and Local Area Network (LAN) monitoring.	16/40.0	7/17.5	3/7.5	4/10.0	4/10.0	2/5.0	4/10.0
11	Troubleshoot and resolve building-level technology infrastructure related issues.	15/37.5	8/20.0	9/22.5	4/10.0	2/5.0	0/0	2/5.0
45	Collaborate with teachers to assist with planning of lessons based on norms-based standards such as project-based learning, and STEM which also incorporate technology integration.	15/37.5	10/25.0	6/15.0	3/7.5	1/2.5	4/10.0	1/2.5
62	Provide routine maintenance on building-level technology.	15/37.5	7/17.5	4/10.0	3/7.5	7/17.5	2/5.0	1/2.5
72	Prepare Internet safety awareness curriculum for student use.	15/37.5	8/20.0	7/17.5	3/7.5	3/7.5	3/7.5	1/2.5
1*	Be familiar with ISTE (International Society for Technology in Education) standards and how these standards are used.	14/35.0	15/37.5	9/22.5	1/2.5	0/0	1/2.5	0/0

Table 7 Continued

5	Direct building-level administrators to purchase technology for use in K-12 classrooms.	14/35.0	9/22.5	8/20.0	5/12.5	0/0	3/7.5	1/2.5
30	Serve as the district contact for selecting software applications.	14/35.0	11/27.5	8/20.0	2/5.0	2/5.0	0/0	3/7.5
32*	Coordinate communication with teachers and staff about technology training opportunities outside the school, grant programs, and new technology projects.	14/35.0	14/35.0	10/25.0	1/2.5	1/2.5	0/0	0/0
48	Establish network security procedures.	14/35.0	9/22.5	3/7.5	4/10.0	3/7.5	4/10.0	3/7.5
2	Instruct students in research skills using the Internet.	13/32.5	9/22.5	5/12.5	6/15.0	2/5.0	2/5.0	3/7.5
12	Develop district-wide staff computer training programs for the purpose of increasing user knowledge-base of hardware integration.	13/32.5	11/27.5	10/25.0	4/10.0	0/0	1/2.5	1/2.5
41	Select alternative teaching strategies, materials, and technology to achieve multiple instructional purposes.	13/32.5	10/25.0	4/10.0	6/15.0	3/7.5	2/5.0	2/5.0
3*	Experience with a variety of instructional models.	12/30.0	15/37.5	7/17.5	3/7.5	0/0	1/2.5	2/5.0
10	Develop a working knowledge of content area curriculum.	12/30.0	11/27.5	10/25.0	1/2.5	4/10.0	0/0	2/5.0
17*	Work with school administrators to create a budget.	12/30.0	17/42.5	2/5.0	5/12.5	0/0	1/2.5	3/7.5
20*	Understanding of funding models.	12/30.0	14/35.0	6/15.0	4/10.0	1/2.5	2/5.0	1/2.5

Table 7 Continued

25*	Serve as a resource to school personnel requiring assistance with assistive technology topics.	12/30.0	18/45.0	9/22.5	0/0	0/0	0/0	1/2.5
31	Maintain documentation related to the installation and configuration of building-level technology.	12/30.0	12/30.0	8/20.0	3/7.5	1/2.5	2/5.0	2/5.0
55	Maintain hardware and arrange for timely repair.	12/30.0	10/25.0	5/12.5	7/17.5	0/0	5/12.5	1/2.5
67	Maintain repair history and file server performance statistics.	12/30.0	7/17.5	4/10.0	5/12.5	3/7.5	2/5.0	7/17.5
18	Assist with the maintenance of district databases, including those storing student demographic information and student account information.	11/27.5	8/20.0	4/10.0	9/22.5	3/7.5	3/7.5	2/5.0
52	Maintain adherence to budget-related purchases so that technology purchased for a particular program (ex. Title I) is only used for that program.	11/27.5	14/35.0	8/20.0	3/7.5	3/7.5	0/0	1/2.5
56	Implement 8th grade tech literacy assessment, gather data and report to the State.	11/27.5	4/10.0	4/10.0	12/30.0	4/10.0	4/10.0	1/2.5
64	Hold a certified teaching license.	11/27.5	7/17.5	5/12.5	3/7.5	3/7.5	3/7.5	8/20.0
9	Assist with the ordering of supplies for building-level technology.	10/25.0	14/35.0	5/12.5	6/15.0	1/2.5	2/5.0	2/5.0
42	Create and maintain policies for business continuity.	10/25.0	11/27.5	5/12.5	9/22.5	2/5.0	1/2.5	2/5.0
43	Research computer hardware system solutions for the purpose of providing technical information on curriculum enhancement.	10/25.0	15/37.5	7/17.5	6/15.0	1/2.5	0/0	1/2.5

Table 7 Continued

38	Coordinate the use of technology-related equipment and labs in and between buildings.	8/20.0	10/25.0	10/25.0	5/12.5	4/10.0	1/2.5	2/5.0
39	Understanding of E-Rate processes such as vendor bidding and selection.	8/20.0	15/37.5	4/10.0	8/20.0	2/5.0	0/0	3/7.5
16	Coordinate the activities of outside vendors, consultants and trainers.	7/17.5	17/17.5	7/17.5	4/10.0	1/2.5	2/5.0	2/5.0
14	Identify students' prior experiences, learning styles, strengths, and needs when designing a lesson plan.	6/15.0	9/22.5	5/12.5	6/15.0	6/15.0	3/7.5	5/12.5
65	Provide training on specific technology to students.	6/15.0	4/10.0	9/22.5	7/17.5	5/12.5	5/12.5	4/10.0
4	Perform classroom observations to provide support to teachers through data collection.	4/10.0	13/32.5	4/10.0	8/20.0	3/7.5	4/10.0	4/10.0
27	Help students troubleshoot computers.	4/10.0	5/12.5	12/30.0	6/15.0	5/12.5	4/10.0	3/7.5
28	Acquire the CompTIA N+ certification.	4/10.0	5/12.5	3/7.5	13/32.5	8/20.0	4/10.0	3/7.5
19	Automate school office clerical functions to computerized time-saving routines.	3/7.5	10/25.0	7/17.5	10/25.0	5/12.5	3/7.5	1/2.5
22	Acquire the CompTIA A+ certification.	2/5.0	8/20.0	6/15.0	10/25.0	8/20.0	3/7.5	3/7.5
37	Maintain the school system's website.	2/5.0	4/10.0	10/25.0	13/32.5	3/7.5	5/12.5	3/7.5
34	Acquire the MSDST (Microsoft Desktop Support Technician).	1/2.5	4/10.0	4/10.0	15/37.5	8/20.0	4/10.0	4/10.0

*Items with an asterisk were selected for the third survey round

Table 8

Delphi Round Two Results Sorted by Means and Standard Deviations

Item Number	Question	Mean	Standard Deviation
68	Adhere to copyright law.	6.58	0.93
51	Understand FERPA (Family Educational Rights & Privacy Act) and HIPAA (Health Insurance Portability and Accountability Act) laws and requirements.	6.55	0.79
54	Ability to facilitate transition to a 21st Century Learning environment.	6.53	0.96
63	Ensure compliance with federal and state requirements and Board of Education policy.	6.38	1.00
40	Understanding of the Children's Internet Protection Act (CIPA) and COPPA (Children's Online Privacy Protection Act).	6.30	1.42
61	Understand and adhere to the educational community's code of ethics.	6.30	1.42
7	Ability to align district level technology decisions with the district's mission and vision.	6.25	1.26
69	Play a leading role in the school's budgetary process to ensure funding for the technology program.	6.18	1.22
49	Maintain knowledge of new computer and network technology.	6.13	1.44
57	Develop a working knowledge of technology curriculum.	6.13	1.42
8	Forecast the technology needs of school personnel including classroom teachers, school administrators, and ancillary personnel (ex. Media specialist).	6.10	1.01
53	Assist with the planning and design of the school's technology infrastructure initiatives.	6.10	1.06
21	Guide teachers and other technology staff with the selection of hardware and software resources that are compatible with the school's technology infrastructure.	6.08	1.38
35	Participate in meetings, workshops and seminars for the purpose of conveying and/or gathering information required to perform technology-related functions.	6.08	1.21

Table 8 Continued

23	Monitor the integration of technology as it relates to system strategic planning.	6.05	1.18
26	Implement district policy on acceptable usage of computer hardware for the purpose of ensuring compliance to standards and regulations.	6.05	1.18
70	Have a strong understanding of data classification and the importance of securing student data.	6.05	1.32
66	Assist school-level administrators in determining the technology needs of classroom teachers.	6.03	1.33
47	Provide professional development and training for certified staff on the use of educational technology.	6.00	1.52
1	Be familiar with ISTE (International Society for Technology in Education) standards and how these standards are used.	5.98	1.05
32	Coordinate communication with teachers and staff about technology training opportunities outside the school, grant programs, and new technology projects.	5.98	0.97
58	Make technology budget recommendations to school administrators.	5.98	1.48
25	Serve as a resource to school personnel requiring assistance with assistive technology topics.	5.95	1.08
33	Evaluate the effectiveness of technology solutions.	5.95	1.48
60	Plan for and then provide technology-related professional development activities that meet the needs of the school's staff members.	5.95	1.54
6	Establish district-wide technology standardization policies.	5.90	1.46
44	Provide teachers with strategies of how technology can be used to in the classroom.	5.90	1.46
46	Ability to connect instruction to technology.	5.88	1.54
59	Facilitate staff participation in the evaluation and selection of new software, hardware, and materials to support instructional objectives.	5.88	1.73
36	Model the integration of technology in all curriculum areas.	5.83	1.38

Table 8 Continued

71	Direct the purchase of educational software to help enhance classroom pedagogy.	5.83	1.45
29	Work with curriculum teams to ensure technology is embedded in all content areas.	5.78	1.54
12	Develop district-wide staff computer training programs for the purpose of increasing user knowledge-base of hardware integration.	5.65	1.39
3	Experience with a variety of instructional models.	5.63	1.53
52	Maintain adherence to budget-related purchases so that technology purchased for a particular program (ex. Title I) is only used for that program.	5.60	1.39
43	Research computer hardware system solutions for the purpose of providing technical information on curriculum enhancement.	5.58	1.32
11	Troubleshoot and resolve building-level technology infrastructure related issues.	5.55	1.60
13	Collaborate with teachers and other instructional staff to develop curriculum materials and specific lesson plans that integrate technology.	5.55	1.91
20	Understanding of funding models.	5.55	1.54
17	Work with school administrators to create a budget.	5.53	1.72
24	Evaluate the effectiveness of educational technology in use in classrooms.	5.50	1.89
5	Direct building-level administrators to purchase technology for use in K-12 classrooms.	5.48	1.63
45	Collaborate with teachers to assist with planning of lessons based on norms-based standards such as project-based learning, and STEM which also incorporate technology integration.	5.48	1.75
10	Develop a working knowledge of content area curriculum.	5.45	1.60
31	Maintain documentation related to the installation and configuration of building-level technology.	5.43	1.68
72	Prepare Internet safety awareness curriculum for student use.	5.40	1.75

Table 8 Continued

62	Provide routine maintenance on building-level technology.	5.36	1.85
9	Assist with the ordering of supplies for building-level technology.	5.30	1.68
16	Coordinate the activities of outside vendors, consultants and trainers.	5.28	1.60
41	Select alternative teaching strategies, materials, and technology to achieve multiple instructional purposes.	5.25	1.81
55	Maintain hardware and arrange for timely repair.	5.20	1.79
2	Instruct students in research skills using the Internet.	5.18	1.89
39	Understanding of E-Rate processes such as vendor bidding and selection.	5.18	1.68
42	Create and maintain policies for business continuity.	5.18	1.66
50	Wide Area Network (WAN) and Local Area Network (LAN) monitoring.	5.13	2.10
48	Establish network security procedures.	5.08	2.06
38	Coordinate the use of technology-related equipment and labs in and between buildings.	5.05	1.63
18	Assist with the maintenance of district databases, including those storing student demographic information and student account information.	4.95	1.84
15	Collaborate with school media specialists to provide leadership in the school's use of instructional technology resources to enhance learning.	4.93	1.19
56	Implement 8th grade tech literacy assessment, gather data and report to the State.	4.75	1.79
67	Maintain repair history and file server performance statistics.	4.65	2.25
19	Automate school office clerical functions to computerized time-saving routines.	4.56	1.52
30	Serve as the district contact for selecting software applications.	4.53	1.71
4	Perform classroom observations to provide support to teachers through data collection.	4.48	1.88
64	Hold a certified teaching license.	4.48	2.32
14	Identify students' prior experiences, learning styles, strengths, and needs when designing a lesson plan.	4.35	1.98

Table 8 Continued

27	Help students troubleshoot computers.	4.31	1.72
65	Provide training on specific technology to students.	4.20	1.88
22	Acquire the CompTIA A+ certification.	4.13	1.62
37	Maintain the school system's website.	4.05	1.55
28	Acquire the CompTIA N+ certification.	4.00	1.68
34	Acquire the MSDST (Microsoft Desktop Support Technician).	3.68	1.47

Analysis of Round Two Data

The purpose of the second survey round was to rate the items on a scale of importance. The rating scale used the values of "Strongly Disagree" to "Strongly Agree" with "Strongly Disagree" representing the lowest rating of importance and "Strongly Agree" representing the highest rating. Forty participants completed Round Two. The results (Appendix I) showed that 66% of the panel members used "Strongly Agree" and "Agree" to rate 35 items, which yielded a summation frequency count of ≥ 26. Those items with a summation frequency count of ≤ 25 were discarded and not included in the third survey round. Eighteen (25%) of the 72 items received a rating of "Strongly Agree" by $\geq 50\%$ of all the panel members. These items received "Strongly Agree" summation scores ranging from 20 to 29. When combined with the "Agree" summation scores the values ranged from 26 to 37. The top three items, having summation scores of 37, 37, and 36, respectively, for the sum of "Strongly Agree" and "Agree," indicate a 90% or better group consensus. Nine of the items that were suggested by the panelists during Round One met the criteria to be included in the third survey round.

Table 8 was included to show the measures of central tendency. When considering the mean, the range of responses varied from 3.68 to 6.58. In this case, the mean has significant importance because it indicates, for the Likert-type scale ratings from 1 to 7, the central tendency of the group of panelists' responses to each item. The standard deviation indicates the degree of dispersion of responses for a single item. With the exception of the last rating, every item had a mean of ≥ 4.0, indicating that panel members considered every item except one to be in the range of "neither agree nor disagree" to "Strongly Agree." Three items had a mean of ≥ 6.5 or better, indicating a

group consensus of "Strongly Agree." The same three items also had a standard deviation of ≤ 1.0, which shows a very strong consensus within the group. Thirty-eight items had a mean of ≥ 5.5 but ≤ 6.5, indicating a group consensus of "Agree." However, these items had standard deviations ranging from .97 to 1.91, which shows very little group consistency or, in other words, a wide dispersion of selections on the Likert-type scale. Twenty-two items had a mean of ≥ 4.5 but ≤ 5.49, indicating a group consensus of "Somewhat Agree." These same items had standard deviations ranging from 1.19 to 2.25, which show a very high measure of group inconsistency. Eight items had a mean of ≥ 4.0 but ≤ 4.49, indicating a group consensus of "Neither agree nor disagree." The standard deviation for these items ranged from 1.55 to 2.32. The final item had a mean of 3.68, showing a group consensus of "Somewhat Disagree." This item had a standard deviation of 1.47. Interestingly, the results of Round Two show no strong consensus for any particular technical credential for the Technology Specialist. The results indicate that specific technical skills are valued but not enough to be included in the third Delphi round.

Delphi Round Three Data Results

The purpose of Round Three was to rank the final list of 35 items that met the cut-off score from the second survey round. Panel members participating in the third round were instructed to rank the list of items from most important (1) to least important (35). Thirty-two (74%) of the original 43 panel members participated in the third and final survey round. Cumulative summation scores arranged from 358 to 735 are listed in Table 6. The item with the lowest cumulative score was considered to be the most important item by the panelists; the item with the second lowest cumulative score was considered to

be the second most important. Cumulative scores show the final rank, in order from highest importance to lowest importance. Those questions that were not included in the original Round One list of items but instead suggested by the panel members are identified in the third column of Table 6.

The cumulative summation scores from Round Three ranged from 358 to 735. The panelists' selections were added together to produce the summation for each item.

Table 9

Delphi Round Three Summation Scores

Question Number	Summation	Question	Added Question
15	358	Ability to facilitate transition to a 21st Century Learning environment.	X
1	376	Monitor the integration of technology as it relates to system strategic planning.	X
4	389	Experience with a variety of instructional models.	
5	461	Ability to align district level technology decisions with the district's mission and vision.	X
26	469	Forecast the technology needs of school personnel including classroom teachers, school administrators, and ancillary personnel (ex. Media specialist).	
29	474	Participate in meetings, workshops and seminars for the purpose of conveying and/or gathering information required to perform technology-related functions.	
2	496	Have a strong understanding of data classification and the importance of securing student data.	X
6	541	Play a leading role in the school's budgetary process to ensure funding for the technology program.	
11	544	Coordinate communication with teachers and staff about technology training opportunities outside the school, grant programs, and new technology projects.	

Table 9 Continued

31	557	Provide teachers with strategies of how technology can be used in the classroom.	
34	566	Be familiar with ISTE (International Society for Technology in Education) standards and how these standards are used.	
10	570	Collaborate with school media specialists to provide leadership in the school's use of instructional technology resources to enhance learning.	
25	572	Work with school administrators to create a budget.	
8	573	Ensure compliance with federal and state requirements and Board of Education policy.	
24	579	Ability to connect instruction to technology.	X
9	580	Develop a working knowledge of technology curriculum.	
14	580	Adhere to copyright law.	
19	584	Work with curriculum teams to ensure technology is embedded in all content areas.	X
33	590	Understand and adhere to the educational community's code of ethics.	
18	591	Provide professional development and training for certified staff on the use of educational technology.	
20	595	Facilitate staff participation in the evaluation and selection of new software, hardware, and materials to support instructional objectives.	
7	605	Establish district-wide technology standardization policies.	X
27	605	Make technology budget recommendations to school administrators.	
17	608	Plan for and then provide technology-related professional development activities that meet the needs of the school's staff members.	
28	618	Assist school-level administrators in determining the technology needs of classroom teachers.	
23	629	Evaluate the effectiveness of technology solutions.	

Table 9 Continued

16	630	Guide teachers and other technology staff with the selection of hardware and software resources that are compatible with the school's technology infrastructure.	
21	631	Implement district policy on acceptable usage of computer hardware for the purpose of ensuring compliance to standards and regulations.	
22	637	Maintain knowledge of new computer and network technology.	
13	655	Direct the purchase of educational software to help enhance classroom pedagogy.	
12	656	Understanding of the Children's Internet Protection Act (CIPA) and COPPA (Children's Online Privacy Protection Act).	X
3	662	Serve as a resource to school personnel requiring assistance with assistive technology topics.	
32	720	Understand FERPA (Family Educational Rights & Privacy Act) and HIPAA (Health Insurance Portability and Accountability Act) laws and requirements.	
35	724	Assist with the planning and design of the school's technology infrastructure initiatives.	
30	735	Understanding of funding models.	X

Analysis of Round Three Data

The purpose of Round Three was to rank the items that met the criteria from Round Two. At the conclusion of Round Three data collection, the "Conceptual Model of Prioritized Knowledge, Skills, and Credentials Required by Technology Specialists" was developed after analyzing the results from the third survey round. Using the list of items identified as having met the criteria from Round Two, a ranked list was developed in order from lowest summation score to highest summation score. As suggested by the review of literature in Chapter 2, the ranked results of a Delphi study showed definite

"gaps" or "clusters" in the data results (Turoff & Linstone, 2002). Five clusters of ranked data were identified. The first cluster had three items that were ranked very highly, having summation scores ranging from 358 to 389. The next four items were ranked as the next highest cluster, with scores ranging from 461 to 496, and were identified as the second cluster. Eleven items with scores ranging from 541 to 584 were identified for the third cluster. The fourth identifiable cluster also contained 11 items that ranged from 590 to 637. The last six items, ranging from 655 to 735, were a fifth identifiable cluster.

Three of the list of 35 items, representing the first cluster, received the lowest ranked summaries, indicating that they were ranked the highest by the panelists. These items are considered to be Priority One items.

1. Ability to facilitate transition to a 21st Century Learning environment (358);
2. Monitor the integration of technology as it relates to system strategic planning (376);
3. Experience with a variety of instructional models (389);

It is important to note that the first two Priority One items were items 1 and 2 that were recommended by the panel members during the first round of the Delphi study.

Analysis of the summation scores of these items reveals that these three items are considered the most critical skills and/or credentials that a Technology Specialist should possess.

The second cluster of responses consisted of four items having summation scores ranging from 461 to 496. These are considered these to be Priority Two items.

4. Ability to align district level technology decisions with the district's mission and vision (461);

5. Forecast the technology needs of school personnel including classroom teachers, school administrators, and ancillary personnel (ex. Media Specialist) (469);
6. Participate in meetings, workshops and seminars for the purpose of conveying and/or gathering information required to perform technology-related functions (474); and
7. Have a strong understanding of data classification and the importance of securing student data (496).

Two of the items within the second cluster (Items 5 and 2) were added items recommended by the panel members during the first round of the Delphi study.

The four items found within the second cluster are considered highly important and necessary skills and/or credentials of Technology Specialists.

The third cluster of responses consisted of eleven items and had summation scores ranging from 541 to 584. These are considered these to be Priority Three items.

8. Play a leading role in the school's budgetary process to ensure funding for the technology program (541);
9. Coordinate communication with teachers and staff about technology training opportunities outside the school, grant programs, and new technology projects (544);
10. Provide teachers with strategies of how technology can be used in the classroom (557);
11. Be familiar with ISTE (International Society for Technology in Education) standards and how these standards are used (566);

12. Collaborate with school media specialists to provide leadership in the school's use of instructional technology resources to enhance learning (570);
13. Work with school administrators to create a budget (572);
14. Ensure compliance with federal and state requirements and Board of Education policy (573);
15. Ability to connect instruction to technology (579);
16. Develop a working knowledge of technology curriculum (580);
17. Adhere to copyright law (580); and
18. Work with curriculum teams to ensure technology is embedded in all content areas (584).

Two of the items within the fourth cluster (Items 24 and 19) were added items recommended by the panel members during the first round of the Delphi study.

The eleven items found within the third cluster are considered to be desirable skills and/or credentials of Technology Specialists.

The fourth cluster of responses consisted of eleven items that had summation scores which ranged from 590 to 637 and are considered to be Priority Four items.

19. Understand and adhere to the educational community's code of ethics (590);
20. Provide professional development and training for certified staff on the use of educational technology (591);
21. Facilitate staff participation in the evaluation and selection of new software, hardware, and materials to support instructional objectives (595);
22. Establish district-wide technology standardization policies (605);
23. Make technology budget recommendations to school administrators (605);

24. Plan for and then provide technology-related professional development activities that meet the needs of the school's staff members (608);
25. Assist school-level administrators in determining the technology needs of classroom teachers (618);
26. Evaluate the effectiveness of technology solutions (629);
27. Guide teachers and other technology staff with the selection of hardware and software resources that are compatible with the school's technology infrastructure (630);
28. Implement district policy on acceptable usage of computer hardware for the purpose of ensuring compliance to standards and regulations (631); and
29. Maintain knowledge of new computer and network technology (637).

One of the items within the fourth cluster (Item 7) was an added item recommended by the panel members during the first round of the Delphi study.

The eleven items found within the fourth cluster are considered skills and/or credentials that competent Technology Specialists will possess.

The final fifth cluster included the last six items and had summation scores ranging from 655 to 735. These are considered these to be Priority Five items.

30. Direct the purchase of educational software to help enhance classroom pedagogy (655);
31. Understanding of the Children's Internet Protection Act (CIPA) and COPPA (Children's Online Privacy Protection Act) (656);
32. Serve as a resource to school personnel requiring assistance with assistive technology topics (662);

33. Understand FERPA (Family Educational Rights & Privacy Act) and HIPAA (Health Insurance Portability and Accountability Act) laws and requirements (720);
34. Assist with the planning and design of the school's technology infrastructure initiatives (724); and
35. Understanding of funding models (735).

Two of the items (Items 12 and 30) within the fifth cluster were added items recommended by the panel members during the first round of the Delphi study.

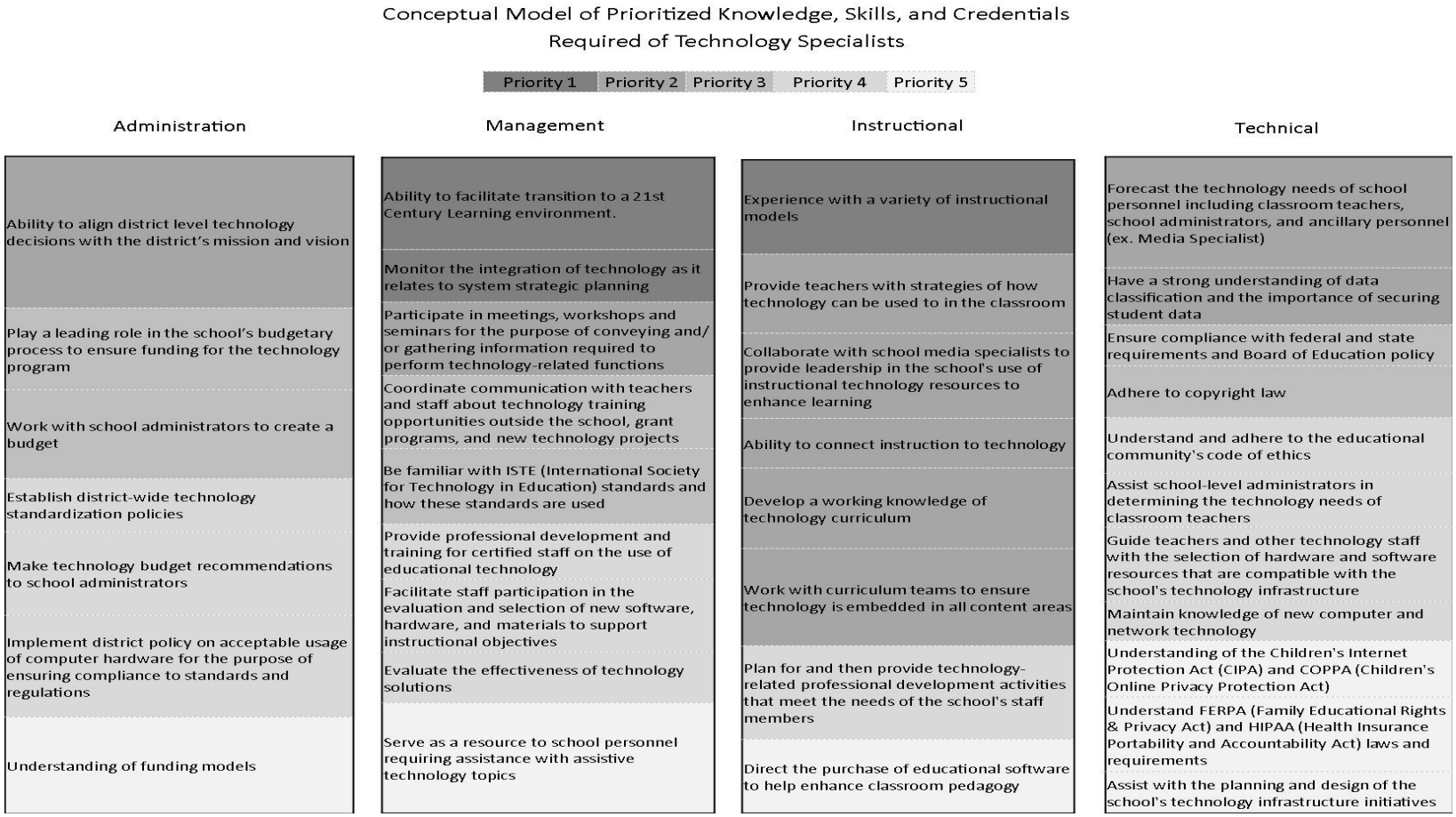
The items found within the last cluster are considered to be the lowest priority of skills and for credentials that Technology Specialists should possess.

Content analysis of the list of items resulted in the following four categories or unifying themes: 1) Administration, 2) Management, 3) Instructional, and 4) Technical.

Once identified, the four unifying themes were used to categorize each item from the third survey round. The model presented in Chapter 4 (Figure 4) indicates the priority of the items within each category arranged from highest importance to lowest importance according to cumulative summation scores and also according to placement within each of the five clusters. All items were included in the model and were regarded as essential knowledge, skills, and credentials that a Technology Specialist must possess.

Figure 4

Conceptual Model of Prioritized Knowledge, Skills, and Credentials Required of Technology Specialists



Related Results

During each round of the Delphi process additional comments, either related to the study or towards certain questions within the survey round, were provided by a small number of panel experts.

Two respondents were extremely interested in participating in the study. One wrote that "This is definitely something that requires more attention. Identifying the credentials necessary for IT staff, so that they can be more effective in supporting instruction and the classroom is important." The second stated "I am well aware of the demands this new generation is putting on the knowledge of the tech department, the flexibility required to meet the needs of a broad range of technology skills found in educators, the need for speed (bandwidth), online communications, and a tech department that understand the educational needs of the classrooms and teachers." Meanwhile, another respondent was hesitant that the final product of this study might prove to dilute the skills of the Technology Specialists. The participant stated that "I will participate [in the study] but remain concerned that the dilution of the skills required of the people required to maintain the backbone of the network, keep all the machines running, repairing the machines, and maintaining the technology need a peripheral understanding of the "trends in educational pedagogy" such that they can understand how the technology is being used. My technicians are expected to repair machines and get them back in use quickly because the teachers need them." This same participant also responded at the end of the third and final round again, indicating his hesitancy by stating that "I worry about this study and the ramifications it may have for people like us."

Chapter Summary

Chapter 4 presented the results of each round of this Delphi study. Information collected from state education certification agencies was presented to ascertain the current state of Technology Specialist credentializing. Demographic information about each panelist was collected in the first round during which the panel of experts selected and/or added those skills, knowledge, and credentials that should be required of Technology Specialists employed in a public school system. During the second round the panelists considered the importance of each item from the first round, using a rating scale of 1 (low importance) to 7 (high importance). Items meeting the cut-off score at end of the second round were then ranked by order of importance during the third and final round. The final rank of items was used to develop the "Conceptual Model of Prioritized Knowledge, Skills, and Credentials Required of Technology Specialists." This conceptual model will be the basis for the recommendation of a Technology Specialist credential in Chapter 5.

Chapter V

CONCLUSIONS

The purpose of this study was to develop a conceptual model that will guide the development of a professional credentialing of Technology Specialists for productive employment in public educational institutions. While each state identifies guidelines useful for the credentialing of almost all educational personnel working for a public school, neither a set of guidelines nor a credential has been identified for Technology Specialists. This study utilized the Delphi technique to first confirm and then develop a prioritized list of knowledge, skills, and credentials necessary to identify the guidelines that could then be used to produce the conceptual model for credentialing Technology Specialists.

Information necessary to answer the research questions was collected using the Delphi technique. Three survey rounds were conducted beginning with 43 Technology Coordinators representing 19 states who were asked to select from a list of items or to provide items considered to be important characteristics of a Technology Specialist. Having 43 participants helped to ensured confidence in the findings of this study. Demographic data were also collected during the first round to ensure that panel members met the panel membership criteria used to identify them as experts thus qualified to participate in the Delphi study. Participants from the northern, eastern, western, and southern regions of the U.S. participated in the study. During the second

round, 40 panel members, representing 18 states, were asked to rate on a scale of 1 to 7 the importance of each item from the derived list generated at the conclusion of the first round. The third, and final, survey round requested that 32 panelists, representing 16 states, rank each item from the list generated in the second round from most important to least important. Panel responses to each of the survey instruments were reported in the findings of the study (Chapter 4). A final list of 35 items ranked by the panel of experts was used to produce a conceptual model. This model was described in Chapter 4. By ranking the skills and knowledge necessary for a Technology Specialist to function productively in a school environment beyond the typical area of technical expertise, a framework can be fashioned which can guide the professional certification of Technology Specialists. This study was concerned with identifying the components that could be used to define the framework of a new professional certification for Technology Specialists.

Data collected were analyzed to provide answers to the following three research questions: 1) What certifications do state education agencies currently require for Technology Specialists; 2) What educational content and skills are necessary for Technology Specialists to become contributing members of an educational organization; and 3) What professionally granted qualifications or credentials should a Technology Specialist possess?

Discussion of Research Questions

Research Question One: What certifications do state education agencies currently require for Technology Specialists? Information collected from state certification agencies along with the information collected from state certification Web

sites revealed that no states currently require that Technology Specialists employed with public education institutions possess either a credential or a certification of any kind. The results do not suggest that credentialing Technology Specialists is not important but instead suggests that the role continues to be frequently misunderstood by administrative personnel and certification personnel, or that the role of the Technology Specialist is only now beginning to evolve into a unique role that mandates additional training and/or credentializing in order to realize the worth of this position to the educational community.

Research Question Two: What educational content and skills are necessary for Technology Specialists to become contributing members of an educational organization?

The original items for the first Delphi survey list were gathered from public school job postings for Technology Specialists from 13 states. The findings of this study led to the identification of four categories of knowledge and skills considered essential to defining the roles of the Technology Specialist. These categories were Administrative, Management, Instructional, and Technical. The identification of these four categories is similar to the four competing lenses described by Davidson's (2003) for the Technology Specialist that included a technician, the classroom teacher, the specialist, and the administrator. Based on a ranking pf the results of the third Delphi survey the 35 identified items were further prioritized according to five cluster "priorities" using the values of "Priority One" for the most important to "Priority Five" as the least important based on ranking results. The results of the Delphi process along with the categories are illustrated in the model illustrated in Figure 4. This model, identified as the *"*Conceptual Model of Prioritized Knowledge, Skills, and Credentials Required of Technology Specialists," details the required knowledge, skills, and credentials of Technology

Specialists. The original items for the first survey list were gathered from public school job postings for Technology Specialists from a variety of states, so the roles identified from the ranked list were already present in the job descriptions.

The Administration Role of the model contains seven items including one item from Priority Two, two items from Priority Three, two items from Priority Four and one item from Priority Five.

According to the results, the ability for Technology Specialists to promote district initiatives is important since three of the seven priorities of the Administrative Role focus on the district's mission and vision, the standardization of technology, and ensuring compliance to standards. Likewise, the results indicate that an understanding of budgets and the budgetary process are priority skills for Technology Specialists. The remaining four of the seven priorities of the Administrative Role focus on the subject of budgets, budget planning, and understanding of funding models. In all, administrative priorities should encompass about 20% (7 of the 35 items) of a Technology Specialist's skill set.

Because the skill set of the Technology Specialist, according to the results, should include an understanding of budget and finance, policy and policy development, and leadership skills with an emphasis in policy, training is necessary to further develop these roles.

The Management Role of the model contains nine items including two Priority One items, one Priority Two item, two Priority Three items, three Priority Four items, and one Priority Five item.

Management of technology has, in the past, traditionally included the maintenance of technology equipment and infrastructure components; however the

results indicated that Technology Specialists should be more concerned with the training and coordination of technology and also with being a change agent. Training, facilitation, and evaluation were the higher priorities. In particular, the ability to "future proof" the school's investment in technology and the integration of technology were considered Priority One items. In all, management priorities should encompass about 26% (9 of the 35 items) of a Technology Specialist's skill set.

The results of the Management Role suggest that the Technology Specialist be knowledgeable about research, assessment, and evaluation, so that this position can be that of a change agent during strategic planning or system training of technology initiatives. Likewise, teamwork is an essential skill since the position often calls for the communication, coordination, and conveying of information with both school personnel and persons outside the district about technology topics that concern education.

The Instructional Role of the model contains eight items including one Priority One item, five Priority Two items, one Priority Three item, and one Priority Four item. The single Priority One item suggests that having experience with a variety of instructional models is necessary for Technology Specialists. Likewise, the Technology Specialist should be capable of working with both classroom teachers and ancillary staff, such as media specialists or academic coaches, to integrate classroom technology and to link technology to instruction. In all, instructional priorities should encompass about 24% (8 of the 35 items) of a Technology Specialists' skill set.

The instructional lens of the Technology Specialist must be knowledgeable of curriculum, instruction, and instructional design. Furthermore, this position must be capable of understanding and distinguishing between pedagogy and andragogy since the

Technology Specialist must, at times, deal with the instruction of children, adolescents, and the adult learner.

The Technical Role of the model contains 11 items including two Priority Two items, two Priority Three items, four Priority Four items, and three Priority Five items. The two Priority Two and two Priority Three items suggested a need for Technology Specialists to understand more "abstract" concepts of technology such as the ability to forecast technology needs and adherence to copyright law. Sixty-four percent of the 11 items of the Technical Role were Priority Four and Priority Five items. These items, such as "knowledge of new computer and network technology" and "assisting with the planning and design of the school's technology infrastructure initiatives," centered on the immediate skill set and knowledge level of the Technology Specialist. In all, technical priorities should encompass about 31% (11 of the 35 items) of a Technology Specialist's skill set.

The technical skills of this role should focus on the areas of needs assessment and human workforce development. The fact that the Technical Role does not include the need for technical, private industry, certifications does not suggest that these certifications are not valued. Instead, the results support the literature that suggests that the role of technology is increasingly more important to education, and in particular, to classroom instruction (Ledesma, 2006). Thus, the role of the Technology Specialist is evolving to include skills and knowledge from the educational arena in addition to the area of technical expertise. Truly, the roles and responsibilities of the Technology Specialist may overlap with the roles and responsibilities of many other ancillary staff

positions, including the academic coach, the instructional technologist, or even the media specialist.

The findings of this study suggest that Technology Specialists would benefit from having a credential that clarifies their roles and divergent responsibilities. This credential would then qualify them for productive employment as Technology Specialists in the educational environment.

Research Question Three: What professionally granted qualifications or credentials should a Technology Specialist possess? The results provide evidence that the Technology Specialist's role has now evolved to include roles and responsibilities well beyond the role of the technical expert from previous generations. So, in as much as the purpose of a Delphi study is to forecast or focus on the future, the ranked list of items identifies the qualifications necessary to professionalize the position of the Technology Specialist as it is evolving to meet the growing demands of technology in the educational arena. An academic degree that includes educational administration and management, instruction, and curriculum design and development as well as educational technology content is necessary.

Conclusions

The purpose of a Delphi study is to bring consensus to a group of experts' opinions (Stitt-Gohdes & Crews, 2004). Because the Delphi's process is iterative, each round can be descriptively and/or statistically analyzed in regard to the research questions of the study. The result of the Delphi study is the model illustrated in Figure 4.

- Conclusion One

  Technology Specialists must be knowledgeable of school-centered administrative

and management tasks, classroom instructional initiatives, technology, and technology initiatives. Results suggest that this position serve a multifaceted role of being a technician, an academician, and an administrator. While a technical knowledge base continues to be a prerequisite for the position of Technology Specialist, this role shall grow in significance as the demands of classroom technology access continue to increase and the position requires the Specialist to be involved in school-based and district-based administrative and management-based objectives. Thus, the position of the Technology Specialist must continue to evolve to now include more knowledge and skills in education-related areas above and beyond the technical expert's standard technology skill set.

- Conclusion Two

  Technology Coordinators suggest that 77% of a Technology Specialist's skill set be something other than "technical" skills. Due to this transformation from previous generations, the credential of the Technology Specialist needs to be designed with an interdisciplinary focus. A recommendation to educate and increase the knowledge level and skill set beyond the role of a technician is essential.

- Conclusion Three

  The position of Technology Specialist is perceived and operationalized differently across the nation. This conclusion is supported by the resulting priorities, especially the lower priorities which show a wide variation.

- Conclusion Four

  Limitations of generalizability from a Delphi study must be considered. The

conclusions derived from this study should be further studied and this study should be repeated. Despite repeated efforts to establish a common definition of a Technology Specialist, it is possible that the Delphi panel members may have applied their own perceptions of a Technology Specialist that then could have in turn affected how they ranked and rated the items of the Delphi surveys.

Recommendations for Further Research

Findings and conclusions resulting from this study lead to the following recommendations for further research and practice.

Recommendation One: This research should be repeated with a similar target group of experts to check for consistency and validity of results.

Recommendation Two: This study should be presented to current Technology Specialists to allow for comments about the results of the data.

Recommendation Three: Because this study considered only public school systems this study should be repeated with private institutions and educational institutions abroad.

Recommendation Four: The definition and clarity of identified roles for the "Technology Specialist" must be better defined and tested for continuity in all regions of the U.S. Comparative analysis between school systems as to what is required to distinguish the skills and knowledge of this position is recommended.

Recommendation for Technology Specialist Credential Standards

The following recommendations of standards for a credential are based on the conceptual model illustrated in Figure 4. This credential should be implemented in an alternative certification process by way of an in-service model.

Standard 1: Technical Skills - A process for verification and validation of a technical skill set such as CompTIA's A+ or N+ certification is necessary.

Standard 2: Foundations of Public Schooling - Technology Specialists must have an understanding of the mission and/or vision of public schools.

Standard 3: Finance - An understanding of specific information about budget and finance is necessary for the Technology Specialist to understand the administrative viewpoint of the financial impact of technology.

Standard 4: Educational Leadership - Knowledge of educational leadership, with an emphasis on school law and policy development, will provide the Technology Specialist with an understanding of the essence of compliance with local, state, and federal initiatives.

Standard 5: Research and Management - The acquisition of management skills with a focus on research and analysis skills and teamwork will ensure that the Technology Specialist has the ability to orchestrate change within the school.

Standard 6: Learning Theory - An understanding of models of teaching and learning for children, adolescents, and adults is necessary as the Technology Specialist must be involved with aspects of education for both students and staff.

Standard 7: Integration of Technology - Learning of the use and about the integration of technology in teaching and learning will instill a sense of how the Technology Specialist's technical skills will be useful in an educational setting.

Standard 8: Curriculum Design - Learning the processes of curriculum design will allow for a better understanding of the staging process that technology will play in the school's plan for instruction.

Standard 9: Instructional Design - An understanding of instructional design will allow the Technology Specialist to play an integral role in the process of infusing technology into lesson planning and staff development.

Discussion

The findings of this study suggest the Instructional Technology Specialists and Instructional Support Specialists overlap. Likewise, these results indicate the role Technology Specialists can play likely varies from state to state or district to district depending on the personnel structure of that system. Additionally, the panel of Technology Coordinators participating in the study may have interpreted the operational definition of "Technology Specialist" differently which may have then influenced the way that the panel members responded. In recent times of reduced funding, schools have been forced to consolidate and/or reduce both instructional and ancillary positions. The results of this study may have also been impacted by economic downturns. The collective of these events is that the boundaries that separate ancillary support positions such as the Technology Specialist, the Instructional Technology Specialist, and the Instructional Support Specialist have been blurred. The literature also supports the idea that this position, which was exclusively technical, continues to evolve into a position that now considers administrative and management responsibilities, and a focus on teaching and learning, to function effectively within a school system (Davidson, 2003).

Human capital theory (Sweetland, 1996) was the theoretical framework used to view the findings of this study. The need for the expanded skill set is undeniable since the use of technology for learning purposes continues to increase. Therefore, the knowledge and skill set of the Technology Specialist will increase in value. This

increasing importance of the Technology Specialist necessitates a credential. The results of this study are consistent with human capital theory, which emphasizes measuring the value of needed knowledge and skills to contribute to the success of the enterprise. These results also show that Technology Specialists' value and worth are more clearly understood, which could improve hiring practices. Thus human capital theory is an appropriate lens through which to understand the results of this study.

This credential could be delivered in different ways. An in-service credential would provide residency-in-training or "on-the-job" training as a means to acclimate the services of education to the pre-existing skill set of the technical expert. A pre-service credential would provide a common ground for school personnel to identify the capacity and worth of the technical expert to public education.

Implemented as an alternate model, an in-service credential would prove to be the easiest to implement because the school system would provide an environment for the Technology Specialist to acquire knowledge and then fashion a skill set that directly ties to the system's educational directives. Delivery mechanisms for this in-service credential could be state departments of education, regional educational service agencies, or colleges and universities.

Significance of this Study

The significance of this study is that it derives experts' view of the knowledge, skills, and credentials needed for the position of a Technology Specialist working in a public school system. A baseline of knowledge and skills now exists for the professionalization of the position of Technology Specialist. Because a deeper understanding of the evolution of the Technology Specialist's job function is

documented, the value of this position to the world of education is measurable. Furthermore, the rankings by the panelists are of value because they qualify the changing role of the Technology Specialist and the value of this position in public education. A conceptual framework from which a professional credential can now be developed and implemented exists. The fact that a consensus of the results was achieved shows that items important to Technology Coordinators are consistent in all areas of the U.S. This study has produced a conceptual model that fills a gap in the literature, and that can serve as the basis for the development of a credential for Technology Specialists.

REFERENCES

Allen, I. E., & Seaman, C. A. (2007, July). Likert scales and data alalyses. *Quality Progress, 2007 July.* Retrieved from http://asq.org/quality-progress/2007/07/statistics/likert-scales-and-data-analyses.html

Anderson, L. S. (Founder/Director). (1999). *Nurturing the IT culture: The leadership challenge.* Mississippi State, MS: National Center for Technology Planning. Retrieved from http://www.nctp.com/articles/nurture.pdf

Antonacci, D. M. (2002, December 11). *Integrating technology into instruction in higher education.*, IS Training and Communications, University of Missouri-Kansas City. Retrieved from http://associations.missouristate.edu/assets/mohighedweb/IS-TechnologyIntegrationinHigherEducation.pdf

Attewell, P. (2001, July 1). The first and second digital divides. *Sociology of Education, 74*(3), 252-259. Retrieved 25 July 2010, from http://www.jstor.org/stable/2673277

Balaraman, S., & Venkatakrishnan, K. S. (1980, January). Identifying engineering education goals and priorities for the future: An experiment with the Delphi technique. *Higher Education, 9*(10), 53-57. Retrieved from http://www.jstor.org/stable/3446603

Beattie, R. M. (2000, November 1). Four ways to ensure quality tech support in schools. *ESchool News.* Retrieved from https://www.eschoolnews.com/2000/11/01/four-ways-to-ensure-quality-tech-support-in-schools/

Becker, G. S. (2008). Library of economics and liberty. (n.d.). In *Human capital*. The Concise Encyclopedia of Economics. Retrieved March 26, 2012, from http://www.econlib.org/library/Enc/HumanCapital.html

Becker, H. J. (2001). *How are teachers using computers in instruction?* (Center for Research on Information Technology and Organizations). Retrieved from http://crito.uci.edu/papers/TLC/findings/special3/How_Are_Teachers_Using.pdf

Becker, H. J. (2000, July). *Findings from the teaching, learning, and computing survey: Is Larry Cuban right?* Presented at the School technology Leadership Conference of The Council of Chief State School Officers, Washington, D.C. Retrieved from http://www.crito.uci.edu/tlc/findings/ccsso.pdf

Beech, B. (1999). Go the extra mile -- use the Delphi technique. *Journal of Nursing Management, 74,* 281-288. Retrieved from http://proxygsu-val1.galileo.usg.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=5167566&site=ehost-live

Beem, K. (2002, June). Tech support. *The School Administrator.* Retrieved from http://www.aasa.org/SchoolAdministratorArticle.aspx?id=10050&terms=technology+support

Bills, D. B. (1988, January). Educational credentials and promotions: Does schooling do more than get you in the door? *Sociology of Education, 61*(10), 52-60. Retrieved from http://www.jstor.org/stable/2112309

Botturi, L. (2009, August 3). Handbook on information technologies for education and training (2nd ed.). *Distance Education, 30*(2), 285. Retrieved from http://proxygsu-val1.galileo.usg.edu/login?url-http://proque_st.umi.com/pqdweb/?did=1857956751&Fmt=3&clientld=30337&RQT=3_09&VName=PQD

Boyd, D., Goldhaber, D., Lankford, H., & Wyckoff, J. (2007, Spring). The effect of certification and preparation on teacher quality. *The Future of Children, 17*(1), 45-68. Retrieved from http://www.jstor.org/stable/4150019

Bryant, J. (2011, October 13). Starving America's public schools. In *Quality education*. Retrieved 27 November 2011, from ourfuture.org: http://www.ourfuture.org/report/2011104111/starving-america-s-public-schools

Bushweller, K. (1996, January 1). How mighty is your wizard: The answer depends on who's waving the techno-wand. *Electronic School.* Retrieved 26 November 2011, from http://alpha.musenet.org:81/news/newsletters/newsletter13.html#wizard

Butler, D. L., & Sellbom, M. (2002). Barriers to adopting technology. *Educause Quarterly, 2,* 22 - 28. Retrieved from http://net.educause.edu/ir/library/pdf/eqm0223.pdf

Cameron, E. M. (1999, August). *School media specialist and school technology specialist: Partners in information technology?* Chapel Hill, North Carolina. Retrieved from http://ils.unc.edu/MSpapers/2546.pdf

Carter, K. (2000, March 1). Staffing up for technology support. *Tech & Learning, 20*(8), 26-33. Retrieved 26 November 2011, from http://library.valdosta.edu:2048/login?url=http://search.proquest.com.proxygsu-val1.galileo.usg.edu/docview/212079593?accountid=14800

Caspary, K., Kusserow, T., Lavin, J., & Movassaghi, M. (1999). *Managing technology efficiently in California K-12 schools: Policies & practices for minimizing the total cost of ownership (TCO).* University of California, Berkeley: Richard & Rhonda Goldman School of Public Policy. Retrieved from http://www.library.ca.gov/crb/99/in_association/01/ia99001.pdf

Clayton, M. J. (1997, December 1). Delphi: A technique to harness expert opinion for critical decision-making tasks in education. *Educational Psychology, 17*(4), 373-386. Retrieved from http://library.valdosta.edu:2048/login?url=http://search.proquest.com.proxygsu-val1.galileo.usg.edu/docview/208814948?accountid=14800

Corazzine, A. J. (1967). When should vocational education begin? *The Journal of Human Resources, 2,* 41-50.

Corn, J. (2010, August 1). Investigating the quality of the school technology needs assessment (STNA) 3.0: A validity and reliability study. *Educational Technology Research & Development, 58*(4), 353. Retrieved 4 August 2010, from http://proxygsu-val1.galileo.usg.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=51313071&site=ehost-live

Crampton, F. E. (2007, Spring). State school finance legislation: A 50-State overview and trend analysis. *Journal of Education Finance, 32*(4), 470-487. Retrieved from http://www.financeproject.org/publications/StateSchoolFinanceLegislation.pdf

Cruz, F. D. (2011). *Columbia university computing history*. Retrieved 26 November 2011, from columbia.edu: http://www.columbia.edu/cu/computinghistory/

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use for technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal, 38*(4), 813-834. Retrieved from http://proxygsu-val1.galileo.usg.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ648257&site=ehost-live

Cuban, L. Retrieved from http://www.csun.edu/~jnk61575/sed514/docs/cuban_intro.pdf

Cuban, L. (2001). *Oversold and underused: Computers in the classroom.* Massachusetts: Harvard University Press.

Culp, K. M., Honey, M., & Mandinach, E. (2003). *A restrospective on twenty years of education technology policy* (U.S. Department of Education, Office of Educational Technology). Retrieved from http://www2.ed.gov/rschstat/eval/tech/20years.pdf

Dalkey, N. C. (1969). *The Delphi method: An experimental study of group opinion* (United States Air Force Project RAND). Retrieved from http://www.rand.org/content/dam/rand/pubs/research_memoranda/2005/RM5888.pdf

Davidson, J. (2003, June). A new role in facilitating school reform: The case of the educational technologist. *Teachers College Record, 105*(518128), 729-752. Retrieved from http://www.tcrecord.org/Content.asp?ContentID=11138

Dore, R. P. (1976, February). Human capital theory, the diversity of societies and the problem of quality in education. *Higher Education, 58*(10), 79-102.

Dubie, D. (2009, March 30). 10 tips for cutting your IT expenses. *Network World, 26*(13), 1. Retrieved 27 November 2011, from http://search.proquest.com/docview/215991768?accountid=14800

Duke, S. (2009, Winter). Educating public relations students to enter the blogosphere: Results of a Delphi study. *Journalism & Mass Communication Educator, 63*(4), 317-332. Retrieved from http://library.valdosta.edu:2048/login?url=http://search.proquest.com.proxygsu-val1.galileo.usg.edu/docview/215290272?accountid=14800

Edwards, D., Marzano, M., Jay, M., Jensen, F., Lucas, B., Mason, B. M. et al. (2011). *Research protocol to derive recreational scores for European forest management alternatives* (European Forest Institute No. 518128). Retrieved from http://www.efi.int/files/attachments/publications/eforwood/efi_tr_63.pdf

Elementary and Secondary Education Act of 1965. (2004). In B. K. Landsberg (Ed.) *eNotes.com* (p. Major Acts of Congress). Retrieved 26 November 2011, from Macmillan-Thomson Gale: http://www.enotes.com/major-acts-congress/elementary-secondary-education-act

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing, 62*(10), 107 - 115. Retrieved from http://academic.csuohio.edu/kneuendorf/c63309/ArticlesFromClassMembers/Amy.pdf

Evaluating technology's role in the classroom. (2004, October 1). *T.H.E. Journal.* Retrieved 25 July 2010, from http://thejournal.com/Articles/2004/10/01/Evaluating-Technologys-Role-in-the-Classroom.htm

Fulfilling the need for a technology integration specialist. (2004, October 4). *T.H.E. Journal.* Retrieved 25 July 2010, from http://thejournal.com/Articles/2004/10/01/Fulfilling-the-Need-for-a-Technology-Integration-Specialist.htm

Georgia Department of Education. *State board of education* (State Education Rules). Retrieved 01 August 2010, from Georgia Department of Education: http://www.doe.k12.ga.us/pea_board.aspx?PageReq=PEABoardRules

Georgia School Superintendents Association. (2006). *Planning, Funding & Budgeting Institute.* Atlanta, GA: Georgia State University.

Gibbons, R., & Waldman, M. (2004, May). Task-specific human capital. *The American Economic Review, 94*(2), 203-207. Retrieved from http://www.jstor.org/stable/3592883

Gordon, T. J. (2003). *The Delphi method* (American Council for the United Nations University No. ver 3.0). Retrieved from http://www.millennium-project.org/FRMv3_0/04-Delphi.pdf

Gosmire, D., & Grady, M. L. (2007). A bumpy road; principal as technology leader. *Principal Leadership, 74*(64), 17-21. Retrieved from http://search.proquest.com/docview/233321553?accountid=14800

Gray, L., Thomas, N., & Lewis, L. (2010). *Educational Technology in U.S. Public Schools: Fall 2008* (U.S. Department of Education, National Center for Education Statistics. No. NCES 2010-034). Retrieved from http://nces.ed.gov/pubs2010/2010034.pdf

Günaydin, H. M. *The Delphi method for graduate research*. Retrieved December 26, 2011, from Izmir Institute of Technology: http://web.iyte.edu.tr/~muratgunaydin/delphi.htm

Haber, L. (1994, September 12). Education is key to success. *CRN, 21A*. Retrieved from http://search.proquest.com/docview/227459216?accountid=14800

Hasson, D., & Arnetz, B. B. (2005, July 19). Validation and findings comparing VAS vs. Likert scales for psychosocial measurements. *International Electronic Journal of Health Education, 8,* 178-192. Retrieved from http://www.aahperd.org/aahe/publications/iejhe/loader.cfm?csModule=security/getfile&pageid=38864

Hess, F. M. (2006, March 29). Technically foolish: Why technology has made our public schools less efficient. *The Weekly Standard*, Author. Retrieved January 19, 2012, from http://www.weeklystandard.com/author/frederick-m.-hess

Hsu, C.-C., & Sandford, B. A. (2007). The Delphi technique: Making sense of consensus. *Practical Assessment Research & Evaluation, 12*(10). Retrieved from http://pareonline.net/pdf/v12n10.pdf

Hsu, C.-C., & Sandford, B. A. (2007, December 1). Minimizing non-response in the Delphi process: How to respond to non-response. *Practical Assessment Research & Evaluation, 12*(17). Retrieved from http://pareonline.net/pdf/v12n17.pdf

Incentive Research Foundation. (2010). *Mastering measurement: The critical performance elements of elements of incentive design* (St. Louis, MO). Retrieved from http://theirf.org/direct/user/file/pdf/Mastering-Measurement.pdf

James, M. L. (2009). *Middle school teachers' understanding of technology integration* (University of North Carolina at Chapel Hill, 2009). Retrieved from https://cdr.lib.unc.edu/record;jsessionid=3DE4E9B508CFEDF207EAD0C241D96314?id=uuid%3Aee9cfac4-0a5c-47ef-a5ed-0f6e3b30bfa5.

Jamieson, S. (2004). Likert scales: How to (ab)use them. *Medical Education, 38,* 1212-1218. Retrieved from http://mahenry.sumnermckenzie.com/pdf/1LikertScales.pdf

Kaestner, R. (2007, May). Gauging technology costs and benefits. *The School Administrator, 58*(64). Retrieved from http://www.aasa.org/SchoolAdministratorArticle.aspx?id=6700&terms=technology+support

Kellogg, L., & Nelson, G. (2011). *Networks have to work or education doesn't* (ENA). Retrieved from http://www.ena.com/wp-content/uploads/2011/02/wp_networkshavetowork_5-1-05.pdf

Kerckhoff, A. C., & Bell, L. (1998, April). Hidden capital: Vocational credentials and attainment in the United States. *Sociology of Education, 71*(2), 152-174. Retrieved from http://www.jstor.org/stable/2673246

Koszalka, T. A. (2004). *Integrating authentic science and educational technologies into middle and high school curriculum* (Syracuse University). Retrieved from http://faculty.soe.syr.edu/takoszal/electronic_portfolio/scholarship/2004elearningMSHSAIDEproceedingkoszalka.pdf

Ledesma, P. (2006, Spring). The Technology Specialist's dilemma: Computer repair technician or instructional leader? *Virginia Society for Technology in Education, 20*(10), 3-8. Retrieved from http://www.vste.org/documents/vj_2001_all.pdf

Leggett, W., & Persichitte, K. A. (1998, May 1). Blood, sweat, and TEARS: 50 years of technology implementation obstacles. *TechTrends, 43*(3), 33. Retrieved from http://library.valdosta.edu:2048/login?url=http://search.proquest.com.proxygsu-val1.galileo.usg.edu/docview/223123888?accountid=14800

Lewis, W. A. (1954). Economic development with unlimited supplies of labor. *Manchester School of Economic and Social Studies, 22,* 139-91. Retrieved from http://www.econ.yale.edu/growth_pdf/cdp891.pdf

Long, C. (2011, August 3). Budget cuts take bigger slice out of school supplies. *NEAtoday*, Education Funding. Retrieved 27 November 2011, from http://neatoday.org/2011/08/03/budget-cuts-take-bigger-slice-out-of-school-supplies/

Loo, R. (2002). The Delphi method: A powerful tool for strategic management. *Policing, 25*(4), 762-769. Retrieved from http://library.valdosta.edu:2048/login?url=http://search.proquest.com.proxygsu-val1.galileo.usg.edu/docview/211297480?accountid=14800

Madsen, M. D. (2005). *A comparison of the job expectations versus the daily duties of a local school technology coordinator* (Instructional technology monographs No. 2). Univeristy of Georgia, Athens, GA: University of Georgia. Retrieved from http://projects.coe.uga.edu/itm/archives/spring2005/madsen.htm

Marcovitz, D. M. (1998). Supporting technology in schools: The roles of computer coordinators. *Technology and Teacher Education Annual,* pp. 1041 - 1045. Retrieved from http://www.loyola.edu/edudept/facstaff/marcovitz/MarcovitzSITE98.pdf

Mathieson, K., & Doane, D. P. (2003, June 21). *Using fine-grained Likert scales in web surveys.*, Depart of Decision and Information Sciences, Oakland University, Rochester, MI. Retrieved from http://www.sba.oakland.edu/workingpapers/mis/2003/2003-1.pdf

McDonald, J., & Gibbons, A. (2009, January 26). Technology I, II, and III: Criteria for understanding and improving the practice of instructional technology. *Educational Technology Research & Development, 57*(3), 377-392.

McGlauflin, R. (2011). *A brief history of computers in education*. Retrieved from http://www.mstf.org/a-brief-history-of-computers-in-education.htm

McKinsey & Company, I. (1995). *Connecting K-12 schools to the information superhighway* (National Information Infrastructure Advisory Council). Retrieved from http://www.uark.edu/mckinsey/exsum.html

Miller, L. (1999, November 1). Hot trends in information technology. *Tech Directions, 59*(4), 20-20. Retrieved December 31, 2011, from http://search.proquest.com/docview/218569983?accountid=14800

Mincer, J. (1965). Investment in human capital and personal income distribution. *The Journal of Political Economy, 66,* 281-302.

National Research Council (U.S.). Committee on Vocational Education Research and Development. (1976). *Assessing vocational education research and development.* University of California: National Academy of Sciences. Retrieved from http://www.nap.edu/catalog.php?record_id=9577

National Science Board. (2002). *Science and Engineering Indicators - 2002*(Vol. NSB-02-1). Retrieved 26 November 2011, from Arlington, VA: National Science Foundation: http://nsf.gov/statistics/seind02/c1/c1s8.htm

Noeth, R. J., & Volkov, B. B. (2004). *Evaluating the effectiveness of technology in our schools* (ACT). Retrieved from http://www.act.org/research/policymakers/pdf/school_tech.pdf

North Carolina Office of State Personnel. (2004, June 1). *Career Banding*. Retrieved January 19, 2012, from North Carolina Office of State Personnel: http://www.osp.state.nc.us/CareerBanding/Specs/Technology%20Support%20Specialist.pdf

Olaniyan, D. A., & Okemakinde, T. (2008). Human capital theory: Implications for educational development. *European Journal of Scientific Research, 24*(2), 157-162. Retrieved from http://www.eurojournals.com/ejsr_24_2_01.pdf

Orange Unified School District. (2004, November 18). *Technology support specialist* (Classified Vacancies). Retrieved January 19, 2012, from Orange Unified School District: http://www.orangeusd.k12.ca.us/hr/classified_pdf/job_desc/11-37_Technology_Support_Specialist.pdf

Parsad, B., & Jones, J. (2005). *Internet Access in U.S. Public Schools and Classrooms: 1994-2003* (U.S. Department of Education, National Center for Education Statistics.). Retrieved from http://nces.ed.gov/pubs2005/2005015.pdf

Paul, C. L. (2008, November). A modified Delphi approach to a new card sorting methodology. *Journal of Usability Studies, 41*(1). Retrieved from http://usabilityprofessionals.org/upa_publications/jus/2008november/JUS_Paul_Nov2008.pdf

Preble, J. F. (1984, June 1). The selection of Delphi panels for strategic planning purposes. *Strategic Management Journal, 58*(2), 157-170. Retrieved from http://www.jstor.org/stable/2486174

Richtel, M. (2011, September 2). In classroom of future, stagnant scores. In *The New York Times* (p. Technology). Retrieved October 10, 2011, from http://www.nytimes.com/2011/09/04/technology/technology-in-schools-faces-questions-on-value.html

Senate Research Office. (2001). The senate study committee on technology education summary of findings [http://www.legis.state.ga.us/legis/2009_10//senate/publications/sro/committee_reports/2001/The_Senate_Study_Committee_on_Technology_Education.pdf]. *Senate Research Office (Atlanta, GA), Georgia State Senate.*B. Littlefield (Ed.), (July 25, 2010).

Shattuck, G. (2007). *The historical development of instructional technology integration in K-12 education.* Unpublished manuscript, The University of Georgia. Retrieved from http://www.nowhereroad.com/technology_integration/readings/shattuck.pdf

Skulmoski, G. J., Hartman, F. T., & Krahn, J. (2007). The Delphi method for graduate research. *Journal of Information Technology Education, 6.* Retrieved from http://jite.org/documents/Vol6/JITEv6p001-021Skulmoski212.pdf

Skutsch, M., Hall. (1973). *Delphi: potential uses in educational planning. Project Simu-School: Chicago component.* Retrieved from http://proxygsu-val1.galileo.usg.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED084659&site=ehost-live

Stitt-Gohdes, W. L., & Crews, T. B. (2004, Spring). The Delphi technique: A research strategy for career and technical education. *Journal of Career and Technical Education, 20*(2). Retrieved from http://scholar.lib.vt.edu/ejournals/JCTE/v20n2/stitt.html

Strudler, N., Falba, C., & Hearrington, D. (2001, July 25). *The evolving role of school-based technology coordinators in elementary programs.* In *Building on the future.* National Educational Computing Conference, Chicago, IL.

Sweetland, S. R. (1996, Fall). Human capital theory: Foundations of a field of inquiry. *Review of Educational Research, 66*(3), 341-359. Retrieved from http://library.valdosta.edu:2060/stable/pdfplus/1170527.pdf

Turoff, M., & Linstone, H. (2002). *The Delphi method: Techniques and applications*. Retrieved from http://is.njit.edu/pubs/delphibook/

U.S. Department of Education. (2000). *E-Learning: Putting a world-class education at the fingertips of all children* (Office of Educational Technology). Retrieved from http://www2.ed.gov/about/offices/list/os/technology/reports/e-learning.pdf

U.S. Department of Education. (2001). *The no child left behind act of 2001* (U.S. Department of Education). Retrieved from http://www2.ed.gov/nclb/overview/intro/execsumm.pdf

U.S. Department of Education. (2002). *Beyond school-level internet access: Support for instructional use of technology* (Office of Educational Research and Improvement No. NCES2002-029). Retrieved from http://nces.ed.gov/pubs2002/2002029.pdf

U.S. Department of Education. (2011, April 5). *Digest of Education Statistics, 2010*. Retrieved from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2011015

Venator, J. (2006). IT certification: Still valuable after all these years. *Techniques, 81*(10), 28-31. Retrieved from http://search.proquest.com/docview/216118370?accountid=14800

Vogt, A. (2009, August 5). *Stimulus helps schools, but not as much as hoped, according to national survey* [American association of school administrators]. Retrieved from http://www.aasa.org/content.aspx?id=5452&terms=technology+support

Walker, A., & Selfe, J. (1996). The Delphi method: A useful tool for the allied health researcher. *British Journal of Therapy and Rehabilitation, 32,* 677-681.

Wallace, R. M. (2004, Summer). A framework for understanding teaching with the internet. *American Educational Research Journal, 41*(2), 447-488. Retrieved 25 July 2010, from http://www.jstor.org/stable/3699373

Wenzel, E. (2010, September 30). Choose the right tech support professional for your business. *PC World, 28*(12), 32. Retrieved from http://proxygsu-val1.galileo.usg.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=56666724&site=ehost-live

Wissehr, C. H. (2011, November 26). Looking back at the sputnik era and its impact on science education. *School Science & Mathematics, 111*(7), 368 - 375. Retrieved from http://proxygsu-val1.galileo.usg.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=tfh&AN=67195536&site=ehost-live

Yousuf, M. I. (2007). Using experts' opinions through Delphi technique. *Practical Assessment Research & Evaluation, 12*(5). Retrieved from http://pareonline.net/pdf/v12n4.pdf

Zhu, E., & Wright, M. C. (2006). Recruiting instructional technology specialists for faculty development. *International Journal of Teaching and Learning in High Education, 17*(2), 119-126. Retrieved from http://www.isetl.org/ijtlhe/pdf/IJTLHE33.pdf

APPENDIX A

Letter to State Educational Certification Agencies

DATE

Dear _____,

I am a doctoral student at Valdosta State University in Valdosta, GA currently researching the need for credentializing technology support personnel in K-12 education environments. While my intent is to conduct a Delphi study, I'm currently assessing which states mandate that Technology Specialists or Technology Support Specialists be professionally certified. For the purposes of this research study I'm particularly interested in support personnel with a responsibility to support the infrastructure and physical integration of technology -- functions which I see different from those of an Instructional Technologist whose responsibility is to help integrate technology into the curriculum / pedagogy.

If you are the appropriate person please respond to this e-mail stating whether your state requires Technology Specialists to possess a credential and which credential is required. Otherwise, please respond stating that Technology Specialists are not required to be certified.

If you are not the most appropriate person to answer, please forward this e-mail to the correct person.

Please respond to this e-mail by {DATE}.

Sincerely,

Keith Osburn, Ed.S.
Doctoral Candidate
Department of Adult and Career Education

Valdosta State University
kosburn@valdosta.edu

Dr. Reynaldo Martinez, Ph.D.
Professor and Head
Department of Adult and Career Education
Valdosta State University
rlmartinez@valdosta.edu

APPENDIX B

E-mail to State Technology Directors

DATE

Dear _____,

I am a doctoral student at Valdosta State University in Valdosta, GA currently researching the need for credentializing technology support personnel in K-12 education environments. My intent is to conduct a Delphi study that will ask selected district-level Technology Directors from your state to participate in three rounds of surveys. For the purposes of this research study I'm particularly interested in support personnel with a responsibility to support the infrastructure and integration of technology -- functions which I see different from those of an Instructional Technologist whose responsibility is to help integrate technology into the curriculum / pedagogy.

The proliferation of technology and its use in the public education classroom has increased the need for quality technology support personnel to help with the selection, acquisition, implementation, maintenance, and training on the use of technological equipment. Likewise, as the demands of technology use have increased, the Technology Specialist must now also be aware of trends in educational pedagogy in order to ensure best practices for the use of technology are employed in the classroom. Unfortunately, while the need for quality Technology Specialists has increased no standard or measure has been agreed upon to allow for a professional endorsement of this position. This study will provide a conceptual model for guiding the development of a professional credential for Technology Specialists employed in public education in the K-12 sector.

Could you please recommend the names of three to five school-system Technology Coordinators from your state that I could invite to participate in this research study?

Please respond to this e-mail with the names and e-mail addresses of those persons you would recommend. Please use the email listed below if you need further clarification.

Please respond to this e-mail by {DATE}.

Sincerely,

Keith Osburn, Ed.S.
Doctoral Candidate
Department of Adult and Career Education

Valdosta State University
kosburn@valdosta.edu

Dr. Reynaldo Martinez, Ph.D.
Professor and Head
Department of Adult and Career Education
Valdosta State University
rlmartinez@valdosta.edu

APPENDIX C

Invitation to Participate in a Delphi Study

DATE

Dear _____,

You have been recommended by your state Technology Director to participate in this research study. This is a three round Delphi study to determine the skills, knowledge level, and credentials that should be required of Technology Specialists employed in the K-12 public education sector. Given your recognized expertise in technology administration and management, your participation would provide a valuable insight and contribution to the public education technology workforce.

The proliferation of technology and its use in the public education classroom has increased the need for quality technology support personnel to help with the selection, acquisition, implementation, maintenance, and training on the use of technological equipment. Likewise, as the demands of technology use have increased, the Technology Specialist must now also be aware of trends in educational pedagogy in order to ensure best practices for the use of technology are employed in the classroom. Unfortunately, while the need for quality Technology Specialists has increased no standard or measure has been agreed upon to allow for a professional certification of this position.

Participating in this three round study involves identifying skills, knowledge levels, and credentials and then rating these potential qualifications on three questionnaires. If you are willing to participate, a web-based survey will be used to allow you to identify and then further rate both your responses and the responses of the other panel participants. Your participation in this study will be completely anonymous and your name will not appear in the results of the study. For this study you will be given a system generated access code that will be unknown to me, to ensure your anonymity. You will be asked to respond to the first questionnaire within the next week. Furthermore, one week will be allowed to rate the selections for each follow-up survey. Each survey will include fewer items to be rated that the previous survey. The first round of the Delphi will request that you select from an item list those skills, characteristics, and knowledge that you consider important for a Technology Specialist to possess. Spaces will be provided for the addition of items not listed. The selections from all participants will be presented in a second round which will allow you to rank the items according to importance. The third round will request that you rank in item from the second round based on your perceived importance. Note that those items from round two which did not measure a positive mean will be discarded and not included in round three.

Requirements for you to participant in this study are that you have been employed as a district-level Technology Coordinator for at least three years, hold an education credential (such as a teaching certificate or leadership certificate) or hold an information technology (IT) certification such as CompTIA's A+ or Microsoft's MCSE credential.

Thank you in advance for your consideration of this request. I very much hope you will participate in this important research. Please send a short response to me by {DATE} at the e-mail address below regarding your decision to participate.

You will be provided with a copy of the results of this study should you desire. If this is your desire please let me know when you respond with your decision to participate in this study.

Sincerely,

Keith Osburn, Ed.S.
Doctoral Candidate
Department of Adult and Career Education

Valdosta State University
kosburn@valdosta.edu

Dr. Reynaldo Martinez, Ph.D.
Professor and Head
Department of Adult and Career Education
Valdosta State University
rlmartinez@valdosta.edu

APPENDIX D

Initial Correspondence to Participants

Date

Dear Technology Coordinator,

Thank you for participating in this three round research study entitled, "Credentialing Public Education's Technology Specialist Workforce: A Delphi Study."

A URL is included below in this e-mail. Using your computer's mouse, please left-click the link upon which you will be redirected to the first page of the study. Please acknowledge your agreement to participate by selecting "I agree to participate." The first page of the survey will be presented after your acceptance.

No special hardware or software requirements other than a modern Internet browser are necessary. The survey is browser independent and will be properly formatted for use on either computer or mobile devices.

Further instructions about completing the survey are provided on the survey.

Please complete this initial round by {DATE}.

Please contact me in you have additional questions or you experience problems connecting to the survey.

Sincerely,

Keith Osburn, Ed.S.
Doctoral Candidate
Department of Adult and Career Education

Valdosta State University
kosburn@valdosta.edu

Dr. Reynaldo Martinez, Ph.D.
Professor and Head
Department of Adult and Career Education
Valdosta State University
rlmartinez@valdosta.edu

http://annexweb.jeff-davis.k12.ga.us/limesurvey/index.php?sid=99548&lang=en

APPENDIX E

Participation Reminder

Dear {FIRSTNAME},

Recently we invited you to participate in a survey.

We note that you have not yet completed the survey, and wish to remind you that the survey is still available should you wish to take part.

The survey is titled:

“{SURVEYNAME}”

“{SURVEYDESCRIPTION}”

To participate, please click on the link below.

Sincerely,

{ADMINNAME} ({ADMINEMAIL})

Click here to complete the survey:

{SURVEYURL}

I

APPENDIX F

List of Job Announcements

http://www.nacs.k12.in.us/Content/Article/332/Technology-Specialist-Job-Description.html

http://www.ncmcs.org/19061012613291337/lib/19061012613291337/JobDescriptions/IT/Job%20Description%20-%20Instructional%20Technology%20Specialist.pdf

http://www.schools.pinellas.k12.fl.us/tchandbk/tcdescp1.htm

http://www.solon.k12.ia.us/district/services/technical_support/documents/scsd_technology_specialist_technician_job.pdf

http://www.puyallup.k12.wa.us/employment/hr/JobDesc/ProTech/ComputerTechSpecHW.pdf

http://www.rcs.k12.tn.us/rc/RCS_NEW/ITS/STS/sts_job.pdf

http://www.monte.k12.co.us/Boardpolicies/policies/GDAD-R.pdf

http://www.ouesd.k12.ca.us/Job-Descriptions/Technology-Specialist.pdf

http://www.bhuhsd.k12.ca.us/Employment/job%20descriptions/classified/Technology%20Specialist.pdf

http://k12jobspot.com/Jobs/?ID=197285

http://www.monte.k12.co.us/Boardpolicies/policies/GDAD-R.pdf

http://www.bhuhsd.k12.ca.us/Employment/job%20descriptions/classified/Technology%20Specialist.pdf

http://waynesville.k12.mo.us/fileadmin/wps/home/District/Human_Resources/Job_Descriptions/2.22.4_Secondary_Building_Tech.pdf

APPENDIX G

First Delphi Round

Credentialing Public Education's Technology Specialists: A Delphi Study

The proliferation of technology and its use in the public education classroom has increased the need for quality technology support personnel to help with the selection, acquisition, implementation, maintenance, and training on the use of technological equipment. Likewise, as the demands of technology use have increased, the Technology Specialist must now also be aware of trends in educational pedagogy in order to ensure best practices for the use of technology are employed in the classroom. Unfortunately, while the need for quality Technology Specialists has increased no standard or measure has been agreed upon to allow for a professional endorsement of this position.

There are 7 questions in this survey

Demographic Information

1 What is your current position *

Please choose **only one** of the following:

- ○ Technology Coordinator - District Level
- ○ Technology Coordinator - School Level

What is your job role in the area of school technology management.

2 Please select your current education credentials: *

Please select between 1 and 4 answers

Please choose **all** that apply:

- ☐ Teaching Degree
- ☐ Specialist Degree
- ☐ Leadership Degree
- ☐ Other: [ ]

Teaching certificate, Support certificate (i.e. Media Specialist), or Educational Leadership

3 Do you currently hold any information technology (IT) certifications?

Please choose **all** that apply:

- ☐ CompTIA's A+
- ☐ CompTIA's N+
- ☐ Microsoft Certified Systems Engineer (MCSE)
- ☐ Certified Novell Engineer (CNE)
- ☐ Other: _____

CompTIA's A+ or N+, Microsoft's MCSE, etc.

4 How many years of experience do you have as a Technology Coordinator? *

Please choose **only one** of the following:

- ○ 0-2 years
- ○ 3 or more years

Years of experience (i.e 1, 2, 3 ...).

5 Please identify your gender. *

Please choose **only one** of the following:

- ○ Female
- ○ Male

Technology Specialists qualifications

Please list, based on your personal experience and qualifications, the knowledge, skills, credentials and qualifications Technology Specialists should have.

6

Please select from the list of skills and knowledge, credentials, and qualifications those which should be included in a compiled list of competencies that should be held by Technology Specialists employed in a K-12 public education school system. The list of items is in no particular order. Space is available at the end for you to make additions to this list.

*

Please choose **all** that apply:

- ☐ Assist with the maintenance of district databases, including those storing student demographic information and student account information.
- ☐ Assist with the ordering of supplies for building-level technology.
- ☐ Assist school-level administrators in determining the technology needs of classroom teachers.
- ☐ Be familiar with ISTE (International Society for Technology in Education) standards and how these standards are used.
- ☐ Collaborate with school media specialists to provide leadership in the school's use of instructional technology resources to enhance learning.
- ☐ Coordinate the use of technology-related equipment and labs in and between buildings.
- ☐ Collaborate with teachers and other instructional staff to develop curriculum materials and specific lesson plans that integrate technology.
- ☐ Direct the purchase of educational software to help enhance classroom pedagogy.
- ☐ Direct building-level administrators to purchase technology for use in K-12 classrooms.
- ☐ Forecast the technology needs of school personnel including classroom teachers, school administrators, and ancillary personnel (ex. Media specialist).
- ☐ Maintain adherence to budget-related purchases so that technology purchased for a particular program (ex. Title I) is only used for that program.
- ☐ Maintain documentation related to the installation and configuration of building-level technology.
- ☐ Provide routine maintenance on building-level technology.
- ☐ Provide professional development and training for certified staff on the use of educational technology.
- ☐ Troubleshoot and resolve building-level technology infrastructure related issues.
- ☐ Guide teachers and other technology staff with the selection of hardware and software resources that are compatible with the school's technology infrastructure.
- ☐ Serve as the district contact for selecting software applications.

- [ ] Adhere to copyright law.
- [ ] Understand and adhere to the educational community's code of ethics.
- [ ] Assist with the planning and design of the school's technology infrastructure initiatives.
- [ ] Evaluate the effectiveness of educational technology in use in classrooms.
- [ ] Play a leading role in the school's budgetary process to ensure funding for the technology program.
- [ ] Plan for and then provide technology-related professional development activities that meet the needs of the school's staff members.
- [ ] Coordinate the activities of outside vendors, consultants and trainers.
- [ ] Provide teachers with strategies of how technology can be used to in the classroom.
- [ ] Facilitate staff participation in the evaluation and selection of new software, hardware, and materials to support instructional objectives.
- [ ] Maintain hardware and arrange for timely repair.
- [ ] Maintain repair history and file server performance statistics.
- [ ] Work with school administrators to create a budget.
- [ ] Make technology budget recommendations to school administrators.
- [ ] Ensure compliance with federal and state requirements and Board of Education policy.
- [ ] Develop districtwide staff computer training programs for the purpose of increasing user knowledge-base of hardware integration.
- [ ] Implement district policy on acceptable usage of computer hardware for the purpose of ensuring compliance to standards and regulations.
- [ ] Experience with a variety of instructional models.
- [ ] Coordinate communication with teachers and staff about technology training opportunities outside the school, grant programs, and new technology projects.
- [ ] Understand FERPA (Family Educational Rights & Privacy Act) and HIPAA (Health Insurance Portability and Accountability Act) laws and requirements.
- [ ] Instruct students in research skills using the Internet.
- [ ] Maintain knowledge of new computer and network technology.
- [ ] Establish network security procedures.
- [ ] Provide training on specific technology to students.
- [ ] Evaluate the effectiveness of technology solutions.
- [ ] Serve as a resource to school personnel requiring assistance with assistive technology topics.
- [ ] Model the integration of technology in all curriculum areas.
- [ ] Collaborate with teachers to assist with planning of lessons based on norms-based standards such as project-based learning, and STEM which also incorporate technology integration.
- [ ] Maintain the school system's website.
- [ ] Perform classroom observations to provide support to teachers through data collection.

- [ ] Help students troubleshoot computers.
- [ ] Acquire the CompTIA A+ certification.
- [ ] Acquire the CompTIA N+ certification.
- [ ] Acquire the MSDST (Microsoft Desktop Support Technician)
- [ ] Participate in meetings, workshops and seminars for the purpose of conveying and/or gathering information required to perform technology-related functions
- [ ] Research computer hardware system solutions for the purpose of providing technical information on curriculum enhancement.
- [ ] Hold a certified teaching license.
- [ ] Automate school office clerical functions to computerized time-saving routines.
- [ ] Develop a working knowledge of content area curriculum.
- [ ] Identify students' prior experiences, learning styles, strengths, and needs when designing a lesson plan.
- [ ] Select alternative teaching strategies, materials, and technology to achieve multiple instructional purposes.
- [ ] Develop a working knowledge of technology curriculum.
- [ ] Prepare Internet safety awareness curriculum for student use

Please select all the items you consider important and should be included in a combined list.

7 Please list items that should be included on the list but have not been listed.

Please choose **all** that apply and provide a comment:

☐ Addition 1	
☐ Addition 2	
☐ Addition 3	
☐ Addition 4	
☐ Addition 5	
☐ Addition 6	
☐ Addition 7	
☐ Addition 8	
☐ Addition 9	
☐ Addition 10	

Thank you for your participation. Round two will begin shortly.

31.12.1969 – 19:00

Submit your survey.
Thank you for completing this survey.

APPENDIX H

Second Delphi Round

Round 2 - Credentialing Public Education's Technology Specialists: A Delphi Study

The proliferation of technology and its use in the public education classroom has increased the need for quality technology support personnel to help with the selection, acquisition, implementation, maintenance, and training on the use of technological equipment. Likewise, as the demands of technology use have increased, the Technology Specialist must now also be aware of trends in educational pedagogy in order to ensure best practices for the use of technology are employed in the classroom. Unfortunately, while the need for quality Technology Specialists has increased no standard or measure has been agreed upon to allow for a professional endorsement of this position.

There are 1 questions in this survey

Round 2 - Rating Responses from Round One

1 The list below includes items that were either selected or submitted by panelists in the first survey round. Please rate each item using a range from one (Strongly Disagree) to seven (Strongly Agree).

*

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Agree	Strongly Agree
Be familiar with ISTE (International Society for Technology in Education) standards and how these standards are used.	○	○	○	○	○	○	○
Instruct students in research skills using the Internet.	○	○	○	○	○	○	○
Experience with a variety of instructional models.	○	○	○	○	○	○	○
Perform classroom observations to provide support to teachers through data collection.	○	○	○	○	○	○	○
Direct building-level administrators to purchase technology for use in K-12 classrooms.	○	○	○	○	○	○	○
Establish district-wide technology standardization policies.	○	○	○	○	○	○	○
Ability to align district level technology decisions with the district's mission and vision.	○	○	○	○	○	○	○
Forecast the							

technology needs of school personnel including classroom teachers, school administrators, and ancillary personnel (ex. Media specialist).	○	○	○	○	○	○	○
Assist with the ordering of supplies for building-level technology.	○	○	○	○	○	○	○
Develop a working knowledge of content area curriculum.	○	○	○	○	○	○	○
Troubleshoot and resolve building-level technology infrastructure related issues.	○	○	○	○	○	○	○
Develop districtwide staff computer training programs for the purpose of increasing user knowledge-base of hardware integration.	○	○	○	○	○	○	○
Collaborate with teachers and other instructional staff to develop curriculum materials and specific lesson plans that integrate technology.	○	○	○	○	○	○	○
Identify students' prior experiences, learning styles, strengths, and needs when designing a lesson plan.	○	○	○	○	○	○	○
Collaborate with school media specialists to provide leadership							

in the school's use of instructional technology resources to enhance learning.	○	○	○	○	○	○	○
Coordinate the activities of outside vendors, consultants and trainers.	○	○	○	○	○	○	○
Work with school administrators to create a budget.	○	○	○	○	○	○	○
Assist with the maintenance of district databases, including those storing student demographic information and student account information.	○	○	○	○	○	○	○
Automate school office clerical functions to computerized time-saving routines.	○	○	○	○	○	○	○
Understanding of funding models.	○	○	○	○	○	○	○
Guide teachers and other technology staff with the selection of hardware and software resources that are compatible with the school's technology infrastructure.	○	○	○	○	○	○	○
Acquire the CompTIA A+ certification.	○	○	○	○	○	○	○
Monitor the integration of technology as it relates to system strategic planning.	○	○	○	○	○	○	○
Evaluate the effectiveness of educational	○	○	○	○	○	○	○

technology in use in classrooms.							
Serve as a resource to school personnel requiring assistance with assistive technology topics.	○	○	○	○	○	○	○
Implement district policy on acceptable usage of computer hardware for the purpose of ensuring compliance to standards and regulations.	○	○	○	○	○	○	○
Help students troubleshoot computers.	○	○	○	○	○	○	○
Acquire the CompTIA N+ certification.	○	○	○	○	○	○	○
Work with curriculum teams to ensure technology is embedded in all content areas.	○	○	○	○	○	○	○
Serve as the district contact for selecting software applications.	○	○	○	○	○	○	○
Maintain documentation related to the installation and configuration of building-level technology.	○	○	○	○	○	○	○
Coordinate communication with teachers and staff about technology training opportunities outside the school, grant programs, and	○	○	○	○	○	○	○

new technology projects.							
Evaluate the effectiveness of technology solutions.	○	○	○	○	○	○	○
Acquire the MSDST (Microsoft Desktop Support Technician).	○	○	○	○	○	○	○
Participate in meetings, workshops and seminars for the purpose of conveying and/or gathering information required to perform technology-related functions.	○	○	○	○	○	○	○
Model the integration of technology in all curriculum areas.	○	○	○	○	○	○	○
Maintain the school system's website.	○	○	○	○	○	○	○
Coordinate the use of technology-related equipment and labs in and between buildings.	○	○	○	○	○	○	○
Understanding of E-Rate processes such as vendor bidding and selection.	○	○	○	○	○	○	○
Understanding of the Children's Internet Protection Act (CIPA) and COPPA (Children's Online Privacy Protection Act).	○	○	○	○	○	○	○
Select alternative teaching strategies,							

materials, and technology to achieve multiple instructional purposes.	○	○	○	○	○	○	○
Create and maintain policies for business continuity.	○	○	○	○	○	○	○
Research computer hardware system solutions for the purpose of providing technical information on curriculum enhancement.	○	○	○	○	○	○	○
Provide teachers with strategies of how technology can be used to in the classroom.	○	○	○	○	○	○	○
Collaborate with teachers to assist with planning of lessons based on norms-based standards such as project-based learning, and STEM which also incorporate technology integration.	○	○	○	○	○	○	○
Ability to connect instruction to technology.	○	○	○	○	○	○	○
Provide professional development and training for certified staff on the use of educational technology.	○	○	○	○	○	○	○
Establish network security procedures.	○	○	○	○	○	○	○
Maintain knowledge of new computer and network	○	○	○	○	○	○	○

technology.							
Wide Area Network (WAN) and Local Area Network (LAN) monitoring.	○	○	○	○	○	○	○
Understand FERPA (Family Educational Rights & Privacy Act) and HIPAA (Health Insurance Portability and Accountability Act) laws and requirements.	○	○	○	○	○	○	○
Maintain adherence to budget-related purchases so that technology purchased for a particular program (ex. Title I) is only used for that program.	○	○	○	○	○	○	○
Assist with the planning and design of the school's technology infrastructure initiatives.	○	○	○	○	○	○	○
Ability to facilitate transition to a 21st Century Learning environment.	○	○	○	○	○	○	○
Maintain hardware and arrange for timely repair.	○	○	○	○	○	○	○
Implement 8th grade tech literacy assessment, gather data and report to the State.	○	○	○	○	○	○	○
Develop a working knowledge of technology curriculum.	○	○	○	○	○	○	○

Make technology budget recommendations to school administrators.	○	○	○	○	○	○	○
Facilitate staff participation in the evaluation and selection of new software, hardware, and materials to support instructional objectives.	○	○	○	○	○	○	○
Plan for and then provide technology-related professional development activities that meet the needs of the school's staff members.	○	○	○	○	○	○	○
Understand and adhere to the educational community's code of ethics.	○	○	○	○	○	○	○
Provide routine maintenance on building-level technology.	○	○	○	○	○	○	○
Ensure compliance with federal and state requirements and Board of Education policy.	○	○	○	○	○	○	○
Hold a certified teaching license.	○	○	○	○	○	○	○
Provide training on specific technology to students.	○	○	○	○	○	○	○
Assist school-level administrators in determining the technology needs of classroom teachers.	○	○	○	○	○	○	○
Maintain repair							

history and file server performance statistics.	○	○	○	○	○	○	○
Adhere to copyright law.	○	○	○	○	○	○	○
Play a leading role in the school's budgetary process to ensure funding for the technology program.	○	○	○	○	○	○	○
Have a strong understanding of data classification and the importance of securing student data.	○	○	○	○	○	○	○
Direct the purchase of educational software to help enhance classroom pedagogy.	○	○	○	○	○	○	○
Prepare Internet safety awareness curriculum for student use.	○	○	○	○	○	○	○

Select the radio button that reflects your rating of each item

Thank you for your participation. The third and final round will begin shortly. A copy of the results of this study will be provided to those requesting one.

31.12.1969 – 19:00

Submit your survey.
Thank you for completing this survey.

APPENDIX I

Third Delphi Round

Round 3 - Credentializing public education's Technology Specialists

The proliferation of technology and its use in the public education classroom has increased the need for quality technology support personnel to help with the selection, acquisition, implementation, maintenance, and training on the use of technological equipment. Likewise, as the demands of technology use have increased, the Technology Specialist must now also be aware of trends in educational pedagogy in order to ensure best practices for the use of technology are employed in the classroom. Unfortunately, while the need for quality Technology Specialists has increased no standard or measure has been agreed upon to allow for a professional endorsement of this position.

There are 1 questions in this survey

Round 3 - Ranking Responses from Round Two

1 Listed below are 35 items from the second round that the panel of experts Agreed or Strongly Agreed are necessary skills, qualifications, or credentials for Technology Specialists employed in a public K-12 school system. In this third and final round please rank the list of items from most important (1) to least important (35). *

Please number each box in order of preference from 1 to 35

- [ ] Ability to facilitate transition to a 21st Century Learning environment.
- [ ] Monitor the integration of technology as it relates to system strategic planning.
- [ ] Experience with a variety of instructional models.
- [ ] Ability to align district level technology decisions with the district's mission and vision.
- [ ] Forecast the technology needs of school personnel including classroom teachers, school administrators, and ancillary personnel (ex. Media specialist).
- [ ] Participate in meetings, workshops and seminars for the purpose of conveying and/or gathering information required to perform technology-related functions.
- [ ] Have a strong understanding of data classification and the importance of securing student data.
- [ ] Play a leading role in the school's budgetary process to ensure funding for the technology program.
- [ ] Coordinate communication with teachers and staff about technology training opportunities outside the school, grant programs, and new technology projects.
- [ ] Provide teachers with strategies of how technology can be used to in the classroom.
- [ ] Be familiar with ISTE (International Society for Technology in Education) standards and how these standards are used.
- [ ] Collaborate with school media specialists to provide leadership in the school's use of instructional technology resources to enhance learning.

- [ ] Work with school administrators to create a budget.
- [ ] Ensure compliance with federal and state requirements and Board of Education policy.
- [ ] Ability to connect instruction to technology.
- [ ] Develop a working knowledge of technology curriculum.
- [ ] Adhere to copyright law.
- [ ] Work with curriculum teams to ensure technology is embedded in all content areas.
- [ ] Understand and adhere to the educational community's code of ethics.
- [ ] Provide professional development and training for certified staff on the use of educational technology.
- [ ] Facilitate staff participation in the evaluation and selection of new software, hardware, and materials to support instructional objectives.
- [ ] Establish district-wide technology standardization policies.
- [ ] Make technology budget recommendations to school administrators.
- [ ] Plan for and then provide technology-related professional development activities that meet the needs of the school's staff members.
- [ ] Assist school-level administrators in determining the technology needs of classroom teachers.
- [ ] Evaluate the effectiveness of technology solutions.
- [ ] Guide teachers and other technology staff with the selection of hardware and software resources that are compatible with the school's technology infrastructure.
- [ ] Implement district policy on acceptable usage of computer hardware for the purpose of ensuring compliance to standards and regulations.
- [ ] Maintain knowledge of new computer and network technology.
- [ ] Direct the purchase of educational software to help enhance classroom pedagogy.
- [ ] Understanding of the Children's Internet Protection Act (CIPA) and COPPA (Children's Online Privacy Protection Act).
- [ ] Serve as a resource to school personnel requiring assistance with assistive technology topics.
- [ ] Understand FERPA (Family Educational Rights & Privacy Act) and HIPAA (Health Insurance Portability and Accountability Act) laws and requirements.
- [ ] Assist with the planning and design of the school's technology infrastructure initiatives.
- [ ] Understanding of funding models.

Thank you for your participation. A copy of the results of this study will be provided to those requesting one.
31.12.1969 – 19:00

Submit your survey.
Thank you for completing this survey.

APPENDIX J

Institutional Review Board (IRB) Exemption Report

Institutional Review Board (IRB)
for the Protection of Human Research Participants

PROTOCOL EXEMPTION REPORT

PROTOCOL NUMBER: **IRB-02811-2012** **INVESTIGATOR:** Keith Osburn

PROJECT TITLE: Credentialing Public Education's Technology Specialist Workforce: A Delphi Study

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DETERMINATION:

☒ This research protocol is exempt from Institutional Review Board oversight under Exemption Category 2. You may begin your study immediately. If the nature of the research project changes such that exemption criteria may no longer apply, please consult with the IRB Administrator (irb@valdosta.edu) before continuing your research.

☐ Exemption of this research protocol from Institutional Review Board oversight is pending. You may **not** begin your research until you have addressed the following concerns/questions and the IRB has formally notified you of exemption. You may send your responses to irb@valdosta.edu.

ADDITIONAL COMMENTS/SUGGESTIONS:

Although not a requirement for exemption, the following suggestions are offered by the IRB Administrator to enhance the protection of participants and/or strengthen the research proposal:

Suggestion #1: In the invitation to participate in the Delphi study, 3rd paragraph, you may want to indicate that the access code, which will be system generated, will be unknown to you, thus ensuring [the participant's] identity.

Suggestion #2: You may want to tell them how they can go about requesting a copy of the results. This should be done in a way that doesn't compromise the anonymity of the data. You could simply add a sentence asking the to let you know of their desire to receive a copy when they respond about their deicision to participate in the research.