A Survey of Elementary School Technology Needs: A Needs Assessment

Shaun Kellogg

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A SURVEY OF ELEMENTARY SCHOOL TECHNOLOGY NEEDS:
A NEEDS ASSESSMENT

by
Shaun Kellogg

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
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Western Michigan University
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A SURVEY OF ELEMENTARY SCHOOL TECHNOLOGY NEEDS:
A NEEDS ASSESSMENT

Shaun Kellogg, M.A.
Western Michigan University, 2008

Given the potential of technology to enhance teaching and learning, there is little surprise that schools have been investing in technology. Unfortunately, technology has been and continues to be an expensive and ongoing investment. Recent federal mandates and public demand have led to increasing pressures on schools to show results and to justify such heavy expenses as technology. Sandy Grove Elementary has followed national trends in its recognition of technology’s potential, its increasing investment, and its need to justify this expense with hard evidence. Sandy Grove is still in the early stages of its evaluation process and currently there is little hard data on the impact of program efforts on teaching and learning. This purpose of this study, then, is to gather an early assessment of where Sandy Grove stands in its current efforts to integrate technology into the classroom, what impact these efforts were having on teachers and students, and what is needed to move forward. In order to assess the technology needs of Sandy Grove Elementary, a survey of Sandy Grove’s educators was conducted using School Technology Needs Assessment (STNA). Findings from the survey suggest that while the technology resources are in place, the human resources have yet to be fully developed.
ACKNOWLEDGMENTS

A project like this is not the work of a single individual, though it is usually their name under the title. It is the work of many that often goes unwritten and unheard of, but whose contribution was vital to the completion of the task. And so, to ensure that their contributions do not remain silent, I would like to acknowledge the following people for their support, encouragement, advice, and expertise.

First and foremost, I would like to acknowledge my wife, Amanda, whose love and support of me in this endeavor has been unwavering. She has given me the confidence to reach beyond my reach.

Secondly, I would like to thank my advisor Dr. Robert Leneway, who pointed me in a direction I might have shied away from, turned me around when I had lost my direction, and provided the assistance needed when called upon.

I would also like to thank my thesis committee for giving me some advice that was just what I needed: stop working so hard! I thank them for letting me know what to worry about and what to save for another day.

Finally, I thank Jenifer Corn for helping me understand the instrument that was used for this study and for her work on such a valuable tool for educators and schools.

Shaun Kellogg
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CHAPTER I

INTRODUCTION

Problem Background

When considering the potential for increased student motivation, unique technological capabilities, new instructional approaches, increased teacher productivity, and acquisition of required skills for the 21st century (Roblyer, 2004; Milken Exchange, 1998), there is little doubt as to why investment in and use of technology is becoming a primary concern for educators around the country. In a *Retrospective on Twenty Years of Educational Technology Policy*, Culp (2003) found that policy makers responsible for educational reform frequently cited technology as a “catalyst for change”, a means to meet the “persistent challenges to delivery, management and support of effective learning experiences”, and that “the economical and social shifts that have made technology skills critical to the future employment of today’s students, and more broadly, to the importance of technology innovation to maintaining the economic and political dominance of the United States globally” (p. 5). Among educators themselves, there is a growing consensus on the importance of technology as a tool for teaching and learning (CDW-G, 2006).

Policy changes over the last 25 years have also highlighted technology’s growing importance across the educational community. In response to “concern about ‘the widespread public perception that something is seriously remiss in our educational
system” a 1983 report titled A Nation at Risk recommend computer science as one of the five “New Basics” (U.S. Department of Education, 1983). Since then, emphasis concerning educational technology has shifted from technology as a distinct content area to technology as a ubiquitous tool used by administrators, teachers and students (U.S. Department of Education, 1996). Additional pressures from legislation, most notably the No Child Left Behind Act of 2001, have required states and districts to develop technology plans as a component of federal funding and to devote 25% of those funds to technology related professional development. (U.S. Department of Education, Office of Elementary and Secondary Education, 2002).

Whether motivated by the potential benefits of technology as a tool for teaching and learning; spurred on by federal, state and local policies and mandates; or influenced by the desire to make a “symbolic, political gesture” to signal “power and modernity” (Cuban, 2001, pp. 158-159), school’s investment in technology has been enormous. “Between 1995 and 2001, federal expenditures on educational technology increased from $21 to $729 million.” (O'Dwyer, Russell, & Bebell, 2003). In 2004, it was estimated that K-12 schools would spend more than $5 billion dollars on educational technology, with two thirds of that money on hardware purchases alone (Bushweller, 2004). According to a report by Benton Foundation (2003, p. 7): “In the last decade, the federal, state, and local governments have invested over $40 billion to put computers in schools and connect classrooms to the Internet.”

A natural result of this investment, at least on paper, has been increased access to technology for both teachers and students. In less than a decade, the ratio of students to computers with Internet access was nearly three times greater, with 12.1 students sharing
a computer in 1998, down to 3.8 students per computer in 2004. (Greene, Lewis, & Wells, 2006). Likewise, nearly 100% of schools have access to the Internet, with 97% using broadband connections. In 2005, the number of schools that provided teachers or students with handheld computers nearly doubled from the previous year, accounting for 19% of schools that have invested in handhelds. And 10% of schools dissatisfied with even a 4 to 1 ratio of students to computers, invested in laptops for students to borrow in an ever expanding one to one movement. However, as noted in a publication by the National Center for educational statistics, “It is important to remember … that in general the presence of physical hardware in a classrooms says little about whether and how it is used in instruction” (U.S. Department of Education, 2002).

Contrary to the ubiquitous use by educators and students that one would expect to follow from this heavy investment in technology, critics such as Cuban have recognized that even in technology rich schools with “abundant access to information technologies” teachers have made “infrequent and limited use of classroom computers” and those teachers who did frequently use technology in their classroom “largely continued their customary practice” and adapted new technologies “merely to sustain old practices” (Cuban, 2001, p. 97). In 1998, a national survey of over 4,000 teachers on teacher and teacher-directed student use of classroom computers, it was found that while computers were becoming a common tool in teacher’s professional lives, roughly just one third of classroom teachers assigned computer related activities to student on a regular basis (Becker, Ravitz, & Wong, Teacher and teacher directed use of computers and software, 1999). Seven years later in 2006, a smaller scale survey found that just slightly more than
one-third of teachers reported that they integrated technology into their instruction on a daily basis (CDW-G, 2006).

These criticisms by Cuban, as well as doubts raised by many others throughout the educational community about the worth and effectiveness of this investment in educational technology, may perhaps have been the cause for policy makers and proponents of technology in Washington to provide recommendations for capitalizing on this enormous investment and increasing presence of technology in schools in order to avoid the pitfalls and problems cited by educational technology’s critics. According to Culp (2003), recommendations from educational technology policy documents over the last 20 years have targeted “increased access, connectivity, and requisite infrastructure… more, sustained, high quality professional-development and overall support for teachers” and “… increase(d) funding from multiple sources” as key components for supporting and sustaining educational technologies. Additionally, former President Clinton in his 1996 Technology Literacy Challenge cited hardware, connectivity, digital content and professional development as the “four pillars” for supporting technology integration in schools (as cited in CEO Forum, 1997). This recognition that the effective use of technology for teaching and learning is a multifaceted and complex issue problem has led to the development of national, state and district technology plans; a number of technology integration models; as well as technology policies and standards for administrators, teachers and students all with the underlying goal of ensuring that such large scale investments payoff (McNabb, Hawkes, & Rouk, 1999).

The state of North Carolina is no exception to this ongoing trend in educational technology, and education in general, of increased emphasis on accountability and the
adoption of measures for the planning, implementation and evaluation to ensure that educational technology is having the desired impact. In accordance with North Carolina law GS115C-102.6, the North Carolina Department of Public Instruction (NCDPI), as well as individual public school districts, have developed technology plans with the aim of “enhancing teaching and learning” through technology. Likewise, the state of North Carolina has developed the IMPACT model which provides guidelines for the planning, implementation and evaluation of library media and instructional technology programs. This model, an initiative funded through NCLB Enhancing Education Through Technology (EETT) grant, was developed as part of a larger initiative called LANCET (Looking at North Carolina Educational Technology) whose aim was to provide research and evaluation of the implementation and impact of educational technology sub-grants such as the IMPACT model (Corn, 2006).

In summary, the potential of technology to improve teaching and learning and prepare students for an increasingly digital age has resulted in large technology investments by schools. This investment has raised concerns about the actual returns in the forms of improved teaching and learning. With technology implementation in schools having been recognized as a multi-faceted and complex issue, policy-makers and organizations have provided recommendations for increasing the returns on this investment, while educators at the state and local levels have developed plans and adopted technology integration models. The purpose of these efforts, whether at the national, state or local level, is to help schools effectively leverage the potential of instructional technologies in order to ensure that the impact on teaching and learning is
proportional to the amount invested. The question for schools is no longer should we adopt technology, but how do we best adapt.

Problem Statement

Like many districts around the country, Hoke County Schools in North Carolina has followed national trends with its investment in educational technologies. As part of Hoke County Schools, Sandy Grove Elementary is at the forefront and has recently made substantial financial investments in educational technologies with the aims of improving student achievement and teacher practice through the use of these technologies. Currently, however, data on areas related to the use of educational technology is needed to guide planning efforts and decision making in order to ensure that this investment is having the desired impact on teaching and learning. Sandy Grove Elementary is at a starting point in this evaluation process and is seeking to identify areas in need of intervention, whether though professional development, changes in policies or practice, or increased support.

Technology Setting

Sandy Grove Elementary is a large, P-5 elementary school located in a rural setting near Lumber Bridge, North Carolina. In terms of technology, Sandy Grove would be considered by many to be a high-tech school. At the heart of the school is a large media center flanked by two computer labs with recently updated desktops for individual student use. Each lab has a full time staff member responsible for teaching a classroom of students during resource time. Computer labs schedules are made at the beginning of the year with each class receiving two 45-minute sessions using Classworks, a computer-
based instructional software program that consists of individualized lesson plans modeled after a direct instructional format. All software applications, including Microsoft Office Suite, a library catalogue and testing software, are accessed on a local area network and available from any computer with internet access. Access to the lab for activities outside of this structured software program is limited to a few remaining time slots that are used on an as needed basis. In K-3, classrooms have a minimum of two “Waterford” computers used only for supplemental reading practice throughout the day as part of the federally funded Reading First program. In some cases there is the presence of an additional computer for student use. Classroom computers in the upper grades vary by teacher, but most teachers have a minimum of two computers as well. Additionally, SmartBoards, an interactive whiteboard tool, have recently been installed in nearly every classroom this past year with the remaining classrooms receiving their SmartBoard at the beginning of the 2008-2009 school year.

Purpose of this Study

The purpose of this study is to gather information in order to: 1) assess the school technology needs of Sandy Grove Elementary; 2) provide baseline data to determine growth and to measure the success of future initiatives and; 3) provide recommendations for future planning of technology related professional development, policies, or resource allocation.

Significance of Study

According to the IMPACT guidelines for media and technology programs (Public Schools of North Carolina, 2005), it is recommended that a readiness assessment be
conducted to determine if the conditions required implement the IMPACT model are in place. As part of the readiness assessment, it is suggested that a staff needs assessment be conducted in order to “determine their readiness to utilize technology and information in a collaborative environment.” Additionally, both the Hoke County Schools and the NCDPI technology plans have incorporated a technology needs assessment as a strategy to address strategic priorities for school improvement. Currently, there is very little concrete data regarding the technology needs of Sandy Grove Elementary teachers or the extent to which they are using technology to support teaching and learning. Given the amount of investment Sandy Grove Elementary has recently made in hardware purchases for classroom technology, there will be the expectation for concrete evidence that this technology is being used to improve teaching and learning.

Research Questions

The impetus for this research began with several questions the researcher had when observing technology use by teachers and students at Sandy Grove Elementary. The first of which was how teachers and students within the building were using technology and how often. Another question was what the school could do better to promote the use of technology to improve teaching and learning.

For the purpose of this study, the above questions were narrowed down and clarified based on a review of the literature and the chosen methodology for this study. The following questions are intended to examine the current status of technology use and implementation and to elicit information regarding the technology needs of Sandy Grove Elementary:
1. What environmental factors do educators feel are either supporting or impeding the use of technology?

2. In which areas do educators feel they would benefit from technology professional development?

3. How do educators feel about the quality of current technology professional development efforts?

4. How frequently do educators feel that technology is being effectively used to support teaching and learning?

5. What do educators feel is the impact that technology is having on teacher practice and learner outcomes?

Definition of Terms

**Needs Assessment**: A form of decision-oriented evaluation that “compares the current status and values of an educational system with the desired outcomes.” The purpose of needs assessment is to “identify the context, provide baseline data of the accomplishments of the site, and identifies unmet needs.” (McMillan & Schumacher, 2006, p. 444)

**Educational Technology**: “Educational computing and technology encompasses knowledge about and use of computers and related technologies in (a) delivery, development, prescription, and assessment of instruction; (b) effective uses of computers as an aid to problem solving; (c) school and classroom administration; (d) educational research; (e) electronic information access and exchange; (f) personal and professional productivity; and (g) computer science education.” (International Society for Technology in Education (ISTE), 2002)
Technology Integration- "...the incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools.” (U.S. Department of Education, 2002, p. 75)

Technology Professional Development- "learning activities of all kinds for school staff that prepare them to use technology in the school setting. Included under the term are activities such as the following:

- familiarization with the operation of equipment and software;
- development of proficiency in the use of the technology “tools” to carry out school tasks;
- the application of software and applications to the management of school activities, whether instructional or administrative; and
- the integration of technology into teaching, learning, and administrative processes.” (U.S. Department of Education, 2002)

Technology Resources- Technology resources are computers and specialized software, network based communication systems, and other equipment and infrastructure. Practices include collaborative work and communication, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data, and other methods. (U.S. Department of Education, 2002, p. 75)

Assumptions

Due to precautions taken to minimize self presentation bias, it is assumed that teachers answered questionnaire items as honestly as possible.
Organization of Study

The remainder of this study is organized into four chapters. Chapter Two provides a review of the literature on needed program strategies for technology implementation to be successful, desired outcomes for technology use by teachers and students, and expected shifts in teaching practice and student learning as a result of technology use. Chapter Three provides the methodology used to address the research questions and purpose of this study as stated above. Chapter Four presents the results related to each research question. Chapter Five presents a summary of the research, finding related to the original purpose of this study, recommendations based on the researcher’s findings, limitations of the study and areas for future research.
CHAPTER II

LITERATURE REVIEW

Introduction

Based upon the recommendations at the state and district level, the researcher decided upon the School Technology Needs Assessment (STNA) instrument in order to determine the school's technology needs. As a result, the literature review was conducted after the selection of the instrumentation and research design, as opposed to conducting a review of the literature prior to the design and methodology for determining constructs and factors related to the technology needs of a school in order to develop an instrument to measure these needs. The purpose of this literature review, then, is to build upon the work conducted by Corn (2006) by elaborating and deepening the justification for the constructs, subconstructs, and factors chosen by research at UNCG for use in the School Technology Needs Assessment.

The reference matrix for the STNA developed by Corn (2006), and to be discussed further in the literature review, supplies a solid foundation for determining what a school needs in order to plan and improve upon the use of technology for teaching and learning. However, much of the cited material referenced by Corn is limited to secondary sources from experts in the field which, although lending credibility to survey items and helping to validate STNA constructs, fail to explain why these needs are vital if a school sincerely wishes to integrate technology into teaching and learning. And
so, the second purpose of this literature review is to not only relate what is needed by schools for technology use based upon the recommendation of leading authorities in the field, but to also explain why these components are necessary with an understanding that such knowledge may prove useful in interpreting the results of this study and guiding recommendations for future technology initiatives.

The organization of the following literature review is based upon the constructs and subconstructs identified by the SERVE Center of the University of North Carolina at Greensboro and later investigated and validated by Corn (2006). The review uses the STNA as a framework and follows the logic model developed by Corn (Figure 1). The first two constructs, “Supportive Environment for Technology Use” and “Professional Development” fall within the realm of technology program strategies taken at the school and district level in order to help achieve the desired outcomes that fall under the two remaining constructs “Teaching and Learning” and “Impact of Technology” which take place at the classroom level. The relationship between those constructs is shown in the logic model below.
This multi-level approach to assessing factors, or strategies, which influence the use of technology is supported in the literature by the work done at Boston College by O'Dwyer, Russel, & Bebell (2004) through the USEiT Study, a three-year study of technology use, support, and impact across 22 districts located throughout Massachusetts. In this study researchers concluded that variables at multiple levels of the school’s organizational structure impacted instructional uses of technology. Researchers found that at the elementary level, factors such as professional development, availability of technology resources, pressure from administration, and other school and district level factors were strong predictors of the frequency and type of use by teachers and students (O'Dwyer, Russel, & Bebell, 2004).
Supportive Environment for Technology Use

For better or worse, in today’s educational environment of accountability, the destination is as equally as important as the journey, and often that destination is fixed. As contrary to popular wisdom as this may seem, there is a body of evidence that suggest that for technology integration to be successful in schools, knowing where you are going and how to get there is essential (Byrom & Bingham, 2001; Cradler & Bridgforth, 2002; Silverstein, Fretchling, & Miyaoka, 2000). Regardless of who is at the wheel, if the destination is unclear, the route unplanned, maintenance neglected, or the money to get there insufficient, the destination will not be reached. The same applies to reaching a school’s goals for technology. Without clear vision for technology, a long term plan, adequate financing and infrastructure, strong support, and access to hardware and software, technology efforts will meet with limited success. And all of these things, as discovered through decades of trial and error, require a system wide effort.

Effectively incorporating technology into teaching and learning is process that requires the support of the entire learning community; a community that extends from teacher in the classroom to the principal, the superintendent and beyond. There is a consensus among authorities in educational technology that a number of environmental conditions at multiple system levels can impact technology use and the implementation of technology programs and initiatives (Byrom & Bingham, 2001; Milken Exchange, 1998; Kelly & Thomas, 2002; U.S. Department of Education, 2002; North Central Regional Education Laboratory, 2000; ISTE, 2002). O’dwyer et al. (2004) recognized that past research had neglected to measure contextual factors at the school and district level that may impact technology use, factors which they found to influence how and to what
extent technology was used. Although a number of essential conditions have been identified by organizations such as the International Society of Technology in Education (ISTE), the STNA has been organized under the following subconstructs to be discussed further:

1) vision and leadership
2) organizational conditions
3) flexible scheduling
4) infrastructure
5) staff support
6) media and software.

Vision and Leadership

Based on years of experience providing technical assistance and professional development, Byrom and Bingham (2001) concluded, “leadership is probably the single most important factor affecting the successful integration of technology into schools” (p. 4). A survey of the literature on school technology integration reveals a number of frequently cited components of effective technology leadership including: developing and communicating a shared vision for technology use, modeling the effective use of technology use by administration, administrative support of changes in policies and practices, providing teacher incentives, and hiring practices that consider technological literacy and leadership as criteria for selection (Baylor & Ritchie, 2002; CEO Forum, 1999; Kelly & Thomas, 2002; Milken Exchange, 1998; Byrom, 2007; ISTE, 2002; U.S. Department of Education, 2002; Frazier & Bailey, 2004).
The U.S. Department of Education (2002) states that "vision pertains to what is expected from technology overall" (p. 10). A shared vision according to the ISTE, is defined as the "presence of proactive leadership" with a "common understanding of the institution’s goals" (p. 20). Additionally, this shared vision must be developed by educational stakeholders, those with a vested interest in student achievement (U.S. Department of Education, 2002; ISTE, 2002; Milken Exchange, 1998; Public Schools of North Carolina, 2005; North Central Regional Education Laboratory, 2000). In other words, it is believed that expectations for how and to what end technology is to be used by staff and students, expectations that are developed by stakeholders and shared among the entire learning community, are necessary for the successful implementation of technology in schools.

In a quantitative study of 94 classrooms from four different states in different geographic regions of the country, Baylor and Ritchie (2002) investigated factors that facilitated perceived student learning in technology using classrooms. Through structured interviews with teachers and administrators, they found that student content acquisition (the acquisition of factual information) through technology was predicted by the strength of technology leadership at schools. In this study, strong technology leadership was operationalized both as the presence of incentives as well a technology using role-model, such as a principal, and the ability of the principal to "work with the school community to formulate, articulate, and communicate a school’s vision" (p. 397). Although strong leadership was not found to influence the use of technology to promote higher-order thinking skills (HOTS), the positive influence on content acquisition "serves as an effective way to provide remediation when...basic skills and knowledge are missing" (p. 17).
Additionally, the researchers concluded that strong technology leaders tended to promote technology through the use recognition and incentives.

A qualitative case study of a North Carolina elementary school revealed findings similar to those by Baylor and Ritchie and supports the claims made about the importance of effective leadership on technology implementation. Through in-depth interviews, direct observations of staff members, document and website reviews, Camp (2007) concluded that the principal’s strong leadership was a key factor in the successful implementation of an IMPACT grant by an “exemplary school for technology use”. Echoing Byrom and Bingham’s (2001) lessons learned regarding factors that influence technology use from their work with SEIR-TEC intensive sites, Camp’s case study of an exemplary technology-using school demonstrates that the principal’s ability to facilitate the development of a shared vision, to model effective uses of technology and to support change were essential factors that contributed to the success of the IMPACT grant and their status as an exemplary school. In addition, support and incentives were offered in the form of graduate coursework tuition, policy changes related to planning time, as well as additional technology resources and staff. Hiring practices were also aligned to the vision created for the grant as the principal selected new staff that shared a similar views and beliefs in the promises of technology.

Baylor and Richie (2002) suggest that the presence of a strong technology leader may lead to a wider incorporation of technology into the classroom if teachers and students perceive that it is valued and used by administrators. This suggestion was confirmed by Camp (2007) who maintained that the principal’s commitment to the vision, his modeling of effective practices, and his support of teachers was a key
ingredient to fostering teacher buy-in, consequently leading to greater collaboration among staff and openness to change, the two single variables that Baylor and Ritchie (2002) found to be predictors of technology integration. Without this shared vision, Brockheimer found that principals had difficulty in “achieving the promises that technology integration holds” (as cited in Camp, 2007, p. 79). In their review of the literature on the the impact of technology investment on learning, Rinstaff and Kelly stated that “Researchers found that the most crucial determining factor in whether teachers who participated in the program successfully integrated technology into their classroom was the level of support they received from school and district administrators (Sandholtz et al., 1997). These findings are consistent with research conducted by the Office of Technology Assessment (1995).”

These studies support what the literature has stated about the importance of vision and leadership when attempting to integrate technology into schools. Without a clear vision of how technology is to be incorporated into teaching and learning and the support of a strong technology leader, school wide technology initiatives such IMPACT will have difficulty in succeeding.

**Organizational Conditions**

An old proverb says that, “A vision without a plan is just a dream, a plan without a vision is just drudgery, but a vision with a plan…” Perhaps having a plan for technology is unlikely to change the world, but it is certainly as important for effectively integrating technology into schools as the support of a strong leader. Without a sound plan, the necessary resources to carry out this plan, and an evaluation of whether or not the plan is working, the vision is merely wishful thinking, despite the initial good
intentions. Perhaps this is what the state of Kentucky had in mind when they became the first state in the union to fully fund a comprehensive technology plan; or why, in 1994, state legislators in Ohio required every district to develop a technology plan a prerequisite to participation in a statewide technology initiative (Milken Exchange, 1998).

Among the U.S. Department of Education’s suggestions and guidelines for helping technology decision makers assess the use and effects of technology in schools is the key question, “Is there a technology plan?” The authors contend that, “a plan for technology can maximize the potential of technological innovations while helping to overcome the challenges of implementation” (U.S. Department of Education, 2002, p. 11). Components of an effective technology plan frequently cited in the literature include involvement of all stakeholders in the development to promote buy-in and support; appropriate funding and budgeting; and ongoing assessment and evaluation of the plan (Barnett, 2001; Anderson, 1996; Byrom & Bingham, 2001; Milken Exchange, 1998; ISTE, 2002; Roblyer, 2004; Public Schools of North Carolina, 2005).

There is evidence among the research that supports the importance of each of these components. Baylor and Ritchie (2002) examined technology plans as well as additional data sources and found that a teacher’s openness to change, as measured from the administrator’s perspective by the whether or not the technology use plan promoted instructional innovation through technology, was found to be a predictor of classroom technology integration. Based on three separate studies related to technology planning, Cradler and Bridgforth (2002) concluded that the planning process was an important factor in the success of technology projects. Camp (2007) studied a North Carolina
elementary school recognized for exemplary technology use and found that it had incorporated their technology plan, Title I plan, Crisis Plan and School Improvement Plan into a single integrated plan. The researcher credited the collaborative development, implementation and continuous monitoring of this plan to be a factor in the school’s successful implementation of their IMPACT grant and resulted in systematic change. And in Illinois, evaluators of the state’s use and impact of technology in public schools found that while only half of the schools had developed a technology plan, case studies revealed that the presence of a technology plan was one of the effective strategies adopted by high usage schools for maximizing the capacity for teachers and student to take advantage of the available technologies (Silverstein, Fretchling, & Miyaoka, 2000).

The absence of any one of these components can result in an additional barrier to technology use. A study of factors associated with the use of computers in K-4 classrooms by Robinette (2001) found that, although the school system studied had made great efforts in providing access to technology resources, technology was used infrequently and in ways that did not meet full potential of the technology systems in place, findings similar to those of Cuban (2001). Based upon the findings, the researcher recommended not only the development of a system-wide vision for technology use in the classroom, but emphasized the importance for the district of developing a detailed plan and timeline to achieve their desired vision that included both an ongoing formative and summative evaluation process. A case study of three urban elementary schools revealed that although a program initially funded through a PT3 grant had brought in technology resources such as equipment, infrastructure, and support staff, teachers and leaders within one of the schools were concerned that financial cutbacks and budgetary
constraints would hinder future projects, continuing professional development, and the development of a long-term plan (Staples, Pugach, & Himes, 2005).

Robinson (2003) compared four elementary schools' barriers to technology integration and found that two of these schools were successful at overcoming barriers to technology integration due in part to the long-range planning during the reform process. In yet another comparison of school that had and had not been successful in integrating technology, the CEO Forum (1997) reported that “Low Tech” schools, schools in which technology integration was limited, were “likely to treat the cost of technology for education as a one-time capital expenditure and to lack long-term technology plans. These schools may also have received donations of computers without planning for the maintenance, upgrading and professional development necessary to take advantage of the technology” (p. 14).

Byrom and Bingham (2001) noticed that some of the same problems occurred at several schools as they were developing their technology plan. One was “a tendency for one individual or a few people to write the plan, a practice that flies in the face of the notion of stakeholder buy-in and community involvement” and the other was that “most plans lack a component for evaluating the success and effectiveness of the program” (p. 6). In schools where teachers and stakeholders were involved in the planning process, it was found that there was indeed a greater commitment to the implementation of the plan and was supported by the teachers (Camp, 2007), and vice versa (Robinson, 2003). According to Cradler (2002), failing to include teachers in the planning process often resulted in teachers failing to use the technology skills learned during professional development activities. Without planning the proper budget or funding, a barrier to
technology use cited by teachers (CDW-G, 2006), creating a long term, sustainable plan is difficult, a conclusion also reached by the Benton Foundation (2003) in a report on sustaining technology investments made by schools. Finally, continuous monitoring and evaluation of the plan ensured that schools not only implement the plan, but that the plan is working and adjustments to the plan are made when problems arrive.

In summary, having a long term plan for technology that has been developed through the collaboration of stakeholders helps to ensure that organized action is taken to achieve the schools vision for technology. Ensuring proper funding and budgeting ensures that the resources are there so the plans goals and objectives can be met. Lastly, monitoring and evaluation of the plan ensures that plan is effective.

Infrastructure

Perhaps the most intuitively obvious need for schools to utilize technology is simply the presence of and access to the technology resources themselves. Some of the key questions identified by the U.S. Department of Education (2002) for assessing technology in schools ask whether the equipment is present, is it available to staff and students, and are personnel available to proved technical support. The state of North Carolina has likewise provided access and infrastructure guidelines for successfully implementing technology in schools through its IMPACT Model for Media and Technology Programs adopted through the state’s technology plan (Public Schools of North Carolina, 2007). These include providing technology resources, providing barrier free access to technology resources, and providing support staff to maintain equipment and assist with technical questions. The importance of these components is further
documented in the literature (ISTE, 2002; North Central Regional Education Laboratory, 2000; Milken Exchange, 1998; Benton Foundation, 2003).

Studies support the obvious: if there is no technology present, or the technology is sufficiently out of date to meet the school’s needs, then there little chance that it will be used for teaching and learning. Although it is common for schools today to have a shared computer lab with a computer for each student, availability of the computers is often extremely limited due to scheduling, leaving teachers to rely on classroom availability to technology resources for computer use. Unfortunately, it is not uncommon for classrooms to be limited to a single computer (Norris, Sullivan, Poirot, & Soloway, 2003). With computer lab availability often limited for use just once or twice a week, this restricts teachers and students to what is available primarily in the classroom. In a study of characteristics associated with five specific uses of educational technology, O’Dwyer, Russel & Bebell (2005) found that increased availability of technology was significant for predicting four of the five technology uses studied and was likely to result in increased use of technology for delivering instruction, increased teacher-directed use of technology by students during class time, increased teacher-directed use of technology by students to create products, and increased use by teachers for class preparation. In fact, Norris et al. (2003) asserted that a minimal student/computer ratio of 4:1 was necessary for more than sporadic use of technology. In the elementary classroom, Becker, Ravitz, & Wong (1999) found that of those with a 4:1 ratio, 67% of teachers were likely to use computers frequently with their students and even those with little to no computers were more likely than upper level grades to use computers with their students, likely due to increased time spent with students and access to computer labs.
Flexible Scheduling

Simply having computers present in a school, however, does not guaranteed that they will actually be used or have an impact on teaching and learning. Surveying teachers across the country, Norris, Sullivan, Poirot, & Soloway (2003) concluded that the reason for this is a simply a lack of access to available computers. Aside from a very limited number of computers in classrooms, nearly 64% had one or no classroom computer, nearly the same percentage reported having access to the schools computer lab either only once per week if that. Interestingly enough, Becker (2001) found that secondary teachers with ready access to classroom computers, 5-8 in a classroom, were more than 3 times as likely have their students use computers than those who used the computer lab, despite having a fewer computers per student. Becker argued that “scheduling of whole classes at wide intervals determined well in advance of (academic) need … makes it almost impossible for computers to be integrated as research, analytic, and communicative tools in the context of the central academic work of an academic class.” (p. 3). This is inline with the IMPACT guideline for providing teachers with flexibly access computer labs to ensure that computers are available when needed. This open access, Sugar (2007) found, allowed computer labs to be used more frequently by those wishing to integrate technology into the curriculum.

Staff Support

Availability and access aside, teachers need ready access to technical support and reliable equipment (Milken Exchange, 1998; CEO Forum, 1999; North Central Regional Education Laboratory, 2000). Unfortunately, Ronnkvist, Dexter, and Anderson (2000)
reported that very few schools have a single full-time school level computer coordinator or technician, the recommended minimum for North Carolina schools according the state’s technology plan (Public Schools of North Carolina, 2007). In a review of the research, Ringstaff & Kelly (2002) found lack of technical support to be a major barrier to technology use and noted that even teachers who enjoy using computers will stop using technology if the equipment becomes unreliable. Rogers (2000) found that with limited technical support, the likelihood of technology integration decreases if teachers view the technology as unreliable.

Media and Software

When the resources are available, the use of media and software to enhance learning can have positive affects on learning. A report by the CEO Forum (1997) comparing schools across the nation using the School Technology and Readiness (STAR) assessment found that in America’s “Low Tech” schools, most computers available to students lack sufficient memory and processor speed to use common web browsers or access multimedia content. In a review of the research on the impact of technology of student learning, Ringstaff & Kelly (2002) found schools using computer assisted instructional software showed gains in student achievement as measured by standardized tests. They noted, however, that it was shortsighted focus only on learning “from” computers.

Professional Development

Even during the early stages of technology’s increasing presence in schools, professional development was acknowledged by the Clinton administration as one of the
“four pillars” of the Technology Literacy Challenge for improving 21st century education through the use of technology (CEO Forum, 1997). Following this administration, the importance of professional development was also duly noted by the Bush administration as schools were required to devote at least 25% of federal funding from formula or competitive technology grants to training and professional development (State Educational Technology Directors Association (SETDA), 2007). As a result, SEDTA’s National Trends Report 2007 found an increase in the use and sophistication of technology professional development for schools across the country.

If there is any doubt about the necessity of this professional development, in a review of the literature and research on the impact of technology on student achievement, Ringstaff & Kelly (2002) concluded that technology training, i.e. professional development, was one of several “key conditions” that are needed for technology to improve education. But as with the infrastructure and access component of a Supportive Environment for Technology Use, the simple presence of professional development is not enough to ensure that technology is used appropriately by staff and students or that it will have the desired impact on teaching practices and student learning. For technology professional development to be effective it should first of all be needed; secondly, it should also be relevant, timely, and ongoing; and lastly, it should be evaluated through both formative and summative assessments.

McKenzie (1999) contends that “professional development is the most effective insurance policy against the screensaver disease,” (p. 6) and argues that using surveys and assessment to guide planning by identifying teachers’ wants and needs, and deemphasizing the one size fits all approach is needed in order to see a return on our
learning return on our technology investments. There is some support in the literature to McKenzie’s contention. Rubin found that there was a relationship between the how well teachers embraced concepts during a professional development workshop and the extent to which they assisted in determining topics for in-service technology training topics (as cited in Baylor & Ritchie, 2002, p. 398), suggesting that teacher input is important to increasing the effectiveness of the professional development. In a qualitative study on an exemplary technology using school, Camp (2007) concluded that among other factors, the use of prioritized needs based on a needs assessment promoted teacher buy-in and contributed to the success of the program’s technology initiatives.

A lesson learned by staff member of the SouthEast Initiatives Regional Technology in Education Consortium (SEIR*TEC) as they provide technical assistance and professional development to underserved schools, is that teachers need “on-site and on-demand assistance” (Byrom & Bingham, 2001). This assistance may come in different forms of professional development such as teacher-trainers, mentors, study-groups, workshops, or more traditional forms such as in-service training. But the lesson is that professional development needs to be timely. In a mixed-method study on the impact of statewide technology program on student achievement in West Virginia, researchers cited comprehensive and timely staff development as a key component in the program’s success (Mann, Shakeshaft, Becker, & Kottkamp, 1999).

Building upon the 10-year Apple Classrooms of Tomorrow (ACOT) project, Sandholtz, Ringstaff & Dwyer conducted a study comparing teacher development programs and concluded that when teachers are learning to integrate technology into their classrooms, authentic learning tasks and hands-on learning were among the most
important features. Byrom & Bingham (2001) reached a similar conclusion based on SEIR*TEC’s work with professional development in site-intensive schools and found that “teachers have a difficult time applying technology skills in the classroom unless there is a direct linkage with the curriculum, teaching strategies, or improvements in achievement” (p. 11). Unfortunately, Sandholtz (2001) noted that professional development opportunities are often limited to “fundamental computer operation rather than preparation on how to use technology as a teaching tool and how to integrate it across the curriculum” (p. 350).

Roblyer and Erlanger summarized their findings from the literature on what makes teacher training programs most effective and found that “traditional models of staff development, particularly ‘one-shot’ inservice training for the entire faculty, are ineffective for teaching skills and for helping teachers develop methods to use computers as instructional tools” (as cited in Roblyer, 2004). Sugar & Kester (2007) noted from their literature review that continual professional development was a “necessary and critical factor” (p. 16) to preparing teachers to successfully use technology in the classroom. The researchers later asserted in their mixed method case-study of four IMPACT Model schools that continual and staff development workshops were essential to the programs success. This assertion was based on the success of two elementary schools whose regularly scheduled workshops which focused on aligning technology-rich projects to the state curriculum standards led to successful technology integration. In contrast, the two middle schools studied held infrequent workshops where teachers learned about new technology in a piecemeal approach. Sadly, the majority of teachers report that even technology professional development that focused on basic computer
skills training rather than technology integration was too short in duration and too limited to be helpful (National Center for Education Statistics, 1999).

Evaluation is also an important component to professional development. McKenzie (1999) provides a number of reasons for “gauging return” on professional development. Not only do schools need to determine what is or is not working and what needs changing, but they also need to show their stakeholders that their investment in professional development is having the desired impact on teacher practice and student learning. One of the findings by Byrom et. al. (2007) was that teachers are “generally less than enthusiastic about doing evaluation for the sake of accountability or research, but if they believe that a particular innovation or strategy will benefit their students, they are more likely to be willing to actively participate in its evaluation” (p. 4).

Teaching and Learning

The following section of the literature review focuses on teacher and student uses of technology to support teaching and learning and discuss what teachers and students need to know and be able to do in order for technology to become an effective tool for supporting teaching and learning. This section moves beyond the conditions necessary for simply the utilization of technology and attempts to examine exactly how teachers and students need to use technology if it is going to have the desired impact on teaching practices and student learning. This section stems from the previous section in that, if the environment is supportive of technology use, and professional development has been adequate to meet the technology needs of staff, the result should be a cadre of teacher and students able to demonstrate the knowledge and skills outlined in this section.
Much of the work in this field has been conducted by the International Society for Technology in Education (ISTE) whose mission is to “… improve teaching and learning by advancing the effective use of technology in education.” (International Society for Technology in Education, 2007, p. 3) Part of this mission has been achieved through the development of the National Educational Technology Standards (NETS) for teachers (NETS-T) and students (NET-S). These standards, in use by nearly every state (International Society for Technology in Education, 2003), provide technology standards for teachers, students, administrators, and technology facilitators as well as performance indicators for measuring observable outcomes.

The NETS-T (Appendix C) is divided into six broad categories with specific standards for each category as well as performance indicators to provide concrete examples of demonstrate proficiency for each standard. According to the NETS-T, teachers should be able to:

1) demonstrate a sound understanding of technology operations and concepts

2) plan and design effective learning environment and experiences supported by technology

3) maximize learning by through curriculum plans that included methods and strategies for applying technology

4) apply technology to assess and evaluate teaching and learning

5) use technology to enhance productivity and practices and

6) understand and apply understanding of social, legal and ethical issues surround uses of technology in PK-12 settings.
At the time of this research, the NETS-T was currently under revision and the updated standards for teachers were to be released in the summer of 2008. As a result, the standards developed in 2000 were used to define teacher technology competencies and were also used to develop the survey items of the School Technology Needs Assessment instrument (STNA).

The NETS-S (Appendix D) is also divided into six broad categories with specific standards for each category as well as performance indicators. According to the NETS-S, students should be able to use technology to:

1) demonstrate creativity and innovation
2) communicate and collaborate
3) gather, evaluate and use information
4) demonstrate critical thinking skills solve problems and make decisions
5) apply understanding of social, legal and ethical issues related to technology
6) demonstrate a sound understanding of technology concepts, systems and operations

Like the NETS-T, these standards have recently undergone a revision from its earlier 1998 version to place more of an emphasis on using technology to promote higher order thinking skills (HOTS) and less on the technology itself.

Impact of Technology

Finally, following the logic model developed by Corn (figure 1), a supportive environment for technology, coupled with quality professional development should influence appropriate uses of technology by teachers and students and ultimately result in expected shifts towards improved instructional practices and student learning found in the
literature. Com's (2008) review of such literature found that as a result of using technology, "examples of expected shifts include instructional practices that are student-centered and interactive, and emphasize student uses of technology for project-based or cooperative learning" (p. 26). As a result of these technology related changes in teacher practice, Com contends that we should expect to see students who are more socially aware, confident, and positive about their future; are independent learners and self-starters; are engaged in their learning; work more collaboratively; and achieve greater academic success.

Regarding these expected shifts, the Apple Classrooms of Tomorrow (ACOT) project charted changes in teacher practice and student learning as a result of ready access to computers and support. This 10-year longitudinal study's goal was to answer this initial question: "What happens to students and teachers when they have access to computers whenever they need it?" (Apple Computer, Inc., 1995, p. 4). The ACOT began by providing teachers and students with a strong supportive environment as outlined above, as well as quality professional development. Over time, researchers found that as teachers moved through a series of orderly stages, their practice shifted from teacher centered, didactic "instruction" to learner-centered, interactive "construction"; from norm-referenced, multiple-guess to criterion referenced, portfolio and performance-based assessments; from an emphasis on drill-and-practice uses of technology, to a use of technology for collaboration, communication, information access and expression. There were also noted changes in student learning as well. Over time independent researchers found that students became more socially aware and confident; became independent

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learners and self-starters; worked well collaboratively; and developed a positive orientation towards the future.

Other studies report similar shifts in both teacher practices and student learning. In a Report on the Effectiveness of Microcomputers in Schools examining 311 studies from either professional journals or doctoral dissertations, Sivin-Kachala & Bialo (2000) found that “students felt more successful in school, were more motivated to learn and had increased self-confidence and self-esteem when using computer-based instruction” (p. 11). Mann, Shakeshaft, Becker, & Kottkamp (1999) evaluation study of the 8-year “Basic Skills/Computer Education” (BS/CE) program in West Virginia concluded that the program had a positive effect on student achievement in reading, writing and math as measured by standardized test scores.
CHAPTER III

METHODOLOGY

Research Design

The purpose of this study is to assess the technology needs of Sandy Grove Elementary as part of a larger effort to determine the future professional development offerings, measure teacher and student growth, and assess the impact of the school’s technology program on teaching and learning. Because the focus of this study is mainly to identify areas that need to be addressed, a non-experimental descriptive research design was chosen to investigate the research questions stated above. A survey instrument developed by the University of North Carolina Greensboro will be used to gather quantitative data from classroom teachers at Sandy Grove Elementary. Nonprobability convenience sampling of the target population will be used with the goal of obtaining a 90% return rate in order to generalize across the entire population.

Survey Population

The population of this study consisted of full time staff members who work directly with children in a classroom setting (N=44). This includes full time certified teachers at the K-5 level (N=31); resource teachers including art, music, PE, reading first, and media and technology specialists (N=7); as well as exceptional children teachers (N=4). In addition, the principal and vice principal (N=2) were included as it was thought that their knowledge of teaching and learning from classroom observations would
provide valuable insight. Of the 44 staff members targeted for the survey, 40 completed the STNA resulting in a response rate of 91%, the recommended response rate needed in order to accurately gauge the school’s technology needs as a whole.

Instrumentation

The School Technology Needs Assessment, or STNA, was chosen as the instrument to collect data for this study based upon the recommendations from the North Carolina Technology Plan (Public Schools of North Carolina, 2007). In addition, due to time constraints of the researcher to develop, test, and validate a reliable survey instrument tailored specifically to the study site, it was thought appropriate to use a standardized instrument adopted by school districts throughout the state. There was also the added advantage of having a comparable standard set of data to use for comparison with other schools.

As part of the Looking at North Carolina Educational Technology (LANCET) grant, an initiative funded by the U.S. Department of Education through one of ten grants to study statewide technology programs, STNA was developed in cooperation with NCDPI by the SERVE Center at the University of North Carolina at Greensboro (UNCG) and is “intended to assess the collective needs of a school staff related to the use of technology for teaching and learning” (Corn, 2006, p. 4). More specifically, STNA was piloted, validated and implemented to assist with the formative evaluation of the IMPACT Model for Media and Technology Programs funded through North Carolina’s EETT grant.

As result of the study conducted by Corn investigating the validity and reliability of STNA, the instrument was further refined and resulted in STNA 3.0, the current
version of the instrument to be used in this study. STNA 3.0 consists of 86 self-report Likert-type items measuring teacher’s perceptions concerning technology implementation in schools. These items are organized into the following constructs:

I. Supportive environment for technology use: Vision and shared leadership (7 items), Organizational conditions (10 items), Flexible scheduling (3 items), Infrastructure (5 Items), Staff support (3 items), Media and software (4 items)

II. Professional development: Instruction (7 items), Planning (8 items), Professional development quality (7 items)

III. Teaching and learning: Instruction (7 items), Planning (8 items), Information and communication technologies (8 items)

IV. Impact of technology: Teaching practices (4 items), Student outcomes (5 items)

Validity and Reliability

Prior to implementation, the STNA was initially piloted at one of the IMPACT model schools by staff members (N=70), after which a small focus group (N=10) from the participants helped to further refine and adjust the beta version resulting in STNA version 2.0. This version was then piloted once more to test for validity and reliability. SPSS statistical software package was then used to examine internal consistency reliability and resulted in Cronbach alpha values greater than .919 or greater for all major constructs indicating high reliability. Principal factor analysis was use to determine how items were clustering and provided “strong support for the validity of the constructs identified within STNA.” (Corn, 2006)
Procedure for Data Collection

Prior to implementation of the STNA survey, the researcher contacted the principal of the school via email (Appendix D) in order to formally request permission to conduct the study. As recommended in the documentation (SERVE Center at UNC Greensboro, 2005), staff members were asked to complete the online survey in one of the two schools computer labs immediately following a staff meeting to help ensure a minimum 90% response rate. In addition, the opportunity was provided for those teachers whose schedules did not permit them to participate at that time, to complete the survey via the email link at a more convenient time. Prior to the meeting, staff members were sent an email with a link to the online URL where the survey could be accessed. As also recommended in the STNA documentation, staff members were notified prior to data collection via email regarding the purpose of the survey, how it relates to the technology program, and the importance of everyone completing the survey. Staff members were given instructions on how to access and complete the survey and were reminded that responses were completely anonymous and would not be used to reward or sanction teachers, but would be combined with other staff members to determine the collective technology needs of the school. During data collection, the researcher was present to assist with any technical difficulties that staff may encounter.

Data Analysis

Results from the respondents are reported as absolute and relative frequencies of all responses and are be presented as color-coded bar graphs and an attending legend. The graphs will provide visual summaries of item responses and will provide a “profile”
for each item. In addition, a narrative is included in order to summarize and organize these results based on profiles provided in the documentation from the SERVE Center for using STNA data (SERVE Center, 2007).
CHAPTER IV

FINDINGS

The purpose of this study is to assess the technology needs of teachers as part of a larger effort to determine the future professional development offerings, measure teacher and student growth, and assess the impact of the school’s technology program on teaching and learning. The study was designed to measure staff perceptions regarding the major constructs noted in the literature review that have been found to influence technology use at the K-12 level. The School Technology Needs Assessment (STNA) developed by the University of North Carolina at Greensboro was used to measure these staff perceptions.

Results of the survey are presented as they relate to each of the research questions. A narrative summary of the results, organized by profiles suggested by the guidelines from the SERVE Center (2007), will be presented first, followed by a graphic summary of the responses for each survey item as it relates to that particular research question.

Research Question 1

What environmental factors do educators feel are either supporting or impeding the use of technology?

In order to address this question, teachers responded to 32 self-report items on a Likert-type scale in section one of the STNA survey instrument. This section was divided
into six additional subconstructs found in the literature to influence technology use and included:

1. vision and leadership
2. organizational conditions
3. flexible access
4. infrastructure
5. staff support
6. media and software

Teachers were asked to respond to statements about each subconstruct on a five point scale ranging from “strongly agree” to “strongly disagree.” Analysis of the data in this has been simplified by the design of the STNA in that one end of the Likert scale is viewed as “positive”, meaning that respondents felt that this technology need has been adequately addressed as the items for each construct are seen as beneficial to the implementation of technology in schools, while the other end of the scale is “negative”, meaning that the respondents did not feel this need has been addressed as the absence of this item has been identified in the literature review as an obstacle to technology integration.

**Vision and Leadership**

This subsection of the survey investigated the extent to which teachers felt that administrators at Sandy Grove Elementary “effectively model and communicate a shared vision for technology and support education technology innovators” (Corn, 2008, p. 23). To measure teacher perceptions toward vision and leadership at Sandy Grove Elementary, respondents were asked to respond to 7 items identified in the literature
review as beneficial to technology integration. Results for each item are presented in Table 1 below.

Without question, the vast majority (97.5%) of respondents agreed with item 4 which states that the current administration is supportive of organizational change related to technology. Other areas in which the majority of respondents agreed that the school environment was supportive for technology was the development of a vision for technology (72.5%), item 1; the effective modeling of technology practices by administration (72.5%), item 3; and the hiring of tech savvy teachers (62.5%), item 7. Although most of the respondents feel positively towards these last three items, the small number of respondents who do not agree with these statements may warrant further investigation.

Regarding items 5 and 6, there are clearly more respondents who feel that the incentives offered to innovators with technology are not adequate than those who do. Of those surveyed, 21 of the 40 respondents, or 52.5%, felt either neutral or negative towards the statement that material incentives are being offered, as opposed to 12 respondents who agreed or strongly agreed with this statement. Likewise, 18 of the 40 respondents felt either neutral or negative towards the adequacy of nonmaterial incentives compared to 15 who did. According to guidelines for interpreting STNA (SERVE Center, 2007), this kind of response distribution in which respondents as a group are either feeling neutral or negative, “represents an issue that should be an area of concern for building decision makers” (p. 4). These items are interpreted with caution though, given the fairly large percentage, 17.5% and 15% respectively, who responded that they “do not know” and may warrant further investigation before and decision are made regarding this area.
Finally, results for item 2 suggest a somewhat divided staff about the issue of whether or not the vision for technology has been effectively communicated. While 50%, or half, feel positively towards this item, the remaining half does not. The item makes interpretation difficult and is an area that requires further investigation.
Table 1

Vision and Leadership

<table>
<thead>
<tr>
<th>View</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
<th>Response Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) A vision for technology has been developed through an effective collaboration among stakeholders, e.g., administrators, specialists, teachers, students, and community members.</td>
<td>27.5% (11)</td>
<td>45%</td>
<td>12.5%</td>
<td>5%</td>
<td>0%</td>
<td>10%</td>
<td>40</td>
</tr>
<tr>
<td>2) The vision for technology use has been effectively communicated to the community.</td>
<td>15% (5)</td>
<td>35%</td>
<td>25%</td>
<td>15%</td>
<td>0%</td>
<td>10%</td>
<td>40</td>
</tr>
<tr>
<td>3) Administrators model effective use of technology.</td>
<td>17.5% (7)</td>
<td>55%</td>
<td>10%</td>
<td>17.5%</td>
<td>0%</td>
<td>0%</td>
<td>40</td>
</tr>
<tr>
<td>4) Administrators support changes in school-level systems, policies, and practices related to technology.</td>
<td>37.5% (15)</td>
<td>65%</td>
<td>3.5%</td>
<td>0%</td>
<td>6%</td>
<td>0%</td>
<td>40</td>
</tr>
</tbody>
</table>
Organizational Conditions

This subsection to Supportive Environment for Technology Use investigated the extent to which educators felt that Sandy Gove Elementary had a “stakeholder-supported long-range technology plan in place that includes an adequate budget for technology resources and provision for evaluation of the technology program” (Corn, 2008, p. 23). Ten items were used to gauge the respondents’ perceptions toward school organization conditions that have been found in the literature to be essential components to foster technology use and integration.
The results of the subsection “Organizational Conditions” (Table 2) suggest a number of areas in which the majority of educators believe that the technology needs of Sandy Grove elementary have been adequately satisfied. Findings show that the majority of teachers “agree” or “strongly agree” on the following items: that there is in fact a long-term technology plan in place (70%), item 8; that it has been developed through a collaboration of stakeholders (60%), item 9; that the plan has the support of stakeholders (77.5%), item 11; supplementary sources of technology funding are being actively pursued (62.5%), item 14; multiple sources of data are being used to evaluate technology’s impact (55%), item 15; and that technology is being used to communicate and collaborate with families (77.5%) and the community (65%), items 16 and 17 respectively.

Findings for the remaining items make interpretation difficult. Although more educators feel “positive” than “negative” towards monitoring and updating of the technology plan (item 10) and the amount of money budget for implementing plans (item 12) and maintain equipment (item 13), a large number of respondents, indicated they “do not know”, suggesting that a large portion of the staff is not fully informed about these areas.

These finding suggest that, as a whole, educators at Sandy Grove feel that there is a stakeholder-developed school technology plan that has the support of teachers, that funding for technology is being actively pursued, technology’s impact is being evaluated, and technology is being used to communicate with families and the community. Theses finding also suggest that there is general disagreement or lack of knowledge, about
whether the budget is sufficient and the plan is being monitored and that further research is needed to determine whether these needs have truly been satisfied.

Table 2
Organizational Conditions

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>8) An effective long-range school technology plan is in place</td>
<td>32% (12)</td>
<td>42% (16)</td>
<td>7.5% (3)</td>
<td>7.5% (3)</td>
<td>2.5% (1)</td>
<td>12.5% (5)</td>
</tr>
<tr>
<td>9) The school technology plan is developed through an effective collaboration among stakeholders, e.g., administrators, specialists, teachers, students, and community members.</td>
<td>12% (4)</td>
<td>50% (20)</td>
<td>15% (6)</td>
<td>7.5% (3)</td>
<td>2.5% (1)</td>
<td>15% (6)</td>
</tr>
<tr>
<td>10) The school technology plan is monitored and updated at least once a year</td>
<td>22.5% (9)</td>
<td>30.5% (12)</td>
<td>15% (6)</td>
<td>10% (4)</td>
<td>2.5% (1)</td>
<td>27.5% (12)</td>
</tr>
</tbody>
</table>
Table 2 – Continued

11) Teachers and other staff members support the school technology plan.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>29%</td>
</tr>
<tr>
<td>(12)</td>
<td>(21)</td>
</tr>
<tr>
<td>10%</td>
<td>12%</td>
</tr>
<tr>
<td>(4)</td>
<td>(3)</td>
</tr>
<tr>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>(1)</td>
<td>(1)</td>
</tr>
</tbody>
</table>

12) The amount of money budgeted for technology resources is sufficient for implementing decisions arising from planning.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.5%</td>
<td>32.8%</td>
</tr>
<tr>
<td>(7)</td>
<td>(12)</td>
</tr>
<tr>
<td>7.5%</td>
<td>7.5%</td>
</tr>
<tr>
<td>(2)</td>
<td>(2)</td>
</tr>
<tr>
<td>12.5%</td>
<td>10%</td>
</tr>
<tr>
<td>(6)</td>
<td>(4)</td>
</tr>
<tr>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>(1)</td>
<td>(1)</td>
</tr>
</tbody>
</table>

13) The amount of money budgeted for technology resources is sufficient for continuously updating and replacing technology systems as they become outdated.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5%</td>
<td>32%</td>
</tr>
<tr>
<td>(5)</td>
<td>(12)</td>
</tr>
<tr>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>(2)</td>
<td>(2)</td>
</tr>
<tr>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>(6)</td>
<td>(4)</td>
</tr>
<tr>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>(1)</td>
<td>(1)</td>
</tr>
</tbody>
</table>

14) Supplemental sources of funding are actively pursued to support technology, e.g., external grants, collaboration with community or parent groups, support from businesses.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5%</td>
<td>32%</td>
</tr>
<tr>
<td>(5)</td>
<td>(12)</td>
</tr>
<tr>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>(2)</td>
<td>(2)</td>
</tr>
<tr>
<td>12.5%</td>
<td>10%</td>
</tr>
<tr>
<td>(6)</td>
<td>(4)</td>
</tr>
<tr>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>(1)</td>
<td>(1)</td>
</tr>
</tbody>
</table>

15) Multiple sources of data are used to evaluate the impact of technology initiatives on student outcomes.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>35%</td>
</tr>
<tr>
<td>(6)</td>
<td>(14)</td>
</tr>
<tr>
<td>22.5%</td>
<td>22.5%</td>
</tr>
<tr>
<td>(3)</td>
<td>(3)</td>
</tr>
<tr>
<td>7.5%</td>
<td>5%</td>
</tr>
<tr>
<td>(2)</td>
<td>(1)</td>
</tr>
<tr>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>(0)</td>
<td>(0)</td>
</tr>
</tbody>
</table>

16) Technology is used to communicate and collaborate with families about school programs and student learning.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>15%</td>
<td>62.5%</td>
</tr>
<tr>
<td>(6)</td>
<td>(25)</td>
</tr>
<tr>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>(4)</td>
<td>(4)</td>
</tr>
<tr>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>(0)</td>
<td>(0)</td>
</tr>
</tbody>
</table>
Flexible Scheduling

Items under the subconstruct of Flexible Scheduling measures the extent to which teachers feel that library and technology resources can be flexibly scheduled in order to ensure maximum access to education and technology resources and that this access is equitable. Three items were included in this subsection and address the schools need for flexible and equitable access to the media center, computer lab and mobile computers.

Results from Table 3 indicate general satisfaction with the flexibility of access for both the media center (item 18) and the computer labs (item 19) with the two clear modes for both of the data sets being “agree”. Although the majority of respondents for both items, 65% and 57.5% respectively, believe these areas to be adequately addressed, there are a significant number of respondents who feel that the access to the computer lab (N=10) and the media center (N=10) is not flexible or fair which suggests the need for additional information to determine why theses respondents feel this way.

Regarding access to mobile computers, there was a great deal of disagreement for this item and a potential area of concern. Of those surveyed, 21.6% replied that the “do not know” whether mobile computers can be flexibly scheduled. Despite the mode for this data set being “agree”, there were more respondents who felt neutral to negative
(N=16) about this are than those who felt positive (N=13), suggesting that more of those are informed enough to respond believe this to be an area of need.

Table 3

Flexible Scheduling

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>18) The media center can be flexibly scheduled to provide equitable access to resources and instruction.</td>
<td>12.5%</td>
<td>(5)</td>
<td>42.5%</td>
<td>(17)</td>
<td>15%</td>
<td>(6)</td>
</tr>
<tr>
<td>19) Computer labs can be flexibly scheduled for equitable access to resources and instruction. (Leave this item blank if your school has no computer labs.)</td>
<td>7.5%</td>
<td>(2)</td>
<td>52.5%</td>
<td>(20)</td>
<td>15%</td>
<td>(6)</td>
</tr>
<tr>
<td>20) Mobile computers can be flexibly scheduled to provide equitable access to resources and instruction. (Leave this item blank if your school has no computer labs.)</td>
<td>2.7%</td>
<td>(1)</td>
<td>32.4%</td>
<td>(12)</td>
<td>21.6%</td>
<td>(8)</td>
</tr>
</tbody>
</table>

Total # of respondents 40. Statistics based on 40 respondents. 0 filtered. 0 skipped.

Infrastructure

This subsection of the STNA measures the degree to which educators feel that there exists at Sandy Grove Elementary a reliable technology infrastructure that provides
sufficient hardware and facilitates electronic communication between the entire learning community. Five items found in the literature to impact technology use were included in this subsection and address the school’s need for access to reliable hardware, internal and external networks, and assistive devices sufficient for communication and special needs students.

Finding from the survey indicate that the majority of educators believe the infrastructure needs of Sandy Grove Elementary have been satisfied. Results from the survey indicate large peaks for “agree” on each of the five items. The majority of respondents believed that teacher have sufficient access to computer hardware (62.5%), item 21; electronic systems for communicating within the school (77.5%) and with the community (70%) are adequate, items 22 and 23 respectively; the reliability and speed of external connections are sufficient (75%), item 24. Despite a clear majority for item 21, it should be noted that 30% of those surveyed were dissatisfied (disagreed or strongly disagreed) with the availability of hardware. This small faction of teachers (N=12) would constitute the equivalent of two entire grade levels at a school the size of Sandy Grove and

Despite these overall positive responses, item 25 indicates a potential area of concern. Although a small majority (52.5%) believe that students with disabilities have appropriate and adequate access to adaptive and assistive devices, 20% disagreed with this item and a fairly large percentage (17.5%) who were unaware of whether or not assistive technology for students with disabilities even exists.
Table 4

Infrastructure

<table>
<thead>
<tr>
<th>View</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>21) Teachers and students have sufficient computer hardware available for their use, e.g., computers, digital cameras, projection devices, scanners, printers.</td>
<td>5% (2)</td>
<td>57.5% (23)</td>
<td>7.5% (3)</td>
<td>10% (4)</td>
<td>10% (4)</td>
<td>0% (0)</td>
<td>40</td>
</tr>
<tr>
<td>22) Electronic systems for communicating within the school are adequate, e.g., e-mail among teachers and staff, network drives to upload lesson plans and grades to the main office.</td>
<td>22.5% (9)</td>
<td>57.5% (22)</td>
<td>7.5% (3)</td>
<td>10% (4)</td>
<td>2.5% (1)</td>
<td>2.5% (1)</td>
<td>40</td>
</tr>
<tr>
<td>23) Electronic systems for communicating with families and the community are adequate, e.g., e-mail, teachers, and/or school Web pages.</td>
<td>12.5% (5)</td>
<td>57.5% (23)</td>
<td>12.5% (5)</td>
<td>15% (6)</td>
<td>2.5% (1)</td>
<td>2.5% (1)</td>
<td>40</td>
</tr>
<tr>
<td>24) Reliability and speed of external connections are sufficient, e.g., connections to the Internet, online databases, and other resources.</td>
<td>15% (6)</td>
<td>62.5% (24)</td>
<td>2.5% (1)</td>
<td>17.5% (7)</td>
<td>8% (2)</td>
<td>0% (0)</td>
<td>40</td>
</tr>
</tbody>
</table>

Response Total: 40
Table 4 – Continued

<table>
<thead>
<tr>
<th>25) Students with disabilities have appropriate and adequate access to adaptive and assistive devices.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
</tr>
<tr>
<td>(4)</td>
</tr>
</tbody>
</table>

Total # of respondents 40. Statistics based on 40 respondents. 0 filtered. 0 skipped.

Staff Support

This subsection of the survey is intended to address Sandy Grove’s needs for technical support and staff “to mentor and support teachers as they integrate technology into lessons.” (Com, 2008, p. 23). Three items were included in this subsection and measure the extent to which teachers perceive they have ready access to technical support, and that the library media coordinator, technology facilitator, and assistant positions are adequately staffed.

Results from Table 5 indicate general consensus about the adequacy of support for the position of media coordinator and/or media assistant. Of those surveyed, 60% felt positively about item 26 suggesting that the majority of educators feel this position has been adequately staffed.

Findings also indicate nearly equal disagreement about the adequacy of staffing for technology positions and the adequacy of technical support. For both items 27 and 28, just slightly more respondents (N=20) felt neutral to negative than those who felt positive (N=19), while just one respondent did not know. These finding suggest good awareness among the respondents about the substance of these items, but the staff is divided on these two issues.
Table 5

Staff Support

<table>
<thead>
<tr>
<th>View</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.1 Teachers have ready access to technical support, e.g., to troubleshoot hardware or software problems, maintain systems. 15.9% (8) 35.3% (32) 15.3% (6) 27.5% (12) 7.5% (5) 2.5% (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.1 Library media coordinator and/or media assistant positions are adequately staffed. 12.5% (5) 47.5% (19) 12.5% (6) 15.0% (6) 7.5% (3) 5.0% (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.1 Technology facilitator and/or technology assistant positions are adequately staffed. 12.5% (4) 37.5% (15) 15.0% (6) 27.5% (11) 7.5% (3) 2.5% (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total # of respondents 40. Statistics based on 40 respondents. 0 filtered; 0 skipped.

Media and Software

This subsection of the STNA reflects to findings from the Access and Support section of the literature review and addresses the need for teachers to have access to a "wealth of electronic resources that consider both the needs of the learner and the curriculum" (Corn, 2008, p. 23). Four items were included under this subconstruct and
were used to measure the extent to which teachers felt that teachers and student had ready
access to productivity tools and media resources, and that teacher had ready access to a
system for finding teaching materials and selected them appropriately.

Results from the STNA indicate that the majority of teachers, 60% or greater,
either “agree” or “strongly agree” with each of the four items with small percentages of
disagreement for each item indicating that media and software needs of Sandy Grove
Elementary are limited to a small group of teachers.

Table 6
Media and Software

<table>
<thead>
<tr>
<th>Item</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>29) Teachers and students have ready access to productivity software, e.g., graphic organizers, word processors, slide presentation, or drawing applications.</td>
<td>17.5%</td>
<td>47.5%</td>
<td>17.5%</td>
<td>10%</td>
<td>0%</td>
<td>7.5%</td>
</tr>
<tr>
<td></td>
<td>(7)</td>
<td>(13)</td>
<td>(7)</td>
<td>(4)</td>
<td>(0)</td>
<td>(3)</td>
</tr>
<tr>
<td>30) Teachers have ready access to a cataloging system they can use for searching and locating teaching materials.</td>
<td>5%</td>
<td>62.5%</td>
<td>12.5%</td>
<td>10.5%</td>
<td>0%</td>
<td>7.5%</td>
</tr>
<tr>
<td></td>
<td>(2)</td>
<td>(15)</td>
<td>(4)</td>
<td>(5)</td>
<td>(0)</td>
<td>(3)</td>
</tr>
</tbody>
</table>
Teachers and students have ready access to a good collection of print, multimedia, and electronic resources.

When educators are selecting resource media and software, they consider both the curriculum and the needs of learners.

Research Question 2

In which areas do educators feel they would benefit from technology professional development?

In order to address this question, teachers responded to 15 self report Likert-type items in section two of the STNA survey instrument. This section was divided into the following two additional subconstructs:

1. Instruction
2. Planning

Teachers were asked to respond to statements about each subconstruct on a five point scale ranging from “strongly agree” to “strongly disagree.” For this section of the survey, a “positive” response (agree or strongly agree) indicates a need for that particular
item, while a “negative” response (disagree or strongly disagree) indicates that this need has been satisfied.

Instruction

This subsection of the STNA survey examines the extent to which respondents felt that they would benefit from technology related professional development in specific areas related to instruction. Seven items were used to identify specific areas identified in the literature review related to appropriate uses of technology.

Findings from Table 7 below suggest a strong need for professional development in the area of instruction. With the exception of item 6, over 85% of educators felt they would benefit from professional development in 6 of the 7 areas identified. Only item 6 which addressed online security and safety had a small handful of educators (N=10) who did not feel that professional development in this area would benefit them.

Table 7

Instruction

"I would benefit from professional development on…"
2) Identification, location, and evaluation of technology resources, e.g., websites that I can use with my students.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>32.5%</th>
<th>62.5%</th>
<th>5%</th>
<th>7.5%</th>
<th>0%</th>
<th>0%</th>
</tr>
</thead>
</table>

3) Performance-based student assessment of my students.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>25%</th>
<th>62.5%</th>
<th>2.5%</th>
<th>7.5%</th>
<th>0%</th>
<th>0%</th>
</tr>
</thead>
</table>

4) The use of technology to collect and analyze student assessment data.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>27.5%</th>
<th>62.5%</th>
<th>7.5%</th>
<th>0%</th>
<th>0%</th>
<th>0%</th>
</tr>
</thead>
</table>

5) Learner-centered teaching strategies that incorporate technology, e.g., project-based or cooperative learning.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>32.5%</th>
<th>62.5%</th>
<th>5%</th>
<th>7.5%</th>
<th>0%</th>
<th>0%</th>
</tr>
</thead>
</table>

6) Online security and safety

<table>
<thead>
<tr>
<th>Percentage</th>
<th>22.5%</th>
<th>52.5%</th>
<th>15%</th>
<th>5%</th>
<th>5%</th>
<th>0%</th>
<th>0%</th>
</tr>
</thead>
</table>

7) The use of technology for differentiating instruction for students with special learning needs.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>37.5%</th>
<th>52.5%</th>
<th>5%</th>
<th>5%</th>
<th>0%</th>
<th>0%</th>
<th>0%</th>
</tr>
</thead>
</table>

Total # of respondents 40. Statistics based on 40 respondents. 0 filtered. 0 skipped.
Planning

This subsection of the STNA survey examines the extent to which respondents felt that they would benefit from technology related professional development in specific areas related to planning for instruction. Eight items were used to identify specific areas identified in the literature review related to appropriate uses of technology for planning instruction. Results for each item are presented in Table 8 below.

As with the results for instruction, there was very little disagreement about the desire for professional development to improve teaching practices related to using technology to plan for instruction. Seven of the eight items clearly indicate a larger majority (80% or more) of respondents indicating that they either agree or strongly agree that they would benefit from professional development. Item 14, the item with the fewest number of respondents (N=30), still indicated that 75% of those surveyed would benefit from professional development related to the use of data to make decisions about technology.
Table 8
Planning

"I would benefit from professional development on..."

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
<th>Response Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3: Uses of technology to increase my professional productivity.</td>
<td>42.5%</td>
<td>7.5%</td>
<td>1.3%</td>
<td>0%</td>
<td>0%</td>
<td>40</td>
</tr>
<tr>
<td>(17)</td>
<td>(19)</td>
<td>(3)</td>
<td>(1)</td>
<td>(0)</td>
<td>(0)</td>
<td></td>
</tr>
</tbody>
</table>

40

| 9: Ways to use technology to communicate and collaborate with families about school programs and student learning. | 32.5% | 47.5% | 12.5% | 0% | 0% | 40 |
| (13) | (19) | (5) | (2) | (0) | (0) | | |

40

| 10: Ways to use technology to communicate and collaborate with other educators. | 27.5% | 52.5% | 12.5% | 0% | 0% | 40 |
| (11) | (21) | (5) | (1) | (0) | (0) | | |

40

| 11: Alignment of lesson plans to content standards and student technology standards. | 37.5% | 47.5% | 7.5% | 0% | 0% | 40 |
| (15) | (19) | (3) | (0) | (0) | (0) | | |

40
Table 8 – Continued

12) Use of research or action research projects to improve technology-enhanced classroom practices

<table>
<thead>
<tr>
<th>Response</th>
<th>0%</th>
<th>5%</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
<th>25%</th>
<th>30%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.5%</td>
<td>21</td>
<td>21</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40</td>
</tr>
</tbody>
</table>

13) Use of data for reflecting on my professional practices

<table>
<thead>
<tr>
<th>Response</th>
<th>0%</th>
<th>5%</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
<th>25%</th>
<th>30%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.5%</td>
<td>22</td>
<td>20</td>
<td>17</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40</td>
</tr>
</tbody>
</table>

14) Use of data to make decisions about the use of technology

<table>
<thead>
<tr>
<th>Response</th>
<th>0%</th>
<th>5%</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
<th>25%</th>
<th>30%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.5%</td>
<td>22</td>
<td>20</td>
<td>17</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40</td>
</tr>
</tbody>
</table>

15) Using technology to participate in professional development activities, e.g., online workshops, hands-on training in a computer lab

<table>
<thead>
<tr>
<th>Response</th>
<th>0%</th>
<th>5%</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
<th>25%</th>
<th>30%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>32.5%</td>
<td>23</td>
<td>21</td>
<td>13</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40</td>
</tr>
</tbody>
</table>

Total # of respondents 40. Statistics based on 40 respondents. 0 filtered; 0 skipped.

Research Question 3

How do educators feel about the quality of current technology professional development efforts?

In order to address this question, teachers responded to seven self-report items on a five-point Likert scale in section two of the STNA survey instrument. These items were similar to those in section one in which a “positive” response, i.e. agree or strongly agree,
is indicative that the respondent feels this need has been satisfied; whereas, a “negative” response, i.e. disagree or strongly disagree, indicates the respondent feels that efforts in that area are in need of improvement.

Results for educator’s perceptions towards to quality of current professional development efforts are presented in Table 9 below. Results show that a majority of respondents felt positively towards the first five items (shown in parentheses) indicating more than half the school feels that profession development is determined by teachers’ needs (62.5%); is timely (60%), relevant (75%) and ongoing(75%); and that teachers have a chance to evaluate professional development opportunities of which they are a part (62.5%). Additionally, the results show that more respondents felt positively (N=20) than neutral to negative (N=12) that the impact of professional development on student learning is being tracked (item 22).

However, results also indicate that while a clear majority of teachers feel that formative evaluation of professional development efforts are adequate, summative evaluation, or evaluation of current professional development’s impact on teacher practice and student outcomes is an item of contention. While 50% of teachers feel that the impact of professional development is being tracked using data on student learning (item 22), only 40% agree or strongly agree that the impact is being track by using data on classroom practice (item 21). Additionally, a significant number (N=8), or 20% of respondents, indicated that they did not know whether summative evaluation, i.e. items 21 and 22, was taking place or not.
Table 9
Professional Development Quality

<table>
<thead>
<tr>
<th>View</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.</td>
<td>Educators in charge of professional development use data from teachers' needs assessments to determine technology professional development topics and activities.</td>
<td>12.5%</td>
<td>42.5%</td>
<td>17.5%</td>
<td>12.5%</td>
<td>5%</td>
</tr>
<tr>
<td>17.</td>
<td>Technology professional development is timely.</td>
<td>12.5%</td>
<td>47.5%</td>
<td>17.5%</td>
<td>12.5%</td>
<td>7.5%</td>
</tr>
<tr>
<td>18.</td>
<td>Technology professional development is relevant.</td>
<td>22.5%</td>
<td>37.5%</td>
<td>12.5%</td>
<td>7.5%</td>
<td>5%</td>
</tr>
<tr>
<td>19.</td>
<td>Technology professional development is ongoing.</td>
<td>22.5%</td>
<td>37.5%</td>
<td>12.5%</td>
<td>17.5%</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>0 5 10 15</td>
</tr>
<tr>
<td>Agree</td>
<td>40</td>
</tr>
<tr>
<td>Neither Agree nor Disagree</td>
<td>0 5 10 15</td>
</tr>
<tr>
<td>Disagree</td>
<td>40</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0 5 10 15</td>
</tr>
<tr>
<td>Do Not Know</td>
<td>40</td>
</tr>
</tbody>
</table>

63
In answer to research question 3, “How do staff members feel about the quality of current technology professional development efforts?”, it is relatively safe to conclude that the majority feel that data is being used to plan current professional development opportunities; that it is relevant, timely and ongoing; and that teachers have a voice in evaluating what’s offered. But whether the impact of these efforts on teaching and learning is being evaluated, there is disagreement.

**Research Question 4**

How frequently do educators feel that technology is effectively being used to support teaching and learning?
In order to address this question, teachers responded to self-report items on using a “how often” Likert-type response set in Section III of the STNA survey instrument. Items 1-15 in this section are aligned with items 1-15 from Section II in which educators responded the extent to which they felt they would benefit from professional development. Items 16-23 examine the extent to which information and communication technologies (ICT) are being used by students to enhance learning. As a whole, Section III examines staff’s and students’ current use of technology teaching and learning, “focusing on teacher implementation of research-based, technology-enhanced instructional strategies in the classroom, and student use of information and communication technologies in the classroom.” (Corn, 2008, p. 25).

Teachers were asked to respond to statements about classroom practices on a five-point Likert-type scale ranging from “daily” to “never.” As with the previous sections, for this section of the survey, a “positive” response is indicated by the choices “daily” or “weekly”, while a “negative” response is indicated by the choices “once per grading term” and “never.” A positive response for this item indicates that

Instruction

This subsection to Section II examines how and to what extent teachers use technology to enhance instructional practices. Results shown in Table 10 (below) indicate that the majority of teachers report that they frequently use technology, either on a daily or weekly basis, to: identify, locate, and evaluate technology resources (60%); collect and analyze student assessment data (60.5%); include technology-enhanced, learner-centered teaching strategies in their lessons (65%); apply policies to enhance online security and safety (60%); differentiate instruction for special needs students (70%). Taken together
with their matching results from section II, these findings indicate that while educators may feel that professional development in these areas would prove beneficial, it may only be needed for a small number of staff members who reported that they do not demonstrate these practices on a frequent basis.

Table 10

Frequency of Technology Use to Enhance Instruction

<table>
<thead>
<tr>
<th>View</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Once per Grading Term</th>
<th>Never</th>
<th>Do Not Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) I consult publications, online journals, or other resources to identify research-based practices I can use in teaching with technology</td>
<td>10%</td>
<td>25%</td>
<td>17.5%</td>
<td>10%</td>
<td>20%</td>
<td>7.5%</td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td>(10)</td>
<td>(7)</td>
<td>(0)</td>
<td>(0)</td>
<td>(3)</td>
</tr>
<tr>
<td>2) I identify, locate, and evaluate technology resources e.g., websites</td>
<td>22.5%</td>
<td>17.5%</td>
<td>22.5%</td>
<td>10%</td>
<td>5%</td>
<td>2.5%</td>
</tr>
<tr>
<td></td>
<td>(5)</td>
<td>(15)</td>
<td>(9)</td>
<td>(4)</td>
<td>(2)</td>
<td>(1)</td>
</tr>
<tr>
<td>3) I apply performance-based student assessment to technology-enhanced lessons e.g., student portfolios, student presentations</td>
<td>22.5%</td>
<td>17.5%</td>
<td>22.5%</td>
<td>10%</td>
<td>5%</td>
<td>2.5%</td>
</tr>
<tr>
<td></td>
<td>(5)</td>
<td>(11)</td>
<td>(9)</td>
<td>(3)</td>
<td>(1)</td>
<td>(1)</td>
</tr>
</tbody>
</table>

Total | 40


Planning

This subsection to Section II examines how and to what extent teachers use technology to enhance teaching practices related to planning. Results shown in Table 11 indicate that the majority of teachers report that they frequently demonstrated the following technology related practices, either on a daily or weekly basis, in order to:
support and increase their professional productivity (77.5%); communicate and collaborate with other educators (75%); reference both content and student technology standards in their lesson plans (62.5%); and use multiple data sources for reflecting on practice (55%). Results for these items take together with their aligned items from the Section II suggest that while professional development in these areas may be

The majority of teachers reported that they infrequently, i.e. on a monthly basis or less, demonstrated the following technology related practices to: communicate and collaborate with families about school programs and student learning (62.5%); do research or action research projects to improve technology enhanced lessons (67.5%); use multiple sources of data to make decision about technology (55%); and use technology to participate in professional development activities (55%).

Table 11

Frequency of Technology Use for Planning

<table>
<thead>
<tr>
<th>Response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>10</td>
</tr>
<tr>
<td>Weekly</td>
<td>15</td>
</tr>
<tr>
<td>Monthly</td>
<td>20</td>
</tr>
<tr>
<td>Never</td>
<td>30</td>
</tr>
<tr>
<td>Do Not Know</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 11 shows the frequency of technology use for planning tasks.
<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>I use technology to communicate and collaborate with families about school programs and student learning.</td>
<td>22.5%</td>
<td>10%</td>
<td>20%</td>
<td>5%</td>
<td>27.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>I use technology to communicate and collaborate with other educators.</td>
<td>45%</td>
<td>30%</td>
<td>12.5%</td>
<td>7.5%</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>My lesson plans refer to both content standards and student technology standards.</td>
<td>52.5%</td>
<td>10%</td>
<td>12.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>I do research on action research projects to improve technology-enhanced classroom practices.</td>
<td>20%</td>
<td>10%</td>
<td>30%</td>
<td>10%</td>
<td>27.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>I use multiple sources of data for reflecting on professional practice.</td>
<td>35%</td>
<td>20%</td>
<td>20%</td>
<td>10%</td>
<td>12.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>I use multiple sources of data to make decisions about the use of technology.</td>
<td>27.5%</td>
<td>12.5%</td>
<td>22.5%</td>
<td>12.5%</td>
<td>20%</td>
</tr>
</tbody>
</table>
Student Use of Information and Communication Technologies (ICT)

This subsection to Section II examines the frequency students effectively use ICT to enhance learning. Results shown in Table 12 indicate that the majority of teachers report that students frequently, either on a daily or weekly basis, perform the following activities: use a variety of technologies (70%); use technology to help solve problems (62.5%); and use technology to support higher-order thinking (67.5%). These results suggest that although these items are not pressing needs for Sandy Grove, there is room for improvement.

Two of the items from this section, items 17 and 19, indicate areas in which technology is used on a limited basis. The majority of teachers reported that students infrequently, i.e. on a monthly basis or less, perform the following activities: use technology during the school day to communicate and collaborate with others, beyond the classroom (57.5%); and use the same kinds of tools that professional researchers use (52.5%). These two items may present areas of concern which may need to be addressed through professional development.

It is important to note that the mode for items 19 and 20 was the response “do not know”, and showed that a large percentage of respondents, 27.5% and 25% respectively,
either did not recognize a key term or terms from the question, or did not have sufficient information to respond. This suggests that a quarter or more of the staff are not fully informed about whether or not their students have used the same kinds of tools as professional researchers use, or that their students are using technology to work on projects that approach real world applications of technology.

Table 12

Student Use of Information & Communication Technologies

<table>
<thead>
<tr>
<th>Term</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Once per Grading Term</th>
<th>Never</th>
<th>Do Not Know</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>16) Students use a variety of technologies, e.g., productivity, visualization, research, and communication tools.</td>
<td>45%</td>
<td>25%</td>
<td>12.5%</td>
<td>2.5%</td>
<td>10%</td>
<td>5%</td>
<td>40</td>
</tr>
<tr>
<td>17) Students use technology during the school day to communicate and collaborate with others, beyond the classroom.</td>
<td>35%</td>
<td>15%</td>
<td>12.5%</td>
<td>2.5%</td>
<td>10%</td>
<td>10%</td>
<td>40</td>
</tr>
<tr>
<td>18) Students use technology to access online resources and information as a part of classroom activities.</td>
<td>35%</td>
<td>15%</td>
<td>12.5%</td>
<td>2.5%</td>
<td>10%</td>
<td>10%</td>
<td>40</td>
</tr>
</tbody>
</table>
Table 12 – Continued

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
</tr>
</thead>
</table>

19) Students use the same kinds of tools that professional researchers use, e.g., simulations, databases, satellite imagery.

<table>
<thead>
<tr>
<th></th>
<th>10%</th>
<th>10%</th>
<th>22.5%</th>
<th>7.5%</th>
<th>22.5%</th>
<th>27.5%</th>
</tr>
</thead>
</table>

20) Students work on technology-enhanced projects that approach real-world applications of technology.

<table>
<thead>
<tr>
<th></th>
<th>12.5%</th>
<th>20%</th>
<th>17.5%</th>
<th>2.5%</th>
<th>20%</th>
<th>25%</th>
</tr>
</thead>
</table>

21) Students use technology to help solve problems.

<table>
<thead>
<tr>
<th></th>
<th>40%</th>
<th>22.5%</th>
<th>12.5%</th>
<th>2.5%</th>
<th>12.5%</th>
<th>10%</th>
</tr>
</thead>
</table>

22) Students use technology to support higher-order thinking, e.g., analysis, synthesis, and evaluation of ideas and information.

<table>
<thead>
<tr>
<th></th>
<th>42.5%</th>
<th>15%</th>
<th>12.5%</th>
<th>10%</th>
<th>10%</th>
<th>12.5%</th>
</tr>
</thead>
</table>

23) Students use technology to create new ideas and representations of information.

<table>
<thead>
<tr>
<th></th>
<th>32.5%</th>
<th>17.5%</th>
<th>17.5%</th>
<th>10%</th>
<th>17.5%</th>
<th>5%</th>
</tr>
</thead>
</table>

Total = of respondents 40. Statistics based on 40 respondents. 0 filtered: 0 skipped.
Research Question 5

What do educators feel is the impact that technology is having on teacher practice and learner outcomes?

In order to address this question, teachers responded to 8 Likert-type items in Section IV of the STNA survey instrument. This section examines the extent to which teacher believer that the impact of technology use has resulted in improvement in both teaching practice and learning outcomes.

Impact on Teaching Practice

This subsection of Section V examines the extent to which teachers felt that as a result of the use of technology, their practices have improved in that their instruction is more student-centered and interactive. Other expected shifts are their emphasis on: teacher uses of technology skills to support instruction, student use of productivity tools, and use of technology as integral parts of teaching strategies.

Results from Table 13 indicate a positive impact on teaching practices for the majority of teachers on 3 of the 4 items. Item 1 shows that the majority of teachers (77.5%) believe their teaching practice is more student-centered and interactive when they incorporate technology. For items 2 and 4 respectively, the majority also believe that their practice emphasizes teacher use of technology skills (75%) and student use of technology as an integral part of instructional strategies (70%). These finding suggest that while there is room for improvement, technology is having the desire impact on teaching practice in these areas. Item 3 may indicate an area of concern.
Table 13
Impact on Teaching Practices

<table>
<thead>
<tr>
<th>View</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>45%</td>
<td>32.5%</td>
<td>17.5%</td>
<td>2.5%</td>
<td>0%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(18)</td>
<td>(13)</td>
<td>(7)</td>
<td>(1)</td>
<td>(0)</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>2)</td>
<td>40%</td>
<td>35%</td>
<td>15%</td>
<td>5%</td>
<td>5%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(16)</td>
<td>(14)</td>
<td>(4)</td>
<td>(2)</td>
<td>(2)</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>3)</td>
<td>15%</td>
<td>37.5%</td>
<td>12.5%</td>
<td>15%</td>
<td>12.5%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td>(15)</td>
<td>(3)</td>
<td>(3)</td>
<td>(3)</td>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td>4)</td>
<td>30%</td>
<td>42%</td>
<td>12.5%</td>
<td>7.5%</td>
<td>5%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(12)</td>
<td>(16)</td>
<td>(5)</td>
<td>(2)</td>
<td>(2)</td>
<td>(2)</td>
<td></td>
</tr>
</tbody>
</table>

Total # of respondents 40. Statistics based on 40 respondents 0 Altered: 0 skipped.
Impact on Student Learning

This subsection deals with the extent to which the impact of technology has improved student learning outcomes. As a result of shifts in teacher practices mentioned in the previous section, we should expect to see shifts in student outcomes as well. These outcomes will be apparent when teacher begin to see students who are more confident, socially aware and positive about the future; are more independent in their learning; are willing to work more collaboratively; are more engaged; and ultimately achieve greater academic success.

Results from the STNA show that the majority of educators are reporting that these outcomes are already present. Not a single respondent felt strongly negative towards these items and the percentages of respondents who felt positively towards these items are as follows: students have become more socially aware, confident and positive (67.5%); students are becoming independent learners and self starters (72.5%); students work more collaboratively (70%); students are more engaged (87.5%); and students have achieved greater academic success (77.5%).
Table 14

Impact on Student Learning

<table>
<thead>
<tr>
<th>View</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
<th>Response Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5) Technology has helped my students become more socially aware, confident, and positive about their future.</td>
<td>32.5%</td>
<td>35%</td>
<td>25%</td>
<td>2.5%</td>
<td>5%</td>
<td>5%</td>
<td>40</td>
</tr>
<tr>
<td>6) Technology has helped my students become independent learners and self-starters.</td>
<td>35%</td>
<td>37.5%</td>
<td>22.5%</td>
<td>2.5%</td>
<td>2%</td>
<td>2.5%</td>
<td>40</td>
</tr>
<tr>
<td>7) Technology has helped my students work more collaboratively.</td>
<td>35%</td>
<td>35%</td>
<td>17.5%</td>
<td>7.5%</td>
<td>5%</td>
<td>5%</td>
<td>40</td>
</tr>
<tr>
<td>8) Technology has increased my students' engagement in their learning.</td>
<td>47.5%</td>
<td>42.5%</td>
<td>7.5%</td>
<td>2.5%</td>
<td>0%</td>
<td>2.5%</td>
<td>40</td>
</tr>
<tr>
<td>9) Technology has helped my students achieve greater academic success.</td>
<td>47.5%</td>
<td>32.5%</td>
<td>15%</td>
<td>2.5%</td>
<td>2.5%</td>
<td>0%</td>
<td>40</td>
</tr>
</tbody>
</table>

Total # of respondents 40. Statistics based on 40 respondents. 0 filtered. 0 shaped.
CHAPTER V

DISCUSSION

Study Summary

Given the potential of technology to enhance teaching and learning (Ringstaff & Kelley, 2002), the power to act as a “catalyst for change” (Culp, Honey, & Mandinach, 2003), and the need to prepare students to live, learn and work successfully in an increasingly digital age (Partnership for 21st Century Skills, 2003), there is little surprise that schools have been investing in technology. Unfortunately, technology has been an expensive and continual investment (Benton Foundation, 2003). Added to that, the impact of technology on student achievement is still an item of great debate. Recent federal mandates and public demand have led to increasing pressures on schools to show results and to justify such heavy expenses (McNabb, Hawkes, & Rouk, 1999).

Hoke County Schools in North Carolina, and specifically Sandy Grove Elementary, has followed these national trends in its recognition of technology’s potential, its increasing investment, and its need to justify this expense with hard evidence that technology is having the desired impact on teaching and learning. Sandy Grove is still in the early stages of its evaluation process and currently there is little hard data concerning the impact of program efforts on teaching and learning. The purpose of this study, then, was gather an early assessment of where Sandy Grove stood in its current efforts to integrate technology into the classroom, what impact these efforts were
having on teachers and students, and what is needed to move forward. With the aim of
determining Sandy Grove’s technology needs, the following research questions emerged:

6. What environmental factors do educators feel are either supporting or impeding
the use of technology?

7. In which areas do educators feel they would benefit from technology professional
development?

8. How do educators feel about the quality of current technology professional
development efforts?

9. How frequently do educators feel that technology is being effectively used to
support teaching and learning?

10. What do educators feel is the impact that technology is having on teacher practice
and learner outcomes?

The answers to these questions are intended to inform staff and building level
decision makers of the school’s technology needs, to guide future technology related
decisions and initiatives, and to provide baseline data to measure the impact of these
decisions and initiatives on teaching and learning.

A review of the literature identified several components that are needed to ensure
that a school’s investment in technology will result effective teaching practices and
student use of computers and have the desired impact teaching and learning. To begin
with, teachers and students need a supportive environment for technology use. A
supportive environment consists of several components: a strong technology leader with
a vision for technology use; a stakeholder-developed plan for technology that is
adequately funded, monitored and evaluated; ready access to quality hardware, software,
and networking; and technology support staff. Additionally, schools need quality professional development that is relevant, timely, and ongoing and is being evaluated before, during and after implementation. With these components in place, the schools will more likely witness effective uses of technology by teachers and students that ultimately leads to improved teaching practice and student achievement.

In order to assess the technology needs of Sandy Grove Elementary, the extent of its current practices, and technology’s impact on teaching and learning, a survey of Sandy Grove’s educators was conducted. The instrument chosen was the School Technology Needs Assessment (STNA) developed by the University of North Carolina at Greensboro (UNCG) and recommended in both the North Carolina State Technology Plan and North Carolina’s IMPACT Guidelines for Media and Technology Programs. The web-based survey was implemented and interpreted according to the guidelines provided by the SERVE Center and UNCG and results were presented using absolute and relative frequencies along with a color-coded bar chart to assist with visually interpreting the data.

Conclusions and Recommendations

The purpose of this study had three main objectives and was conducted for the following purpose:

1. To identify potential school technology needs of Sandy Grove Elementary.
2. To provide baseline data to determine growth and measure the success of future program initiatives, and;
3. To provide recommendations for future planning of technology related professional development, policies, or resource allocation.
This section will address objectives 1 by discussing conclusions reached about the technology needs of Sandy Grove Elementary based upon the findings from the STNA survey, as well as the researcher's prior knowledge of the research setting. Objective 3 will be addressed by making recommendations based upon the conclusions reached from the STNA findings. Regarding objective 2, the results from this STNA will provide baseline data for comparison with future surveys in order to measure growth and improvement over time.

**Potential Areas of Need**

Findings from this study suggest that, overall, teachers work in an environment where technology is supported by a number of components found to be necessary for promoting effective technology use by teachers and students. Although there is definite room for improvement, teachers generally felt that strong leadership, a vision for technology use and a plan for achieving that vision, and access to a variety of adequate technology resources were in place. However, despite this relatively supportive environment, there are a few areas of concern that may need to be addressed by the administration.

*Incentives may be needed.* Perhaps it should come as no surprise that material and non-material incentives offered for technology innovators should present an area of concern. According to a 2007 State Technology Report, North Carolina had no official statewide policies for offering "professional or financial incentives to use technology" for teachers or administrators (EPE Research Center, 2007, p. 4). Findings from the STNA indicate general disagreement as to whether incentives are being offered at all. This may suggest that only a handful of educators are being offered or have access to incentives,
while others are being overlooked; or perhaps that current incentives, especially material incentives, are felt to be inadequate by a large percentage of the staff. With the importance of these incentives for promoting teacher buy-in to technology programs; increasing attendance in technology related professional development; and increasing teacher morale, self-esteem and motivation, this is an area that Sandy Grove may need to address, especially for those reluctant to adopt new practices or technology resources or for those using technology on a frequent basis only for mandated administrative tasks such as grading, attendance, of data collection and analysis.

More support from technology staff may be needed. Despite having a full time technology facilitator and technology assistant, as well as a four district technicians, findings from the survey suggests that support staff for technology may not be meeting the needs of teachers at Sandy Grove Elementary. Research from the ACOT project found that when teachers were in the early stages of technology adoption, teachers' needs focused primarily on technical support, but as their skills and proficiency expanded, and their use of technology for instruction became more sophisticated, instructional support became just as important (as cited in Ringstaff & Kelley, 2002). For those teachers already reluctant or hesitant to use technology, or even for those open to change, the perception that technology support is not readily available when needed is a serious deterrent for teachers considering whether or not to investing time and energy into integrating technology into their teaching. A lack of solid staff support could potentially undermine other efforts taken by the school to achieve the desired outcomes and impact on teaching and learning.
Targeted technology related professional development would be beneficial.

Among the four sections of the STNA, professional development stood out as an area in which there was the greatest consensus by respondents. Despite the fact that a large majority of respondents reported that they would benefit from professional development for nearly every item, it may not be an immediate concern in those areas where high frequencies of use was reported by the majority of teachers such as locating and evaluating technology resources, differentiating instruction, or using technology to increase productivity. Areas more likely indicate a strong need for professional development are those in which a large number of teachers reported little to no use. The findings suggest professional development may more likely be needed in areas such as helping teachers to apply performance based assessment, use research techniques to improve their practice, communicate with families, as well as incorporating student activities that use authentic tools or allow them to work with students beyond the classroom.

Better communication is needed. Specific items were included in this survey to measure whether or not technology is being used to communicate with families and the community about school programs, and findings suggest that, from a leadership standpoint, it is; but when it comes to whether or not leaders are communicating with educators about technology programs, the results are not quite as positive. Although no specific items measure this aspect, a number of items about administrative functions of the technology program, functions such as budgeting and evaluation, have not been communicated to a large percentage of the staff. In many instances, 20% or more of those surveyed did not have enough information to form an opinion. Conversely, teachers
report that they are using technology to communicate and collaborate with staff, but when it comes to parents, nearly over half of staff members reported infrequent use, and many staff members reported never using technology to reach out to families.

*Further investigation is needed.* Although findings from the STNA show a staff consensus on a number of issues, there remain many areas related to a supportive environment for technology and professional development in which the staff opinion is divided. These areas touch upon the issues of incentives, technical and instructional support staff, access to computers and media, budgeting, and tracking of professional development’s impact. While no program is likely to meet every single need of every teacher, findings suggests these areas need to be investigated further to determine why the staff has mixed feeling about this issue, how teachers who felt negatively about this issue can be better supported, whether or not this is an issue that needs to be addressed on a school-wide level.

**Recommendations**

The following section provides a summary of recommendations based on findings from this study and the potential areas of concern that have been identified above. These recommendations reflect findings from both the literature review and the researcher’s own experiences as an educator in the research setting.

*Consider examining the incentive/reward structure for technology use.* Sandy Grove may need to examine its current incentives/reward structure for teachers to ensure that all teachers feel their efforts will be valued and appreciated when they have gone beyond the minimum requirements for technology use. Non-material incentives that were identified in the literature review as possible strategies include, but are not limited to:
public recognition of teachers using technology at staff meetings, articles in a local paper or district newsletter, opportunities to attend state or national technology conferences, or release time from class for planning, risk-free practice of new skills, or visiting classrooms to observe effective technology practices. Material incentives might include stipends or bonuses to attend technology-related professional development outside of school, additional classroom equipment to pilot for future adoption, or tuition reimbursement for technology-related college coursework as in the case of the study conducted by Camp (2007).

_Broaden support through traditional and non-traditional models._ Given the range of professional development desired, the diversity of needs indicated by the varying degrees of technology use, and the concerns over inadequate technology support, Sandy Grove may want to reconsider its approach to technology staff development and support. This past year, professional development focused primarily on training of administrative tools and two sessions of basic skills training on SmartBoard use. McKenzie (1999) contends that we need to deemphasize “training” and focus on “learning” through more informal support structures such as technology mentoring, peer coaching, study groups, classroom observation, and hands-on workshops. Online learning opportunities may also be an additional strategy for addressing such a broad range of needs and the scheduling and time constraints of busy teachers. Free learning management software (LMS), such as Moodle, is ideal for creating informal online professional learning communities, while more structured offerings can be provided through online professional development services such as PBS’s TeacherLine, UNC’s Learn NC, or Atomic Learning. Additionally, the use of technology support position evaluation tools such as the
IMPACT Technology Facilitator Performance Appraisal Instrument can provide insight into areas of improvement for technology support staff.

*Reconsider use of computer labs.* Based upon the finding from the STNA survey, Sandy Grove may want to consider its current use of the computer lab sessions in order to promote uses of technology that move beyond the acquisition of basic skills commonly targeted in computer-assisted instructional software and to uses that are more aligned to the goals of 21st Century Skills targeted in both the district's technology and strategic plan. Findings from the survey indicate areas of infrequent use of technology to communicate and collaborate with peers, work on projects that approach real-world applications, and create and present new ideas and representations of information. These skills are cited by both the Partnership for 21st Century Skills (2003) and the National Education Technology Standards for Students (ISTE, 2007). Given the current rigid structure of technology use during computer labs sessions, Sandy Grove may want to consider freeing either one or both of the scheduled computer lab days from the computer assisted instructional (CAI) delivery model that focuses on math and language arts basic skills, and using this time to address more sophisticated skills such as the National Educational Technology Standards for Students (NET-S). In order to facilitate this process, it is recommended that collaborative planning be established between teachers and a technology facilitator to address more authentic applications and skills that are aligned both to the NET-S, the district's pacing guide, and the state's standard course of study. Classworks can still be used to differentiate instruction and remediate students on basic skills in a classroom setting, provided a sufficient number of computers are present. Another more subtle, and perhaps less severe, alternative is the incorporation during
Classworks lab time of the Classworks embedded projects that more closely model authentic technology applications. This approach could serve as a transition from the CAI model to a more authentic approach that better address 21st century skills and uses of technology.

*Prepare to IMPACT technology.* A number of areas of concern mentioned in the previous section--concerns such as such a lack of communication, professional development, technology support, and the need for a more in-depth study--can be addressed through the adoption of the IMPACT model for medial and technology programs. The presence of a fully developed model that incorporates strategies for creating a supportive environment for technology use, a more robust approach to professional development, and tools for the evaluation of program components, can provide the guidance and initial structure that is needed for more accurately assessing and addressing the school’s technology needs and the limitations of the current study.

According to the IMPACT Guidelines for Media and Technology Programs (Public Schools of North Carolina, 2005), the first step in this process would be a school-wide in-service to create an awareness of the benefits of the IMPACT model as well a focus on the flexibility, change and collaboration that will be required to implement the model. In addition, a Media/Technology Advisory Committee (MTAC) would need to be formed to conduct a full-scale readiness assessment in order to more accurately gauge teacher skill level; hardware, software, media and network capacity and resources; scheduling needs; curriculum mapping and pacing guides; and the existing budget. With the necessary components in place, Sandy Grove could begin to create collaborative planning times between teachers and technology support staff for creation and evaluation of
multidisciplinary units of instruction that integrate technology/information skills across the curriculum.

**Areas of Further Inquiry**

Aside from the recommendations in the previous section for using additional methods to assess the technology program at Sandy Grove Elementary, questions arose during this study that present avenues for further investigation. These questions are simply presented as they were noted by the researcher throughout this project and do not follow in any specific order of importance or sequence in which they arose.

1. Despite findings in the literature by O'Dwyer, Russel, & Bebell (2004) about the impact of teachers' beliefs and their openness to change has on the extent and types of technology use, why was this construct excluded from the survey?

2. How is it possible for a majority of teachers to report that their practices when using technology are both student-centered and teacher-centered, and emphasize both productivity tools and project-based cooperative learning? This seems like an either/or proposition, though more so for the former than the latter. Does this construct attempt to measure a shift in teacher practice by providing a “before” and “after” item set?

3. To what extent is flexible access and equitable access mutually exclusive? By opening up a computer lab so that teachers could access it on a more flexible basis, it seems to follow that teachers who felt more comfortable using technology would use the lab on a regular basis, while others would not, resulting in inequitable access for students.
Limitations of Study

1. Because STNA collects perceptive data, results only depict how staff members think or feel about a given item and are therefore subject to individual biases and opinions.

2. Mathematical analysis of this descriptive quantitative data is limited to reporting the absolute and relative frequencies, as well as reporting on the mode of the data sets. A more rigorous mathematical analysis, such as the standard normal curve distributions suggested by Jenifer Corn (personal communication, June 16th, 2008) would provide a more precise measurement to use for interpreting the data sets.

3. The School Technology Needs Assessment makes no attempt to measure the teachers’ beliefs as they relate to technology, a factor which has been found in the literature to directly impact teacher and student uses of technology. (O’Dwyer, Russel, & Bebell, 2004)

4. Finally, STNA provides only a small snapshot of a technology program and its impact. Additional quantitative and qualitative data collection methods from teacher interviews, school technology inventories, focus groups, and classroom observations would provide a more accurate picture of Sandy Grove’s technology program and its needs.
Appendix A

STNA Survey
School Technology Needs Assessment (STNA)

The School Technology Needs Assessment (STNA, say "Stenna") is intended to help school-level decision makers—administrators, technology facilitators, media coordinators, or technology committee members—collect data to plan and improve uses of technology in teaching and learning activities. The STNA is designed to be completed by teachers and other educators working directly with students, and should be administered to the entire staff of any school for which needs are being assessed. STNA results are not scored or reported for each individual respondent. Instead, each person's responses are combined with those of other educators in their building, and reported at the school level in terms of how many times each possible response is selected for each item. Pilot testing indicates that it should take approximately 25 minutes to complete the STNA.

On this paper-pencil copy of the STNA, responses are coded for use with the STNA Scoring Tool spreadsheet. The numbers located next to the response checkboxes have no meaning and are provided only to aid scoring.

I. Supportive Environment for Technology Use

Selecting Responses — Section I

1. For each item, check the box below the response that best matches how much you agree with the statement — "Strongly Agree," "Agree," "Disagree," or "Strongly Disagree."

2. If you do not have enough information to form an opinion about the topic of an item, select "Do Not Know."

3. If you have enough information to form an opinion but are simply split between "Agree" and "Disagree," select "Neither Agree nor Disagree."

<table>
<thead>
<tr>
<th>&quot;In my school...&quot;</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
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<tbody>
<tr>
<td>1) A vision for technology has been developed through an effective collaboration among stakeholders, e.g., administrators, specialists, teachers, students, and community members.</td>
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<td>2) The vision for technology use has been effectively communicated to the community.</td>
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<td>3) Administrators model effective uses of technology.</td>
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<td>4) Administrators support changes in school-level systems, policies, and practices related to technology.</td>
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<td>2</td>
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<td>5) Teachers who are innovators with technology receive material incentives, e.g., stipends, perks, wavers, special opportunities.</td>
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<td>6) Teachers who are innovators with technology receive non-material incentives, e.g., public recognition, special appreciation.</td>
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<td>7) When administrators are seeking or hiring teachers, they consider technology literacy and leadership for technology as criteria for selection.</td>
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### “In my school...”

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<td>8)</td>
<td>An effective long-range school technology plan is in place.</td>
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<td>9)</td>
<td>The school technology plan is developed through an effective collaboration among stakeholders, e.g., administrators, specialists, teachers, students, and community members.</td>
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<td>10)</td>
<td>The school technology plan is monitored and updated at least once a year.</td>
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<td>11)</td>
<td>Teachers and other staff members support the school technology plan.</td>
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<td>12)</td>
<td>The amount of money budgeted for technology resources is sufficient for implementing decisions arising from planning.</td>
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<td>13)</td>
<td>The amount of money budgeted for technology resources is sufficient for continuously updating and replacing technology systems as they become outdated.</td>
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<td>14)</td>
<td>Supplemental sources of funding are actively pursued to support technology, e.g., external grants, collaboration with community or parent groups, support from businesses.</td>
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<td>15)</td>
<td>Multiple sources of data are used to evaluate the impact of technology initiatives on student outcomes.</td>
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<td>16)</td>
<td>Technology is used to communicate and collaborate with families about school programs and student learning.</td>
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<td>17)</td>
<td>Technology is used to communicate and collaborate with the community about school programs designed to enhance student learning.</td>
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<td>18)</td>
<td>The media center can be flexibly scheduled to provide equitable access to resources and instruction.</td>
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<td>19)</td>
<td>Computer labs can be flexibly scheduled for equitable access to resources and instruction. (Leave this item blank if your school has no computer labs.)</td>
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<td>20)</td>
<td>Mobile computers can be flexibly scheduled to provide equitable access to resources and instruction. (Leave this item blank if your school has no computer labs.)</td>
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"In my school..."

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<tr>
<th></th>
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<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
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<tr>
<td>21</td>
<td>Teachers and students have sufficient computer hardware available for their use, e.g., computers, digital cameras, projection devices, scanners, printers.</td>
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<td>22</td>
<td>Electronic systems for communicating within the school are adequate, e.g., e-mail among teachers and staff, network drives to upload lesson plans and grades to the main office.</td>
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<td>23</td>
<td>Electronic systems for communicating with families and the community are adequate, e.g., e-mail, teacher and school Web pages.</td>
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<td>24</td>
<td>Reliability and speed of external connections are sufficient, e.g., connections to the Internet, online databases, and other resources.</td>
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<td>25</td>
<td>Students with disabilities have appropriate and adequate access to adaptive and assistive devices.</td>
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<td>26</td>
<td>Teachers have ready access to technical support, e.g., to troubleshoot hardware or software problems, maintain systems.</td>
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<td>27</td>
<td>Library media coordinator and/or media assistant positions are adequately staffed.</td>
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<td>28</td>
<td>Technology facilitator and/or technology assistant positions are adequately staffed.</td>
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<td>29</td>
<td>Teachers and students have ready access to productivity software, e.g., graphic organizers, word processing, slide presentation, or drawing applications.</td>
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<td>30</td>
<td>Teachers have ready access to a cataloging system they can use for searching and locating teaching materials.</td>
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<td>31</td>
<td>Teachers and students have ready access to a good collection of print, multimedia, and electronic resources.</td>
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<td>32</td>
<td>When educators are selecting resource media and software, they consider both the curriculum and the needs of learners.</td>
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</table>
II. Professional Development

Selecting Responses – Section II

1. For each item, check the box below the response that best matches how much you agree with the statement - "Strongly Agree," "Agree," "Disagree," or "Strongly Disagree."

2. If you do not have enough information to form an opinion about the topic of an item, select "Do Not Know."

3. If you have enough information to form an opinion but are simply split between "Agree" and "Disagree," select "Neither Agree nor Disagree."

<table>
<thead>
<tr>
<th>&quot;I would benefit from professional development on...&quot;</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Research-based practices I can use in my teaching.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>2) Identification, location, and evaluation of technology resources, e.g., websites, that I can use with my students.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
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<tr>
<td>3) Performance-based student assessment of my students.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>4) The use of technology to collect and analyze student assessment data.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>5) Learner-centered teaching strategies that incorporate technology, e.g., project-based or cooperative learning</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>6) Online security and safety.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>7) The use of technology for differentiating instruction for students with special learning needs.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>8) Uses of technology to increase my professional productivity.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>9) Ways to use technology to communicate and collaborate with families about school programs and student learning.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>10) Ways to use technology to communicate and collaborate with other educators.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>11) Alignment of lesson plans to content standards and student technology standards.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>12) Use of research or action research projects to improve technology-enhanced classroom practices.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>13) Use of data for reflecting on my professional practices.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>14) Use of data to make decisions about the use of technology.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>15) Use of technology to participate in professional development activities, e.g., online workshops, hands-on training in a computer lab.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
</tbody>
</table>
"In my school..."

<table>
<thead>
<tr>
<th>Professional Development Quality</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>16) Educators in charge of professional development use data from teachers' needs assessments to determine technology professional development topics and activities.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>17) Technology professional development is timely</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>18) Technology professional development is relevant</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>19) Technology professional development is ongoing.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>20) Teachers have an opportunity to evaluate technology professional development activities in which they participate.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>21) The impact of technology professional development is tracked using data on classroom practice.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>22) The impact of technology professional development is tracked using data on student learning.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
</tbody>
</table>
III. Teaching and Learning

Selecting Responses – Section III

1. For each item, check the box below the response that comes closest to indicating how often you do the described activity - "Daily," "Weekly," and so on.

2. If you do not have enough information to select a number response for an item, select "Do Not Know."

<table>
<thead>
<tr>
<th>&quot;In the settings where I work with children...&quot;</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Once per Grading Period</th>
<th>Never</th>
<th>Do Not Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) I consult publications, online journals, or other resources to identify research-based practices I can use in teaching with technology.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>2) I identify, locate, and evaluate technology resources, e.g., websites.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>3) I apply performance-based student assessment to technology-enhanced lessons, e.g., student portfolios, student presentations.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>4) I use technology regularly to collect and analyze student assessment data.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>5) My lessons include technology-enhanced, learner-centered teaching strategies, e.g., project-based learning.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>6) I apply policies and practices to enhance online security and safety.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>7) I use technology to differentiate instruction for students with special learning needs.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>8) I use technology to support and increase my professional productivity.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>9) I use technology to communicate and collaborate with families about school programs and student learning</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>10) I use technology to communicate and collaborate with other educators.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>11) My lesson plans refer to both content standards and student technology standards.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>12) I do research or action research projects to improve technology-enhanced classroom practices.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>13) I use multiple sources of data for reflecting on professional practice.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>14) I use multiple sources of data to make decisions about the use of technology.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
<tr>
<td>15) I use technology to participate in professional development activities, e.g. online workshops, hands-on training in a computer lab.</td>
<td>□ 1</td>
<td>□ 2</td>
<td>□ 3</td>
<td>□ 4</td>
<td>□ 5</td>
<td>□ 6</td>
</tr>
</tbody>
</table>
"In the settings where I work with children..."

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>16) Students use a variety of technologies, e.g., productivity, visualization, research, and communication tools.</td>
<td>Daily</td>
<td>Weekly</td>
<td>Monthly</td>
<td>Occasionally</td>
<td>Grade Period</td>
<td>Never</td>
</tr>
<tr>
<td>17) Students use technology during the school day to communicate and collaborate with others, beyond the classroom.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18) Students use technology to access online resources and information as a part of classroom activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19) Students use the same kinds of tools that professional researchers use, e.g., simulations, databases, satellite imagery.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20) Students work on technology-enhanced projects that approach real-world applications of technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21) Students use technology to help solve problems.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22) Students use technology to support higher-order thinking, e.g., analysis, synthesis, and evaluation of ideas and information.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23) Students use technology to create new ideas and representations of information.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IV. Impact of Technology

Selecting Responses – Section IV

1. For each item, check the box below the response that best matches how much you agree with the statement - “Strongly Agree,” “Agree,” “Disagree,” or “Strongly Disagree.”

2. If you do not have enough information to form an opinion about the topic of an item, select “Do Not Know.”

3. If you have enough information to form an opinion but are simply split between “Agree” and “Disagree,” select “Neither Agree nor Disagree.”

<table>
<thead>
<tr>
<th>&quot;In the settings where I work with children...&quot;</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Do Not Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) My teaching is more student-centered and interactive when technology is integrated into instruction.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2) My teaching practices emphasize teacher uses of technology skills to support instruction.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3) My teaching practices emphasize student uses of productivity applications, e.g., word processing, spreadsheet.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4) My teaching practices emphasize student uses of technology as an integral part of specific teaching strategies, e.g., project-based or cooperative learning.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5) Technology has helped my students become more socially aware, confident, and positive about their future.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6) Technology has helped my students become independent learners and self-starters.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7) Technology has helped my students work more collaboratively.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8) Technology has increased my students' engagement in their learning.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9) Technology has helped my students achieve greater academic success.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Appendix B

Approval Letter from the Human Subjects
Institutional Review Board
WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

APPLICATION FOR PROJECT REVIEW

I. REQUIRED HUMAN SUBJECTS WEB-BASED TRAINING AT
   www.citiprogram.org must be completed before HSIRB can approve this protocol.

II. PROJECT TITLE: An Elementary School Case Study of Technology Implementation

III. INVESTIGATOR INFORMATION

   WMU INVESTIGATORS
   PRINCIPAL INVESTIGATOR OR ADVISOR
   Name: Robert Leneway
   Assistant Professor
   Degree Attained: PhD
   Email Address: bob.leneway@wmich.edu
   Street or Campus Address:
   City: State: ZIP:
   Office Phone: Home Phone:
   Human Subjects web training at www.citiprogram.org completed: Select one
   
   CO-PRINCIPAL OR STUDENT INVESTIGATOR
   Name: Shaun Kellogg
   Degree Attained: BA
   Email Address: sbkellogg@hotmail.com
   Street or Campus Address: 226 Harris Ave
   City: Raeford
   State: NC ZIP: 28376
   Office Phone: 269-718-7454 Home Phone: 269-718-7454
   Human Subjects web training at www.citiprogram.org completed: Yes
   Status and level of involvement of student investigator:
   ☐ Undergraduate ☐ Master level ☐ Doctoral level
   ☒ Assisting ☐ Thesis ☐ Dissertation ☐ Other (please specify):

   CO-PRINCIPAL OR STUDENT INVESTIGATOR
   Name: Degree Attained:
   Email Address:
   Street or Campus Address:
   City: State: ZIP:
   Office Phone: Home Phone:
   Human Subjects web training at www.citiprogram.org completed: Select one
   Status and level of involvement of student investigator:
   ☐ Undergraduate ☒ Master level ☐ Doctoral level
   ☐ Undergraduate ☒ Master level ☐ Doctoral level
If there are more WMU investigators, please complete the "Additional WMU Investigators" form.

COLLABORATING INVESTIGATORS AND AFFILIATIONS
Name: Affiliation:
Name: Affiliation:
Name: Affiliation:

IV. PROPOSED PROJECT DURATION:
From (mm/dd/yyyy): 01/09/07
To (mm/dd/yyyy): 05/07/07
(maximum one year later)

V. TARGETED PARTICIPANT POOL
Total number of subjects: 35
Number of subjects in the control group: 0
Age range (lower limit – upper limit, e.g., 18-99): 20-65
Gender: Both
Targeted Race/Ethnicity: None/Not applicable
Inclusionary criteria: certificated teacher
Exclusionary criteria: non-certificated teacher
Source of participants: Sandy Grove Elementary
Length of participation (x min/session, y sessions, over z months): 25min/session, 1 session

Targeted Participants in Special Consideration Categories: (Check all that apply.)
☑ None
☐ Children (age range: )
☐ Cognitively impaired persons
☐ Prisoners
☐ Pregnant or lactating women
☐ Blind individuals
☐ Other subjects whose life circumstances may interfere with their ability to make free choice in consenting to take part in research (please specify):

VI. FUNDING
Funding source: None
WMU proposal number for funded project:
Date of submission to funding agency:

VII. RESEARCH SITE(S)
Site(s) and organizations involved in data collection and or research activity: WMU,
Sandy Grove Elementary
Letters of approval from project site officials:
will be submitted when site is approved by HSIR3
Date: January 31, 2008

To: Robert Loneway, Principal Investigator
    Shawn Kellogg, Student Investigator for thesis

From: Amy Nangle, Ph.D., Chair

Re: HSIRB Project Number: 08-01-29

This letter will serve as confirmation that your research project entitled "An Elementary School Case Study of Technology Implementation" has been approved under the exempt category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: January 31, 2009
VIII. Protocol Outline

Prepare and attach a proposal that follows the outline below. NUMBER YOUR PAGES. Do not submit your thesis or dissertation proposal, grant application, etc. Please review your proposal and mark each box below with a ✔ following review of that section.

- ✔ ABSTRACT: One page maximum
- ✔ PURPOSE BACKGROUND INFORMATION:
- ✔ SUBJECT RECRUITMENT: Describe in detail how you intend to contact and recruit participants. Attach all written advertisements. posters and oral recruitment scripts.
- ✔ INFORMED CONSENT PROCESS: Describe the process by which informed consent will be obtained. If the participant is a child or mentally challenged, explain how the parent(s) guardian(s) will be contacted for consent and how the researcher will insure that the participant understands and assents to the research.
- ✔ RESEARCH PROCEDURE: (including what exactly subjects will do as part of the study). Method of data collection. Instrumentation. Location of data collection. and Duration of the study.
- ✔ METHODOLOGY: Design. Analysis. and Dissemination (e.g. thesis. dissertation. peer-reviewed journal. presentation).
- ✔ RISKS AND COSTS TO AND PROTECTIONS FOR SUBJECTS: Describe the nature and likelihood of possible risks (e.g., physical. psychological. social. economic) so far as they are known. Risks include mild discomforts, inconveniences, and potential for disclosure of sensitive information. Describe measures to be taken to protect subjects from possible risks or discomforts.
- ✔ BENEFITS OF RESEARCH: Briefly describe the expected or known benefits of the research. Indicate benefits specific to the research participant. longer term or more general benefits. and benefits to the knowledge base.
- ✔ CONFIDENTIALITY OF DATA: Describe precautions to ensure the privacy of subjects and confidentiality of information. Be explicit if data are sensitive. Describe coding procedures for subject identification. Include the method. location and duration of data retention. (Federal regulations require data to be maintained for at least 3 years. Your professional society may require you to keep it longer.)
- ✔ APPENDICES: Attach questionnaires. interview scripts. and data collection instruments. etc. Attach coding sheets for video- or audio-tapes and other data collection procedures. Attach a copy of all consent assent documents. including non-English and Braille translations. if applicable.
IX. CONSENT DOCUMENT DEVELOPMENT CHECKLIST

The following information must be included in the consent document. Mark (√) each of the requirements you have included. Omitted information must be justified on a separate sheet of paper. Sample consent documents are posted on the HSIRB WebPage under Consent Assent Document Development.

GUIDELINES

☐ Leave a minimum top margin of 2 inches on all pages. Submit the final version of the consent document without headers such as “Draft” or “Appendix.”

☐ Language in the form of an invitation to participate AND at a reading level appropriate for the participants.

Note that the mean reading level in the United States is 6th grade.

☐ Do not include phrases like “I am aware” or “I understand” anywhere in the document.

☐ Do not include language that would absolve the researcher of responsibility for negligence.

REQUIRED COMPONENTS

☐ A header that includes “Western Michigan University, Department of _______” (if departmental letterhead is not used). Principal Investigator: (name). Student Investigator: (name(s)).

☐ The nature, purpose, and duration of the study.

☐ Procedures to be employed in the research: exactly what the subject is expected to do.

☐ Risks (hazards, inconveniences, discomforts) the subject may undergo, so far as they are known, and how any risks will be minimized.

☐ Benefits to the subject (and to the general subject population)

☐ Conditions of participation.

☐ How confidentiality will be maintained and any limits to confidentiality.

☐ Statement that the participant can refuse to participate: stop participating at any time: or refuse to answer any question without prejudice, penalty, or risk of any loss of service he/she would otherwise have.

☐ The researchers’ names and telephone numbers (including the faculty advisor) as well as the following statement: “You may also contact the Chair: Human Subjects Institutional Review Board (387-8293) or the Vice President for Research (387-8298) if questions or problems arise during the course of the study.”

☐ A place for date and signature of participant and a witness line, if required (e.g., with subjects who are not legally competent); a place for date and signature of translator, if applicable; a place for date and signature (or initials) of individual obtaining the consent, if applicable.

☐ The following statement must be included in all consents: “This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.”

The following are only to be included if appropriate:

☐ If there is physical activity or a possibility of physical injury, include the statement: “As in all research, there may be unforeseen risks to the participant. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be available to you except as otherwise stated in this consent form.” Any available compensation or additional treatment should then be specified, if appropriate.

☐ If the research is therapeutically related, disclose alternate procedures the subject might choose.

☐ Circumstances under which the researcher may terminate the subject’s participation.

☐ Any additional costs the participant may have to bear.

☐ Consequences of the participant’s withdrawal from the study.

☐ The approximate number of participants in the study.

☐ Debriefing procedures.
X. LEVEL OF REVIEW

- **Administrative or Expedited:** This project does not require a full board review because it meets at least one of the following criteria: data collection is anonymous.

  Forward the original application to the office of the research compliance coordinator, 251W Walwood Hall.

- **Full:** Forward original application plus 15 copies to the office of the research compliance coordinator, 251W Walwood Hall.

  If blood products are involved, you must complete and attach the HSIRB collection of blood and blood products form.

  Your application must be in the research office by 5:00 pm on the first Wednesday of the month in order to be reviewed at the board meeting on the third Wednesday of that month.

XI. CERTIFICATION/SIGNATURE

I certify that the information contained in this HSIRB application and all attachments is true and correct. I certify that I have received approval to conduct this research from all persons named as collaborators and from officials of the project sites. If the Human Subjects Institutional Review Board approves this proposal, I agree to conduct the research according to the approved protocol. I agree not to implement any changes in the protocol until such changes have been approved by HSIRB. If, during the course of the research, unanticipated risks or harm to subjects are discovered, I will report them to HSIRB immediately.

/ ___________________________________________________________________
Principal Investigator/Faculty Advisor Signature Date

/ ___________________________________________________________________
Co-Principal or Student Investigator Signature Date

/ ___________________________________________________________________
Co-Principal or Student Investigator Signature Date

/ ___________________________________________________________________
Co-Principal or Student Investigator Signature Date
Appendix C

Consent Form
You are invited to participate in a research project entitled "An Elementary School Case Study on Technology Implementation" designed to identify staff technology needs. Results from the School Technology Needs Assessment (STNA) are intended to help school-level decision makers—administrators, technology facilitators, media coordinators, or technology committee members—collect data to plan and improve uses of technology in teaching and learning activities. The study is being conducted by Dr. Robert Leneway and Shaun Kellogg from Western Michigan University, Department of Educational Leadership, Research and Technology. This research is being conducted as part of the Thesis requirements for Shaun Kellogg.

STNA is comprised of 86 items and will take approximately 25 minutes to complete. Your responses will be completely anonymous. You may choose to not answer any question and simply leave it blank. If you choose to not participate in this survey, you may close the web browser and exit the computer lab. Submitting the survey indicates your consent for use of the answers you supply. If you have any questions, you may contact Dr. Robert Leneway at (269) 387-3465, Shaun Kellogg at 269-718-7454, the Human Subjects Institutional Review Board (269-387-8293) or the vice president for research (269-387-8298).

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board as indicated by the stamped date and signature of the board chair in the upper right corner. You should not participate in this project if the stamped date is more than one year old.
Appendix D

Letter to Principal
Mr. Dawson,

I was hoping I could meet with you this week about potentially surveying the staff as part of my Masters Thesis. The purpose of the survey is to assess the technology needs of a school in order to determine areas in which either professional development or technology support is needed. I thought this would mesh nicely with HCS’s strategic priority 2, goal 2 by providing data to justify and guide decision making for future professional development.

The survey was developed by the SERVE Center at the University of North Carolina Greensboro and is intended to be used as one step in a readiness assessment for implementing the IMPACT Model for Median and Technology Programs. It would take teachers and support staff approximately 20-25 minutes to complete online and we would have the results immediately.

I've attached a copy of the paper-based survey for you to look over. When would be a good time to meet and discuss potential dates for administering the survey?

Shaun Kellogg
Appendix E

NETS-T
I. Technology Operations and Concepts
Teachers demonstrate a sound understanding of technology operations and concepts. Teachers:
A. demonstrate introductory knowledge, skills, and understanding of concepts related to technology (as described in the ISTE National Educational Technology Standards for Students).
B. demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies.

II. Planning and Designing Learning Environments and Experiences
Teachers plan and design effective learning environments and experiences supported by technology. Teachers:
A. design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners.
B. apply current research on teaching and learning with technology when planning learning environments and experiences.
C. identify and locate technology resources and evaluate them for accuracy and suitability.
D. plan for the management of technology resources within the context of learning activities.
E. plan strategies to manage student learning in a technology-enhanced environment.

III. Teaching, Learning, and the Curriculum
Teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning. Teachers:
A. facilitate technology-enhanced experiences that address content standards and student technology standards.
B. use technology to support learner-centered strategies that address the diverse needs of students.
C. apply technology to develop students' higher-order skills and creativity.
D. manage student learning activities in a technology-enhanced environment.

IV. Assessment and Evaluation
Teachers apply technology to facilitate a variety of effective assessment and evaluation strategies. Teachers:
A. apply technology in assessing student learning of subject matter using a variety of assessment techniques.
B. use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and
maximize student learning.
C. apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication, and productivity.

V. Productivity and Professional Practice
Teachers use technology to enhance their productivity and professional practice. Teachers:
A. use technology resources to engage in ongoing professional development and lifelong learning.
B. continually evaluate and reflect on professional practice to make informed decisions regarding the use of technology in support of student learning.
C. apply technology to increase productivity.
D. use technology to communicate and collaborate with peers, parents, and the larger community to nurture student learning.

VI. Social, Ethical, Legal, and Human Issues
Teachers understand the social, ethical, legal, and human issues surrounding the use of technology in PK-12 schools and apply those principles in practice. Teachers:
A. model and teach legal and ethical practice related to technology use.
B. apply technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities.
C. identify and use technology resources that affirm diversity.
D. promote safe and healthy use of technology resources.
E. facilitate equitable access to technology resources for all students.
Appendix F

NETS-S
1. Creativity and Innovation
Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:
   a. apply existing knowledge to generate new ideas, products, or processes.
   b. create original works as a means of personal or group expression.
   c. use models and simulations to explore complex systems and issues.
   d. identify trends and forecast possibilities.

2. Communication and Collaboration
Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:
   a. interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
   b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.
   c. develop cultural understanding and global awareness by engaging with learners of other cultures.
   d. contribute to project teams to produce original works or solve problems.

3. Research and Information Fluency
Students apply digital tools to gather, evaluate, and use information. Students:
   a. plan strategies to guide inquiry.
   b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
   c. evaluate and select information sources and digital tools based on the appropriateness to specific tasks.
   d. process data and report results.

4. Critical Thinking, Problem Solving, and Decision Making
Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:
   a. identify and define authentic problems and significant questions for investigation.
   b. plan and manage activities to develop a solution or complete a project.
   c. collect and analyze data to identify solutions and/or make informed decisions.
   d. use multiple processes and diverse perspectives to explore alternative solutions.

5. Digital Citizenship
Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:
   a. advocate and practice safe, legal, and responsible use of information and technology.
b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.
c. demonstrate personal responsibility for lifelong learning.
d. exhibit leadership for digital citizenship.

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


