LEADING COMPLEX DECISION-MAKING IN TECHNOLOGY INTEGRATION INVESTMENT: A DESCRIPTIVE CASE STUDY OVER TIME OF THE LEADERSHIP ROLES IN THE DECISION-MAKING PROCESS OF A NEW ENGLAND SCHOOL DISTRICT

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Abstract
Organizations that will experience change due to the integration of new technology must have a process in place to make decisions that reflect the needs of the stakeholders. This thesis examined the leadership roles in a school district’s decision-making process concerning technology selection, adoption, and integration for a New England high school. Specifically, the study explored the involvement of various stakeholders at different stages of the process (initial development of the plan; selection and integration of the tool; and rollout and adoption of the technology) to ascertain the leadership functions they assumed over time related to the Complexity Leadership Theory in order to facilitate the decision-making process associated with a technology investment for a high school. This descriptive case study utilized one-on-one, semi-structured interviews with participants to collect data, and sought to address a gap in the literature concerning research related to school technology integration leadership. Eleven themes emerged from the analysis of the data revealing that there was a process in place in the subject school district, guided by the overarching presence of shared leadership as demonstrated by the actions of the stakeholders during the course of the selection decision. Furthermore, while the district did not make a knowing choice to follow the Complexity Leadership Theory, it provided an environment that was conducive to allow similar practices to develop. Recommendations for effectively using a technology selection decision-making process that allows for the participation of the key stakeholders are also offered.

Keywords: school technology integration, one-to-one, stakeholder involvement, shared leadership, complexity leadership theory, technology integration process
Acknowledgements

I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I—
I took the one less traveled by,
And that has made all the difference.
Robert Frost - *The Road Not Taken*

"It's supposed to be hard. If it wasn't hard, everyone would do it. The hard...is what makes it great."
Jimmy Dugan (Tom Hanks) - *A League of Their Own*

I would like to dedicate this dissertation to my parents Patrick and Bridget (née McHugh) of County Leitrim and County Donegal, respectively. Even though growing up in rural Ireland neither one received a formal education beyond a few years of grade school, they instilled in me an appreciation for the value of learning from an early age. Hopefully, they are now smiling down from above.

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program within the originally estimated timeframe. I tried to ensure that I didn’t miss any important events during that time. Hopefully, I was successful…

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Chapter 1—Introduction

Statement of the Problem

Just as technology’s introduction in business and society in general has had a profound impact on peoples’ lives, its integration into the education sector has greatly influenced the way teachers teach, and students learn. Yet, based upon my experience in the fields of business and education, these effects are not evenly felt because of the sometimes imperfect manner in which the technology tools are introduced. Unlike in a business setting where a major technology project may involve analysis of the users’ needs, detailed written requirements, an assessment of the supporting infrastructure, and a detailed project plan agreed to by all constituents, technology often shows up in a school unannounced and unplanned. Additionally, as a recent New York Times article pointed out, “schools are spending billions on technology, even as they cut budgets and lay off teachers, with little proof that this approach is improving basic learning” (Richtel, 2011). From observation during my career in business and now in education, this may be due to the organizational structure of a school district, the sudden availability of a funding source, the latest technology article read by an administrator, or any of a host of other reasons. Studies that have focused on the decisions regarding the selection, integration, and adoption of technology have shown mixed results in terms of success on both the positive and negative side. In some cases these decisions include an effective plan for technology integration, and studies such as Buckenmeyer (2010), Lei and Zhao (2008), and Lowther, Inan, Strahl, and Ross (2008) have indicated that teachers and students can then put the technology to practical use, often leading to positive results in learning. In his study, Buckenmeyer (2010) stressed the important link between teacher professional development and positive attitudes towards technology adoption in the classroom. Lei and Zhao (2008) explored the impacts that ubiquitous access to a technology
tool such as a laptop had on student learning experiences, both inside and outside the classroom. In their research, Lowther et al. (2008) studied the correlation between technology integration and student-centered teaching methods.

However other studies, such as An and Reigeluth (2011), Donovan, Green, and Hartley (2010), and Hew and Brush (2007), indicate that problems sometimes arise when there has not been sufficient prior planning concerning a technology integration project, and considerations for teacher training, technology department support, and potential changes in curricular assessments are not addressed in a timely manner. An and Reigeluth (2011) studied the limitations of “one size fits all” professional development programs that try to cram a large amount of information into a short training session, but overlook the relationships among technology, pedagogy, and content. Donovan et al. (2010) set out to examine the impact of different implementation configurations on student engagement, and also found a wide range of off-task behavior exhibited regardless of which configuration was chosen. Hew and Brush (2007) looked at the need for a shared vision for technology integration in the K-12 classroom, or risk not meeting the goal of enhancing student learning of the curriculum.

Any organization that will experience change due to the integration of new technology must have a process in place to make decisions concerning all aspects of the acquisition. However, within K-12 school districts, top-down, bureaucratic decisions often take place without adequate representation of the constituents who will be affected. As a result, problems sometimes arise when the decision-making process does not involve adequate prior planning, and considerations for teacher training (Lawless & Pelligrino, 2007), technology department support (Raths, 2012), and potential changes in curricular assessments are not addressed in a timely manner (Blair, 2012). Since organizational change literature has shown that participation
of all key stakeholders can increase acceptance, adoption and sustainability of changes such as technology integration (Yukl, 2010), allowing school district leaders “[t]o rely on the ‘unanticipated consequences’ of laptops as Trojan Horses for educational change is not a realistic strategy” (Garthwait & Weller, 2005). In other words, purchasing technology and asking people to use it will not automatically result in improved educational outcomes. Therefore, more needs to be known about the relationship that exists between all of the stakeholders involved in a technology investment selection decision, as well as how to improve those stakeholders’ level of participation throughout the process, which are both key elements in effective 21st century school district leadership.

Going forward, the leaders of school districts (and their private and public partners) will continue to be called upon to fund initiatives designed to equip students and teachers with technology tools intended to improve student engagement. Yet, research studies have shown contradictory results with regard to such goals, often due to technology integration decisions coming from the top-down without the involvement of all of the stakeholders who will be affected. More specifically, leadership is a key component in any decision-making process, and many leadership studies have been focused on bureaucratic organizations rooted in the previous century rather than those that comprise the current “knowledge economy” (Uhl-Bien, Marion, & McKelvey 2007). Therefore, the purpose of this doctoral research project was to explore the leadership roles in a school district’s decision-making process concerning technology selection, adoption, and integration for a New England high school. Specifically, the study explored the involvement of various stakeholders at different stages of the process (initial development of the plan; selection and integration of the tool; and rollout and adoption of the technology) to
ascertain the leadership functions they assumed over time in order to facilitate the decision-making process associated with a technology investment for a high school.

**Research Questions**

In order to understand stakeholders’ experiences related to one technology selection investment decision in a New England school district, the following research questions were utilized:

**Central Question:**

- How does a school district make technology investment decisions?

**Sub-questions:**

- How were leadership roles distributed throughout the decision-making process?
- How did the stakeholders describe their experiences in each phase of the process?

**Significance of the Problem**

Why should educational researchers be concerned with whether or not school district decision-making processes result in the selection of technologies for which integration is acceptable and sustainable for all stakeholders? Researchers should be concerned about this problem of practice because there appears to be a gap in the research that has been conducted to date. As previously indicated, studies (e.g. Buckenmeyer, 2010; Lei & Zhao, 2008; Lowther et al., 2008) have shown that the ubiquitous provision of technology to students and teachers leads to increased engagement, support for learning activities, improved attendance, and positive results in student achievement. However, other studies (e.g. An & Reigeluth, 2011; Donovan et al., 2010; Hew & Brush, 2007) have also shown inconsistent results with regard to improved student achievement, especially improvements that narrow the so-called academic gap between low and high socioeconomic groups. This has often been the result of the method in which the
plan is implemented. If school districts, and their private and public partners, are to continue to fund the purchase of technology tools intended to improve student outcomes, these contradictory findings reveal that more needs to be known about the “best practices” that have been used to put these projects in place. Best practices are important not only for the research community, but also for all stakeholders who are involved with purchase or use of the technology.

From the economic standpoint, all of the stakeholders who are responsible for funding the technology selected for integration want to ensure that purchases are made in a fiscally responsible manner. School districts or grant providers are being asked to spend large amounts of money—either tax receipts or corporate goodwill—to purchase computer devices for teachers and students, and they will want proof that their investments have been worthwhile. This is also true for parents of students in districts that require students to bring their own devices to school, and who must invest in these devices. Technology is a major investment for any institution, therefore stakeholders want to safeguard that they are making the most effective and productive decisions. For instance, Larkin (2011) and Larkin and Finger (2011) found that the provision of computers in a 1:2 ratio rather than a 1:1 ratio is optimal, as well as more cost effective, in achieving a “balance between productivity, student engagement, social activity, and individualised learning” (Larkin, 2011, p. 101). Financial responsibility is essential in order to make sure that resources remain available to provide students with the equipment needed to optimize their learning with technology.

Technology is frequently part of students’ everyday learning experience, and from the students’ perspective, they are the “digital natives” who have only known a world where technology is constantly available (Prensky 2001, para. 5). Yet, in many schools, they must “power down” (Prensky, 2001, para. 15) or check their technology at the door, so to speak,
because their own devices cannot be used within the school, and the available technology in the school is scarce and outdated. These students need to be able to learn to effectively use technology as a tool so that they will become productive citizens in the global society of the 21st century. In a subsequent article, Prensky (2005) stated that “educating or evaluating students without these tools makes no more sense to them than educating or evaluating a plumber without his or her wrench” (p. 12). In other words, technology has shaped who the students are and how they think. Therefore, it is a natural learning tool for students who are digital natives. Since technology is central to the current generation of students, these tools are also essential for their teachers who are helping them learn.

Teachers need the tools with which to engage students to work collaboratively, to solve “real-world” problems, and to not only consume online information, but also to create and share it. Students already frequently engage in this type of work outside of school. Teachers need the training and the equipment so they can also engage students in this type of thinking within school. Prensky (2005) puts it succinctly: “Kids do know what engagement is: Outside school, they are fully engaged by their 21st century digital lives. If educators want to have relevance in this century, it is crucial that we find ways to engage students in school” (p. 11). If public K-12 education continues to stress the use of 20th century teaching techniques in a fast-paced, digital age, our society risks graduating students who will not be prepared to be the knowledge workers necessary to be competitive in the 21st century economy. In order to give students the access they need to modern technology, there must be a process in place that helps schools purchase, integrate, and monitor technology use. This research has made a contribution to help ensure that organizations have effective processes in place to do so.
Positionality Statement

The integration of technology is a key element in a student-centered learning environment, yet the manner in which such tools are introduced and used by teachers and students is not always the most efficient. The research study that I have chosen, which sought to understand stakeholders’ experiences related to a technology selection investment decision, is directly connected to perspectives I have developed regarding technology in three primary aspects of my life: Personal life, working in the business sector, and working in the educational sector. These three perspectives will form the structure in which I will present my position as a scholar-practitioner in relation to this study.

In my personal life, I have always supported the use of technology to find better, more efficient ways to get things done. I have always encouraged my own children to use technology when doing their schoolwork and for entertainment, and I make myself available to assist colleagues and friends with technology questions. The ability to seamlessly utilize technology to access information that was previously only available to an elite few, is a powerful way in which to “level the playing field” for all who are seeking knowledge. I see the use of technology by young and old alike as a means of opening hitherto inaccessible worlds to exploration leading to a richer, deeper understanding of previously unimaginable concepts. Readily available access to information, combined with the ability to discern the credibility of the source of such information, is a requirement that is crucial to one’s ability to survive in the 21st century. In sum, I am a self-proclaimed fan of technology, and I believe it is a useful tool in individuals’ personal lives and also in their professional work.

As a business analyst for several companies, I also was able to demonstrate the uses and needs of technology for individuals while working on a number of technology implementation
initiatives in the role of liaison between technology users and providers. In that role, I would be the interface between the two groups. I would translate the users’ needs to the programmers so that the solutions they developed would meet the requirements of the business unit. On the other side, I would explain the capabilities of certain technology applications to the users in terms that they could understand so that they could make informed decisions about how to proceed. And, by having a foot in both worlds, I could see the positive results that technological changes had on business practices.

I specifically decided to change careers and enter education in order to find a similar role in which I could collaborate with teachers and students in order to integrate technology into the curriculum. I believe technology should be used as a tool in school, as it is in the business world, to allow access to information and to streamline processes. In order to make this transition, my research found that the Library Media Specialist was the position that matched my interests, and I completed a master’s program in Educational Technology that also gave me K-12 certification in a New England state. I believe that in order for teachers and students to effectively use technology as a tool, there is an ongoing need for the media specialist’s role in all schools to guide both groups in the efficient location, evaluation, analysis, synthesis, and presentation of information.

That transition has led to my current position as a library media specialist at a large urban public high school in the Northeast. In this role, I work with teachers and students on a daily basis to enable them to research information (both in print and online), evaluate and understand that information, and then utilize it to communicate the results to teachers and peers through various creative mediums. I have also participated in school-wide and district-wide committees focused on improvements in curriculum and student achievement. Through this participation, I
have been able to work with leaders at both the school and district level, and have been able to make contributions to discussions concerning technology integration solutions based upon my previous experience. In addition to working with teachers and students through an instructional technology role, I have also had the opportunity to work with how schools fit in to a district wide plan.

I also work closely with the high school’s Technology Leader, which has afforded me the opportunity to observe obstacles to technology integration such as inadequate infrastructure planning or the lack of funding for proper teacher training on the use of new hardware or software. Through this relationship, I have been able to discern a lack of communication among the various stakeholders within the district with regard to various decisions concerning the acquisition and integration of potential technology solutions. These factors seemed to me to be in opposition to the manner in which similar projects were approached when I had worked in the business sector. For instance in business, a new integration of technology would involve a detailed, step-by-step plan of each phase. Whereas in schools, I have observed technology projects beginning before a project leader has even been identified. These potential roadblocks also paralleled the themes developed in my review of the literature surrounding school technology integration.

As a result of these observations, as well as my interest in leadership at the school district level, this research study evolved from one focused on one-to-one computing related to student achievement to a study of the leadership roles assumed during the decision-making process leading to a new technology acquisition. It is hoped that the results of the study will contribute to school administrators’ understanding of all phases of the decision-making process, the importance of multiple perspectives in that process, and the comprehensive social interaction
needed for sustainable choice. Further, the results may also potentially justify continued investment in technology by school districts, possibly increasing the need for district level technology administrator roles to ensure that best practices involving hardware and software integration are standard across schools.

**Theoretical Framework**

**Theory selection rationale.** Given my desire as a scholar-practitioner to bridge knowledge from business with current research in education, the use of a theoretical lens related to decision-making and leadership seemed practical. However, many of these theories focused only on a hierarchical leader-follower dynamic derived from the industrial era. Since the world has essentially moved forward into a knowledge era, and decisions now involve the participation of multiple stakeholders at various times in the decision-making process, the Complexity Leadership Theory proposed by Uhl-Bien, Marion, and McKelvey (2007) was selected as an appropriate framework for this study. This theory, which builds upon the Leader-Member Exchange (LMX) theory advanced by Dansereau, Graen, and Haga (1975), and Graen and Cashman (1975), moved away from previous attempts at simplification of decision-making processes by proposing the interaction of three leadership roles (adaptive, administrative, and enabling) that constantly strive to maintain a balance in order to address ever-changing situations faced by those involved in a decision-making process (Yukl, 2010).

**Features of the model.** Drawing upon a concept originally conceived for the physical sciences, the Complexity Leadership Theory (Uhl-Bien et al., 2007) is comprised of three connected leadership positions. Uhl-Bien et al. (2007) explained that in Complexity Leadership Theory there are “three entangled leadership roles (i.e., adaptive leadership, administrative leadership, and enabling leadership) that reflect a dynamic relationship between the bureaucratic,
administrative functions of the organization and the emergent, informal dynamics of complex adaptive systems (CAS)” (p. 298). In other words, rather than concentrating on individual leaders as had previously been done, this theory highlights the leadership that emerges from the adaptive interaction between all of the participants in response to an ever-changing internal and external environment. To further clarify this theory, each of the three leadership roles will be explored in a bit more detail.

*Administrative leadership* focuses on alignment and control, and relates to “actions of individuals and groups in formal managerial roles who plan and coordinate activities to accomplish organizationally-prescribed outcomes in an efficient and effective manner” (Uhl-Bien et al., 2007, p. 305). Essentially, one may perform a bureaucratic (administrative) function that provides the order and control needed to run the day-to-day operations required to move the organization forward towards its goals. These activities may include controls that are beneficial to the organization, such as controlling costs, allocating resources, and medium- and long-term planning.

At the other end of the spectrum are those playing roles that are more flexible, innovative, and creative (adaptive) with respect to environmental stimuli. Uhl-Bien et al. (2007) define *Adaptive leadership* as “adaptive, creative, and learning actions that emerge from the interactions of CAS as they strive to adjust to tension” (p. 305). These individuals are not necessarily bound by the “company rules” as they make decisions based upon personal vision and values. However, adaptive leadership is not so much defined by individuals, as by the interactions, negotiations, and alliances between groups of individuals in response to a particular situation or problem.
Uhl-Bien et al. (2007) describe the third leadership function as follows: “*Enabling leadership* works to catalyze the conditions in which adaptive leadership can thrive and to manage the *entanglement*…between the bureaucratic (administrative leadership) and emergent (adaptive leadership) functions of the organization” (Uhl-Bien et al., 2007, p. 305). This role is played by those who seek to bridge the previous two extremes and maintain a balance between them by supporting a shared leadership approach that is dependent on the situation at hand. These facilitators seek to be responsive to the needs of the organization by overcoming problems or conflicts that may arise between the other two roles to ensure that there is enough loosening of bureaucracy combined with control of creativity to allow innovative outcomes to occur. However, in all cases, these functions or roles are not assigned to specific individuals; instead, different individuals may assume them at different moments in time as the situation warrants.

Finally, in the portion of the theory that aligns most closely with complexity science, Uhl-Bien et al. (2007) indicate that these bureaucratic roles bond together in complex adaptive systems (CAS) based upon adjustment to the preferences of the individuals. This interaction can lead to the concept of *emergence*, which is a sudden change in a system that may be brought about by a collapse of barriers, sudden mergers or splits of networks, or cascading changes throughout the entire system (Uhl-Bien et al., 2007, p. 303). Uhl-Bien et al. (2007) put it succinctly: “Creativity and learning occur when emergence forms a previously unknown solution to a problem or creates a new, unanticipated outcome (i.e. adaptive change)” (p. 303). This is an outcome that may be seen when all of the stakeholders involved in a decision are brought together during the process.

**Fit of theory to study.** Complexity Leadership Theory (Uhl-Bien, 2007) was appropriate for this research study because it applied a leadership lens to a problem of practice
related to effective decision-making regarding all phases of a technology integration selection decision. Through the use of this theory, I was able to explore the roles played by the various stakeholders involved in the decision-making process at distinct phases within that process: initial development of the plan; selection and integration of the tool; and rollout and adoption of the technology. This assisted in achieving the overall goal of the study to know more about the relationship that exists between all of the stakeholders involved in a technology investment selection decision, as well as how to improve those stakeholders’ level of participation throughout the process, which are both key elements in effective 21st century school district leadership.
Chapter 2—Literature Review

In the literature selected for analysis in the initial section of this review, the topic of the effectiveness and sustainability of technology integration is tied to a number of different factors within the implementation process. This review of the literature revealed that five primary elements need to be considered when evaluating the usefulness of a project that introduces new technology to a school. These five aspects: infrastructure and support (Raths, 2012); implementation planning (Lu & Overbaugh, 2009); teacher preparation (Lawless & Pellegrino, 2007); curricular changes (Oliver, 2010); and equitable distribution (Warschauer, 2008), will form the framework for this portion of the literature review. While these topics have been defined as distinct items, as the review unfolds it will become more evident that there are overlaps among these related areas in many of the studies. The initial review will conclude with a summary of this complex issue from a broader theoretical perspective, and will lead to an examination of literature specifically related to the leadership and planning associated with technology integration that provided a foundation for this study.

Infrastructure and Support

Infrastructure and support are key elements in technology integration within a school, just as they are in any type of organization. Infrastructure essentially means the network within an organization that connects computers to one another, and allows software applications to run. Most networks are a combination of wired (i.e. devices physically connected to the network) and wireless. A network’s infrastructure may also involve security settings to allow users within an organization to share software applications and files, while also providing protection against access by individuals from outside the organization.
Support means having the necessary skilled manpower to be able to maintain such a network configuration. This may include addressing issues that arise with either software or hardware, ensuring that regular updates to both hardware and software are applied, and properly adding access to the network for new hardware, software, or users. However, several factors and concerns may come into play as potential barriers during the integration of new technology. Barriers related to infrastructure and support include whether the existing network can accommodate the new devices and applications (Crichton, Pegler, & White, 2012); whether the technology department is aware of, and skilled in supporting, the new devices and applications (Raths, 2012); and whether the new technology is compatible with the overall technology vision of the school or district (Hew & Brush, 2007). The organization’s vision for technology use can be one of the most important factors in the acceptance and sustainability of technology integration.

Vision. In a study of the knowledge gaps involved in the integration of technology, Hew and Brush, (2007) specifically advocated the need for a shared vision and technology integration plan. Having an overall vision for technology use gives “school leaders and teachers an avenue to coherently communicate how technology can be used, as well as a place to begin, a goal to achieve, and a guide along the way” (Hew & Brush, 2007, p. 234). Once the vision is in place, according to Hew and Brush (2007), the next step is to create a technology integration plan in order to provide the details of the steps needed to translate the school technology vision into reality.

Having such a vision and plan allows the school or district to address potential infrastructure barriers such as integration of new devices on the existing network, as well as the preparation of the technology staff to support the changes. Hew and Brush (2007) even proposed
the training and use of students to assist with simple technology problems to save on the expense of professional technicians. Hew and Brush (2007) also touched upon topics covered in greater depth in other studies, including the need for effective teacher preparation (An & Reigeluth, 2011; Jost & Mosley, 2011; Kingsley, 2010; Lowther et al., 2008), and adjustments to the curriculum to accommodate the new technology (Bravo & Young, 2011; Hickey, Kindfield, Horowitz, & Christie, 2003).

Factors that promote or prevent integration. Lu and Overbaugh (2009) took a somewhat different approach in their study of the effects of infrastructure on technology implementation when they considered potential factors that promoted or prevented integration. The researchers investigated whether the technology implementation environment varied for schools at different locations (urban, suburban, or rural) and different grade levels (elementary, middle, or high). At all of the study locations, which took place across mid- and southeastern Virginia, Lu and Overbaugh (2009) found that a lack of time for adequate preparation as well as challenging technical issues such as resolving technology problems with minimal disruption of instructional time and a sufficient number of working/compatible computers as the most serious problems facing teachers who were attempting to implement technology. In regards to location, Lu and Overbaugh (2009) found that suburban schools had stronger models of technology integration than urban and rural schools. They believed that this was due to a greater availability of usable devices, up-to-date software, and professional technology staff to help facilitate technology integration in the suburban schools as compared to either the rural or urban locations. The study did not identify the level of the school as a significant factor in the success or failure of a technology integration project.
Infrastructure challenges due to new technology. As the integration of technology has further evolved to the point where many school districts now either deploy mobile devices or allow staff and students to bring their own into school for use on a wireless network, new infrastructure and support challenges have surfaced. Crichton et al. (2012) found that the deployment of mobile devices in a school caused shifting roles and responsibilities for teachers, IT support people, and school based administration due to the amount of work necessary to utilize these tools effectively. The primary cause of this shift is due to personal devices such as iPods or iPads now being used in a shared environment that requires new and more immediate support tasks from all involved, especially teachers. That being the case, Crichton et al. (2012) stated:

So, at this early stage of their deployment in shared, public settings such as schools, it must be remembered these devices are ‘I’ devices – technologies designed for individual users. By…suggesting others might share that one device, we are repurposing them for uses they were not intended. (p. 30)

In other words, schools are choosing to have students share mobile devices in order to minimize the impact on their budgets. However, devices like iPods or iPads were designed for individual users who, after purchase, essentially “personalize” these devices with their own set of preferences. Trying to have groups of students share the same device can lead to difficulties in the seamless utilization of the device, which then immediately impacts the teacher’s intended use for a specific learning experience.

Likewise, when schools allow the use of students’ or teachers’ own personal devices, Raths (2012) showed that issues with connecting devices to the existing school infrastructure can far outnumber the effective use of technology for instructional purposes. One reason for this is
that a vast majority of newly installed computer networks within organizations become obsolete within a few years due to poor planning (Raths, 2012). Compounding that problem is the previously cited concern of whether the technology staff in a school or a district has the expertise to design and manage such a system. As individual devices continue to proliferate, the overall technology infrastructure of schools will need to be a continued focus of attention as a component of any planned technology implementation.

**Implementation Planning**

The second factor that has an impact on technology integration is implementation planning, which may be described as the preparation and decisions surrounding how new technology is added to an organization’s existing environment. Prior planning can anticipate potential issues that may arise during the implementation phase, and integration teams should have solutions devised to address these in advance. This planning should also take into account the optimal method in which to utilize the new technology in order to achieve the maximum benefit.

However, when new technology is introduced in an educational environment, the planning process is not always as robust as it could be and studies such as Donovan, Green, and Hartley (2010) demonstrate that unanticipated outcomes can result. In contrast to this, properly planned projects can lead to learning outcomes unattainable without the technology (Lei & Zhao, 2008), as well as improved productivity (Larkin, 2011; Larkin & Finger, 2011). This planning may be enhanced through the leadership efforts of the principal (Gerard, Bowyer, & Linn, 2008), or through that of the teachers themselves (Griffin, 1995).

**Implementation design.** The manner in which technology is implemented may have an impact on the resulting effectiveness of the integration project. In one such study by Donovan et
al. (2010), the authors had initially sought to examine the methods in which a one-to-one computing initiative was implemented in 7th grade classrooms to determine the effect on student engagement. The goal of the researchers was to explore numerous aspects of daily classroom life that are influenced by the introduction of technology, including student learning needs, behaviors, and changing classroom roles and relationships. As they progressed through their observation process, however, Donovan et al. (2010) determined that off-task behavior, an unanticipated result, specific to certain configurations would also need to be considered.

The researchers utilized a mapping process that led them to determine that there were three clearly identifiable configurations that ranged from almost total utilization of the laptops by both students and teachers (Configuration A), to almost total disregard for their use (Configuration C). These configurations were not anticipated prior to the deployment of the new technology, and it was the findings related to off-task behavior that were more compelling to Donovan et al. (2010) in the end. Because of their extensive observation of this behavior in all three configurations, Donovan et al. (2010) concluded that “the results of our study do not support the notion that increased access to technology leads to increased engagement in the K-12 setting” (p. 437). Even students in the optimal configuration, A, exhibited this behavior. However, due to the more project-based nature of their assignments combined with their level of motivation, it had less impact on the completion of their work.

**Improved learning outcomes.** In contrast to the findings of Donovan et al. (2010), the results from a study by Lei and Zhao (2008) demonstrated that providing the appropriate technologies supported learning activities for students that would not otherwise be possible. This study focused on a small, northwestern middle school with relatively good technology resources, and whose students virtually all had access to computers at home. The implementation strategy
was to give all students and teachers laptop computers that could be used at school or at home. The findings by Lei and Zhao (2008) suggested that having constant access to their own laptop computer allowed students to improve their proficiency with the technology while working on various assignments and tasks. There was an increase in student GPAs in the one year time period of the study, however the authors noted that they did not draw any conclusions from this because they had not set out methods to specifically measure such a change. Finally, while Lei and Zhao (2008) indicated that there were concerns around student discipline, over dependence on technology, and the need for more in-depth study of the relation of technology to improved grades, their conclusion was that the implementation of a one-to-one computer initiative resulted in improved student learning experiences due to the additional opportunities and possibilities that the technology provided.

Taking a somewhat different implementation approach, Larkin (2011) proposed that the provision of computers in a 1:2 rather than 1:1 ratio was the more optimal implementation method. This proposal was also corroborated in a related study (Larkin & Finger, 2011). Larkin (2011) studied 11- to 13-year-old students in Australia, and compared classrooms with 1:1 computing with those having a 1:2 configuration. The findings of the study suggested “that 1:2 computing is preferable to 1:1 computing to achieve a balance between productivity, student engagement, social activity, and individualised learning” (Larkin, 2011, p. 101) due to the fact that in the 1:2 configuration half the class was receiving direct instruction from the teacher while the other half were working on the computers. While this model resulted in a greater workload for the teacher in preparing work for the students on the computers, and teaching the lesson twice to each half of the class, the benefit cited by Larkin (2011) was a higher level of engagement for the entire class. This was because half of the class was focused on the teacher’s instruction in a
smaller, more responsive group, while the other half was independently and productively using the laptop computers. Larkin (2011) also found that this implementation method resulted in a higher level of laptop usage than that of the 1:1 classroom, and at a substantial cost savings for the school district.

**Importance of leadership.** Another factor in the successful implementation of technology is the role of the leadership of the principal in setting the tone for the school (Gerard, Bowyer, and Linn, 2008). Gerard et al. (2008) found that the active and early involvement of the principal can have a beneficial effect on the acceptance of technology reforms. Griffin (1995) found that teacher participation in school decision-making had an impact on a number of school and classroom activities, including the use of technology, while a study by Kumar and Altschuld (1999) found that an environment conducive to teacher innovation, strong administrative commitment, and active faculty involvement were additional factors in the successful implementation of technology projects.

These studies demonstrated the fact that even when a great deal of planning regarding the implementation of technology took place, unanticipated outcomes can result. The success or failure of a technology integration project can be greatly impacted by any of a number of variables. Perhaps the greatest variable is related to the ultimate users of the technology, which leads to the next factor: teacher preparation.

**Teacher Preparation**

Another key factor to the success of technology integration is adequate preparation of teachers for the changes that are going to occur in their classrooms. While teachers may receive many forms of training and professional development throughout the year, teacher preparation in this context refers to training specific to the introduction of new technology hardware, software,
or procedures. This would be similar to user training when an organization rolls out a new technology integration project. Teacher preparation is an important component of technology integration because it has an impact on the acceptance of the changes (Buckenmeyer, 2010), especially when connected with applying the new technology to the practice of teaching (An & Reigeluth, 2011). Otherwise, issues can arise when new technology is introduced in isolation (Higgins & Spitulnik, 2008), or with training that is lacking in quality (Lawless & Pellegrino, 2007).

**Acceptance of change.** In a study involving 144 teachers and other staff from two suburban Midwestern high schools, Buckenmeyer (2010) found that teacher preparation, in conjunction with attitudes toward technology, available resources and support, created an atmosphere that facilitated the appropriate integration of changes. Buckenmeyer (2010) proposed that teacher preparation could be introduced in a number of different ways in order to assist with the process of acceptance of the new technology. While one such method could be to combine technology training with traditional content-based professional development opportunities, Buckenmeyer (2010) suggested that this training need not only be confined to formal sessions with the entire staff in one place. Instead, Buckenmeyer (2010) proposed that some activities could be more informal whereby groups of teachers could “work together to learn new technologies, and trial and error approaches are encouraged” (p. 33). In this way, teachers who have already adopted technology use in their classrooms may be able to provide guidance to colleagues who still require additional assistance. Furthermore, these early adopters of the new technologies would be able to demonstrate their enthusiasm for the successes that have been achieved in their classrooms to their colleagues.
**Connection to pedagogy.** A study by An and Reigeluth (2011) cautioned that problems can arise when teacher preparation programs are solely focused on technology knowledge and skills while paying little attention to the “dynamic relationships between technology, pedagogy, and content” (p. 60). This can prevent the teacher from effectively utilizing the technology in the classroom for the purpose in which it was intended. An and Reigeluth (2011) proposed that teachers need to come away from preparation sessions with specific integration ideas for their subject areas that will allow them to make authentic connections to the students in their classrooms. An and Reigeluth (2011) also pointed out that teachers need differentiation in the levels of instruction provided to them based upon their prior skills, and that they need to have some time to use and try out the technology instead of simply trying to add it on to a professional development program already full of many other diverse topics.

The formation of learning communities is also important in teacher preparation for technology integration. An and Reigeluth (2011) suggested that teachers form communities of practice in order to share experiences, tips, and tools as a means of providing one another with ongoing assistance beyond any formal training received in district or school sponsored programs. The use of a similar method of teacher preparation, which focuses more on how the teacher would seek to integrate the technology in an authentic, learner-centered environment for the benefit of the students, was also a finding in a study by Kayler & Sullivan (2011). Teacher preparation can be used as a method to overcome the technology generation gap between teachers and students so that teachers can properly evaluate the content of their students’ work over its form (Ford et al., 2005).

**Challenges with professional development.** In a 2007 literature review, Lawless and Pellegrino described the critical nature of professional development in ensuring that teachers
utilize technology tools to enhance teaching and learning. However, the authors also indicated that many studies have found professional development to be inadequate, especially in terms of quality. Another related concern noted by Lawless and Pellegrino (2007) was that ineffective professional development may lead to fewer teachers with the necessary skills to successfully integrate technology in order to support 21st century learning, which may in turn further widen an already existing digital divide among students of different socioeconomic levels. The authors advocated for rigorous, flexible, and at times non-traditional professional development that is engaging for teachers. Lawless and Pellegrino (2007) concluded by suggesting that “[i]f we are to understand who is best served by different approaches to professional development then we need to examine why certain teachers volunteer to participate and others do not” (p. 601), and develop best practices based upon that. In other words, professional development programs focused on technology integration need to have different options in order to meet the varying skill levels of teachers who will choose to attend them, and there is a need to determine why teachers decide to enroll in various training sessions.

Higgins and Spitulnik (2008) centered on the need for professional development for technology integration in science because it is a complex task when combined with the inquiry-based learning needed for science. Higgins and Spitulnik (2008) also emphasized the quality of the instruction specific to the needs of science teachers, and found that technology integration should not be done in isolation because “social supports can improve teachers' integration of technology in the classroom” (p. 516). Higgins and Spitulnik (2008) concluded that learning to use technology as a powerful scaffolding tool for student achievement is a worthwhile goal of professional development, however one that still needs further research. Additionally, several studies focused on the need to have effective teacher preparation programs for pre-service and
in-service teachers in order to introduce them to the integration of technology (Pellegrino & Altman, 1995; Strudler & Wetzel, 1999; and Willis, Thompson, & Sadera, 1999), and to help them overcome some of the potential barriers to successful implementation (Ertmer, 1999, 2005).

In sum, there is need for professional development in technology integration that provides teachers with the skills and the context to allow them to successfully integrate new technology tools into their classrooms. Furthermore, the disparities in the manner in which teacher preparation relative to technology integration has been provided presents a need to further study professional development opportunities for teachers in order to determine the optimal manner that school districts may adopt in which to succeed. While professional development that can help teachers learn about new technological skills and pedagogy is important, there is also a need to consider curriculum changes necessitated by technology integration.

**Curricular Changes**

The introduction of technology hardware and software to the classroom, regardless of the configuration of the implementation, often requires some modification to the existing curriculum in order to address how course materials are presented, the method that students work on their projects, or the manner by which students’ assignments are assessed. For instance, with the integration of technology teachers may now be able to provide students with access to resources far beyond what would previously have been found in a textbook. Students may also have greater opportunities to work collaboratively on projects, either in the classroom or outside of school, which moves teaching to a more learner-centered environment. Such a shift, however,
means that teachers must develop new, more innovative rubrics by which to assess each student’s individual contribution to a final group project.

Studies such as those by Lowther et al. (2008) and Oliver (2010) found positive results for students when curricular changes were made in order to accommodate the introduction of technology. However, other studies such as one by Garthwait and Weller (2005) found that attempts at changes in the classroom sometimes ran up against conflicting policies within the district. Furthermore, as the 21st century has moved forward, the technology skills of students has continued to evolve. To address this, Blair (2012) and Bravo and Young (2011) suggested approaches to integrate new methods of assessment of student work.

**Improved student outcomes.** Lowther et al. (2008) conducted a three-year study of 13 sets of PK-12 schools (program and control) that were participating in the Tennessee EdTech Launch (TnETL) initiative. According to Lowther et al. (2008), TnETL was a program with an overall goal of integrating technology as a tool into curriculum and instruction in order to prepare students to meet state academic standards through the creation of student-centered learning environments. The findings of this study revealed that, as compared to those in the control group, the teachers who were a part of the program group were able to meaningfully integrate technology into their classroom curriculum in such a way as to positively affect student learning when compared to the control group. Taking this further, Lowther et al. (2008) found from their observations and interviews of program teachers that “the use of technology positively influenced student learning and their use of student-centered practices. The program classes were more frequently focused on academics and had a higher level of student attention and interest than control classes” (p. 205). Furthermore, the study also revealed that the program

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1 Tennessee EdTech Launch was funded by a state-level grant enacted under the Enhancing Teaching Through Technology (ETTT) initiative as Title-II-D of the No Child Left Behind (NCLB) Act of 2001, and was strategically designed by the Tennessee Director of Technology to address research-identified barriers to technology integration.
students performed as well as, or better than, the control students when measuring achievement, with the added benefit of increased knowledge of computer use by the program students. Lowther et al. (2008) cautioned, however, that more studies to prove a direct correlation between the integration of computers and increased student achievement are still needed. Similarly, a study by Slavin, Cheung, Groff, and Lake (2008) found that reading programs that combined changes in curriculum with technology integration were more successful than those which focused on either curriculum or technology alone. Oliver (2010) found in a study of North Carolina Early College High Schools that the integration of laptops initially allowed the teachers to learn to use the capabilities of the new technology to make their existing instructional practices more efficient through the distribution of notes and the electronic collection of student assignments. Students could come in to class, take out their laptops and get right to work, rather than copying information from the board. As the study progressed, Oliver (2010) found that the availability of the computers and the resources they could access allowed more and better opportunities for teachers to differentiate instruction for their students. Going further, the findings by Oliver (2010) revealed that teachers changed their methods of classroom instruction to include “more student-directed projects, group work, and presentations” (p. 62), which allowed the teachers to develop more appropriate methods of assessing these products. Even though there is some data that demonstrates the benefit of technology integration for students, incorporating technology into a school involves changes in practice for teachers.

**Potential barriers to change.** In a one-year study of two teachers who were participating in the Maine Learning Technology Initiative (MLTI) in which all 17,000 seventh graders and their teachers received laptop computers, Garthwait and Weller (2005) found that
necessary curricular changes sometimes ran into roadblocks from policies enacted by the district. One of the teachers wished to use the websites that he had created to publish student work; however, the district did not have the necessary authorization form available, so he had to alter his teaching. Garthwait and Weller (2005) found that the other teacher had to limit assignments and projects to those that could be finished during the school day because the district initially did not permit students to bring their laptops home, but still expected work not done in class be completed at home. An additional problem cited by the authors was the fact that students could lose network access after a certain number of infractions such as not keeping the laptop charged or printing material not deemed school-related, which also created problems in curriculum planning for the teachers when a student was disconnected from the network. On the other hand, district-level support was positive for teachers in that they had reliable access to a technology medium for both presentation and research. This increased access, allowed teachers to no longer have the additional worry of planning certain units weeks in advance to ensure the availability of a computer lab or the library. Overall, many barriers to change can be influenced with planning at the district level that includes stakeholders from within the classroom. At the same time, school districts can provide support that schools are unable to provide individually that can enhance curriculum delivery in the classroom so that student can continue to learn the curriculum as well as technological skills.

**New methods of learning.** Students’ abilities to use technology, however, are moving at an increasingly rapid pace. Blair (2012) indicated that current students have already evolved in their learning abilities just since the start of the new millennium. Instead of being satisfied with watching videos or taking turns on a whiteboard, they now demand instant access to information that they can immediately put to use. In order to accommodate this, Blair (2012) cites a call
from the Partnership for 21st Century Skills (a national organization advocating for 21st century readiness for every student) to transform the core curriculum in such a way as to fuse “the traditional three Rs with four Cs: critical thinking, creativity, communication, and collaboration” (p. 10). Teachers must continue to evolve, and facilitate the use of technology so that students can create their own learning experiences. Therefore, through the addition of these new elements, students will be able to develop problem-solving, decision-making, and innovation skills that they will be able to use throughout life, regardless of what technological tool they may choose to utilize.

In line with this “four C” concept, Bravo and Young (2011) studied graduate education students who were tasked with creating collaborative Wikipedia content. The research participants found that they had a positive perception of the assignment, which led them to realize that Wikipedia may be a valuable source of information that is appropriate for use as an assignment or project in their own K-12 classroom. Changes such as this also involve a shift in thinking with regard to curricular assessments because, as Blair (2012) indicated, not only are the projects excellent tools for formative and summative assessments, they are also a means for students to construct their own learning experiences that they can take with them beyond the classroom. Similarly, one of the conclusions of a study by Hickey et al. (2003) of the use of technology to examine genetic concepts suggested that technology integration was most effective when combined with student assessments. Hickey et al. (2003) indicated that their conclusions supported the concept that assessments can enhance learning and teaching, as long as they are accompanied by feedback that furthers student understanding and that teachers can also use to reflect upon and refine their own instructional practices. Even though there are new methods of
learning that take place with the integration of technology, access to up-to-date equipment is a precursor.

**Equitable Distribution**

Initiatives with goals that set out to provide technology to a wide population of students may also have the potential to lessen the “digital divide,” and narrow the “achievement gap” between higher and lower socioeconomic status (SES) students. According to Pew Research (Zickuhr & Smith, 2012), the digital divide is essentially the difference in access to the internet, particularly high-speed broadband service, based upon differences in demographic groups. The achievement gap broadly refers to differences in academic performance between groups of students. However, according to Education Week (2011), it is commonly used in relation to the difference in performance of minority groups when compared to their non-Hispanic white peers, or in relation to a disparity between students from low-income families and those from families who are better off. While initiatives that include such outcomes among their goals have the potential to make a difference, they may still be hampered by the existing environment of the school and community.

**Small gains.** In a study by Magolda (2006), the author defined the effects of the digital divide by indicating that a lack of exposure to technology at home and in classrooms “closes doors to students, leading, among other things, to lower paying jobs, job insecurity, and professional lives on the margins” (p. 299). In other words, the inability of students to become familiar with what are essentially the tools of the new century will have a long-term impact on their future as productive members of society. The study by Magolda (2006) followed 16 inner-city high school students, nine of whom had no access to a computer at home, who were given access to the technology needed to create a website on the Underground Railroad through a
collaborative initiative. According to Magolda (2006), the Underground Railroad project allowed students to use higher-order thinking and problem-solving skills and apply these to real-world tasks so that they could take control of their education. In addition to the skills gained through the use of the computer technology, the students also had the opportunity to improve life skills such as research, writing, teamwork, and oral presentations that had previously been essentially nonexistent. As a final point relative to the impact this program had on the students, Magolda (2006) pointed out that 15 of the 16 students applied for college, even though they were in a non-college bound track.

While an initiative such as this provides benefits for one small, underserved population, Magolda (2006) emphasized that the digital divide is “not simply a ‘technology problem’ that can be solved by teamwork. Digital divide ‘solutions’ are more complex than working together to provide high quality software, hardware, and instruction” (p. 300). There are, in fact, many issues ranging from poorly wired school buildings to larger social and economic issues such as a low tax base, underpaid teachers, and overcrowded classrooms. While this project only impacted a limited number of students, it demonstrated the potential of such a technology implementation initiative to decrease the digital divide and to improve student learning.

**Economic barriers.** In a broader study of schools in California and Maine, Warschauer (2010) found that a laptop program resulted in some improvements in reading, writing, and technology skills but did little to improve upon the academic achievement gaps between students with low and high socioeconomic status. Warschauer (2008) found that, while technology integration programs do provide value to low SES schools and students, such programs are unlikely to cause a significant decrease in achievement gaps by themselves. Contributing to the challenge of using technology to increase the achievement gap was that schools in lower
socioeconomic communities find it harder to start a laptop program, and to keep it going.

Overall, Warschauer (2008) posited that while many schools may be able to make good use of technology integration projects, “the playing field may have to be *unleveled*—where superior rather than equal educational resources are provided to low-income students in order to overcome many of the disadvantages they face” (p. 64). In other words, underserved schools need more support, not necessarily the same support, to improve student-learning outcomes.

Similarly, Park, Sinha, and Chong (2007), found that the federal government’s E-Rate program, which provides access to the internet for educational institutions, cannot solve the digital divide problem just by providing that access. The fact that a school has technology (or access to it) does not mean that it will be utilized to the students’ advantage. This was, likewise, a finding of an earlier study by Ross, Smith, and Morrison (1991) in which fifth and sixth grade minority students were provided access to technology through the Apple Classroom of Tomorrow program. When these students moved on to seventh grade, they no longer had the almost unlimited access they were accustomed to and, therefore, their outcomes no longer exceeded those of a control group. In sum, inequity in achievement and resources can be addressed by the introduction of technology, but providing low achieving and high achieving schools the same support will not end the achievement gap and the digital divide.

**Summary and Implications**

From this review of the literature addressing the problem of practice of how a school district effectively integrates technology into the classroom so that it meets the needs of all of the stakeholders who will be impacted, one can see that the issue is multifaceted and still requires additional research. Even though five main factors were initially identified as a framework for this review, note that the literature showed that each factor has several subtopics that could lead
to its own discrete path of review. Likewise, many of the factors are also intertwined with one another in the results of several studies: teacher preparation may need to cover curricular changes; the infrastructure in place needs to be considered when planning for implementation; equitable distribution of technology must take into account infrastructure at all locations, as well as how to implement the technology.

Ultimately, the divergent nature of the studies leads one to recognize the complexity of the immense undertaking that is technology integration in schools. Despite the divergence, one aspect that can address all of these issues is a planning process that takes into consideration all of these factors. Examining the implementation of technology in school as a tool to facilitate processes and make these more efficient is a task that will lead to deeper understanding for administrators and teachers of how to leverage technology integration for the benefit of student learning. Currently, many schools and districts implement technology without a planning process that utilizes multiple stakeholders. The underdeveloped strategy of schools related to technology implementation is a problem that can undermine technology as a means for education improvement. To repeat Garthwait and Weller (2005), “[Relying] on the ‘unanticipated consequences’ of laptops as Trojan Horses for educational change is not a realistic strategy” (p. 375). Further study of this problem will help schools be more strategic about educational change related to technology integration.

**Review of technology integration planning process.** Even though many schools have not approached technology integration with a systematic planning process, there are some schools that have implemented technology with a specific strategy. Further research has been conducted in order to understand the technology integration planning process, as well as the
impacts of various forms of leadership on that process. What follows is a review of studies on planning for technology integration.

Tan (2010) performed an extensive review of the literature related to research that has been conducted on technology leadership with a concentration on the effective integration of technology in schools and found two broad categories: studies that focused on the identification of roles and competencies of technology leaders, and studies that explored the relationships between various leadership factors. The roles of the technology leaders were further categorized into four main areas of change: infrastructure, organization structure and policy, pedagogy and learning, and school culture. Tan (2010) also found that technology leadership was a stronger predictor compared to infrastructure factors for three different dependent measures on technology outcomes: frequency of use of Internet by students and teachers, frequency of integration of information and communication technology (ICT) into lessons, and extent to which students use ICT for academic works in the school. Overall Tan (2010) noted that there was a “paucity of empirical studies in the field of school technology leadership” (p. 902), and suggested technology leadership as viewed from the perspective of different stakeholders as a possible future area of research.

Jameson (2013) argued that despite the huge influx of technology into education, and the expansion in both the fields of educational leadership and educational technology, leadership focused within educational technology is an under-researched field. The term “e-leadership” used by Jameson (2013) specifically refers to leadership of educational technology advances across all levels of schooling. Jameson (2013) suggested that there is a need for e-leaders who have excellent communications skills, and who are able to apply rigorous analysis when choosing between the myriad of available educational technology opportunities for improved
teaching and learning. Jameson (2013) also stated that e-leadership characteristics may be grouped into three organizational leadership categories: purpose, people, and structures and social systems. These are skills that are needed at the senior and middle management levels, and they cannot be “repackaged” from existing leadership skills.

Looking at another leadership approach, Tan and Aloysius (2011) found that the complexity of change influenced the types of system differentiation and the degree of distribution of leadership in their study of distributed leadership practices in technology integration in three Singapore schools. The researchers’ study looked at three schools with different leadership distribution structures. School A reflected a top-down leadership structure with no differentiation strategy; School B showed a limited degree of distribution in leadership and employed a segmentation strategy; and School C demonstrated a high level of distribution in leadership and a functional differentiation approach. In other words, School B’s segmentation approach utilized subunits of existing departments, with the result being that the principal and head of ICT played facilitative roles. Taking a different approach, School C created four new IT Director positions with unique functions focused on staff development, student development, infrastructure, and special projects. School C was found to be most successful in its use of technology for self-directed and collaborative learning among the students. Tan and Aloysius (2011) proposed that an explanation for the success of School C was that the complexity of change influenced the types of system differentiation and the degree of distribution of leadership. However, the authors cautioned that research on how distributed leadership is practiced among school personnel in leading technology change was still in its “infancy stage” (p. 1213), with this study only an initial effort to contribute to the field.
In another Singapore-based study of distributed leadership, Seong and Ho (2012) found that, although there are indications that besides the principal there are others who perform instructional and transformational leadership, there is a scarcity of studies that examined how instructional and transformational leadership are shared by different people. The findings of this study observed that the leadership provided by senior management and middle management were reinforcing. On the one hand, the leadership provided by senior management afforded empowerment for the instructional leadership of middle management at the department level. On the other hand, the instructional leadership of middle management reinforced the strategic direction set by senior management at the school level. While this study was limited to one government elementary school in Singapore, the findings seem to support the success of a broad distribution of leadership seen in School C of the Tan and Aloysius (201) study. Seong and Ho (2012) opined that context is also a key element and not simply background to leadership activity. Based upon this, the researchers suggested further study of how leadership is distributed in different contexts in which school ICT reforms could take place so as to contribute findings that may be relevant to a larger audience.

In sum, there is a need for leadership in technology implementation and integration in schools (Allen, Franceschini, & Lowther, 2010; Anderson & Dexter, 2005; Chen, 2012; Everhart, Mardis, & Johnston, 2011; Flanagan & Jacobsen, 2003; Hewitt, Mullen, Davis, & Lashley, 2012; Hughes & Zachariah, 2001; Keengwe, Kidd, & Kyei-Blankson, 2009; Lee, Leary, Sellers, & Recker, 2013; MacNeil, 1998; Means, 2010; Rice & Miller, 2001; Stuart, Mills, & Remus, 2009; Wang, 2010; Yuen, Law, & Wong, 2003). More specifically, there is also a need for effective planning by the decision-makers and stakeholders involved in such integration projects (Anthony, 2012; Baker, 2012; Bauer & Kenton, 2005; Corn, 2010; Earle,
2002; Glazer, Hannafin, & Song, 2005; Gülbahar, 2007; Hall, 2010; Hixon & Buckenmeyer, 2009; Meltzer & Sherman, 1997; Mentz & Mentz, 2003; Mooij & Smeets, 2001; Peck et al., 2011; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010; Smith, 2010). Finally, in addition to the need for leadership and planning in technology, there is also the previously noted lack of specific research on leadership in technology (Jameson, 2013; Seong & Ho, 2012; Tan, 2010; Tan & Aloysius, 2011).

**Connections to leadership attributes.** Examples of a limited scope in research with regard to effective leadership were seen in a number of studies. Allen et al. (2010) identified a relationship between the leadership attributes of mentor, innovator, and facilitator and successful technology program implementation. These attributes were defined by personal interaction and a willingness to take risks, and correlated to positive implementation results. Anderson and Dexter (2005) examined technology leadership characteristics and their effects on technology outcomes and confirmed that technology leadership played a very central, pivotal role in technology-related results, greater even than technology infrastructure or expenditures. The study found that leaders’ involvement in a range of key technology leadership areas (i.e., leadership and vision; learning and teaching; productivity and professional practice; support, management, and operations; and social, legal and ethical issues) is important for successful technology use in a school.

In one of a number of non U.S.-based studies, Chen (2012) looked at teachers’ perceptions of leadership distribution and its effect on teachers’ efforts during the implementation phase of a technology project. The study’s findings indicated that the teachers perceived that both transformational and instructional leadership for technology integration was distributed among the principal, subject head, and technology head, which supports successful
integration. A study by Everhart et al. (2011) highlighted the lack of research on the leadership role of the school librarian in the effective integration of technology. Everhart et al. (2011) pointed out the commitments to and successes with technology leadership that school librarians have experienced with both students and teachers demonstrated in their prior research. However, also emphasized was the unrealized leadership potential of school librarians beyond their buildings, either at the district level or within their larger, professional community. Flanagan and Jacobsen (2003) developed a leadership model for principals to assist them in technology planning and integration. The authors indicated that if school principals are to effectively inspire and lead a staff in integrating technology across the curriculum, then professional development opportunities must be available for principals to develop these skills and dispositions. Flanagan and Jacobsen (2003) further stated that the need for ongoing professional development would have implications for all of the training programs provided to current and future school leaders, including those offered in graduate programs.

Related to leadership training, Hewitt et al. (2012) provided commentary on a partnership between universities and K-12 schools in North Carolina to develop leadership skills in middle school and high school leaders so that technology might be used as a catalyst for school reform. Hewitt et al. (2012) indicated that technological innovations call for leadership from teachers and administrators that anticipates the radical changes for which they must prepare. One manner to prepare is through partnerships between school systems and the universities who are charged with training the future teachers and administrators who will lead students into a future that is difficult to discern. Hewitt et al. (2012) suggested that education needs to be disrupted in order to think about new ways of learning and the purposes of public education. The authors go on to opine that leadership preparation must cultivate leaders’ ability to respond innovatively to new
demands for technology leadership. They concluded by stating that the success of educational technology integration depends on the teachers’ sense that they are in control of their own participation in the ongoing changes, and that they are receiving leadership and support from the district level.

A study by Hughes and Zachariah (2001) focused on the relationship between faculty perceptions of administrative leadership styles and their influence on implementation efforts of new technological programs or instructional strategies. The results of the study found that there was a direct correlation between the attitudes educators exhibited about the educational culture of the building, the learning environment, and the type of leadership style under which it operated. One method of facilitating change was having administrators depend more on teachers to use and model technology use. Hughes and Zachariah (2001) proposed that enabling teacher leadership is another way that leaders can make technological innovation a reality in schools because it extends the traditional sense of governance and decision-making to individuals who would not necessarily serve in an administrative role. This leads to further collaboration and team building, which further enhances the acceptance of the technology integration.

Keengwe et al. (2009) explored leadership factors of higher education administrators and technology leaders affecting faculty and staff acceptance of technology integration. These factors included strategies for effective change management, effective communication to staff, identifying technology leaders who understand both technology tools and teaching practices, and involving all stakeholders in the assessment of how the technology is meeting the previously assessed needs of the school. A study by Lee et al. (2013) considered the role and influence of one particular district coordinator on teacher acceptance and use of new technology. Lee et al. (2013) identified five major activities that were common to all the coordinators: aligning
curriculum, purchasing curriculum materials, overseeing assessment, facilitating professional development, and translating state and district standards. As a representative of the district office, the researchers indicated that the district coordinator’s work with teachers provided support for the teachers’ acceptance of the new technology.

In an earlier study of technology integration, MacNeil (1998) found that building administrators were aware of inhibitors to implementing technology in the classroom, such as insufficiency of financial resources for hardware, software, and infrastructure, as well as lack of time for professional development and planning. However, MacNeil (1998) concluded that the leaders within the school building needed to accept the challenge of these barriers and create a supportive environment in order to foster innovative use of technology. The researcher further indicated that, based upon interpretation of the survey results, principals must think “outside the box” to simultaneously address issues such as funding or the importance of training so that they use existing resources wisely and creatively in an ever-changing environment to continue to support the technology integration that is demanded by students. Means (2010) also found that school building leadership needed to provide support and time for teachers to collaborate around technology use in order for implementation to be successful. This was especially true with regard to teacher management of transitions onto and off of software, teachers’ communication of connections between online and offline instruction, and teachers’ struggles to fit technology-based learning activities into schedules dominated by a core curricula that may not be technology-based.

In a study of technology integration at the higher education level, Rice and Miller (2001) identified the necessity for participation in the decision-making process by faculty advisory groups. Data in the study indicated a strong concern by the participants regarding three
dominant areas: structural initiatives related to the process of planning for the use of technology, a better identification of who should be involved in technology planning and decision-making, and the overall decision-making process in general. Stuart et al. (2009) examined the prerequisite to train leaders in New Zealand in ICT competency in order to enhance their abilities to be effective champions of change. This is important because the findings of the study revealed that school leaders had low levels of knowledge about system development activities due to their limited involvement in the processes to acquire the school’s technology. Stuart et al. (2009) also indicated that the study confirmed the importance of professional development in relation to technology experience in that it provided school leaders with more confidence to actually apply the skills they had learned. Yuen et al. (2003) found the need for leadership vision and understanding of technology’s role in the curriculum as key elements in mobilizing people within the school to become adaptive. Conversely, Wang (2010) described the negative impact on technology projects that can arise from a leader’s lack of vision, commitment, and support from the point of view of those implementing the changes. The case study findings described how the lack of support and recognition from the principal negatively affected the morale of the technology coordinator and his team, who were highly motivated regarding technology integration. Wang (2010) stated that the coordinator and his team could not become effective change agents in the school because of the lack of the principal’s empowerment. In the conclusion of the study, Wang (2010) indicated that further research is needed to investigate the professional development components required for principals to become effective technology leaders.

Overall, there are several themes that may be identified from the literature that has focused on leadership attributes related to technology integration initiatives in schools. A
number of studies identified the need for the development and use of certain leadership characteristics to support successful technology implementation. These characteristics included facilitation (Allen et al., 2010), a need for vision (Anderson & Dexter, 2005; Yuen et al., 2003), inspiration (Flanagan & Jacobsen, 2003), innovation (Hewitt et al., 2012), creativity (MacNeil, 1998), and motivation (Wang, 2010). Several studies revealed the importance of the distribution of leadership to the success of these types of projects (Chen, 2012; Everhart et al., 2011; Hughes & Zachariah, 2001), while one (Tan & Aloysius, 2011) connected the type of leadership needed with the complexity of the change to be implemented. Additionally, the researchers in numerous studies concluded that the leadership involvement of various stakeholders to be impacted by technology projects should be present in the planning and integration process from the start (Keengwe et al., 2009; Lee et al., 2013; Rice & Miller, 2001; Stuart et al., 2009; Tan, 2010).

**Relationship to planning activities.** After the importance of technology leadership, the relationship between planning for technology integration and successful implementation outcomes was seen in a number of additional studies. Anthony (2012) identified a network of planning and integration activities between districts and schools that influenced teachers’ technology use. The findings of the study indicated that the ways these district-classroom systems interacted can have profound influences on the nature and frequency of teacher’s technology use. Baker (2012) found that understanding and addressing organizational factors that affect technology integration could impact success. These factors included teacher perception of technology, technology director’s actions, and the influence of so-called “early adopters” of technology on their peers during the integration process. Specific to planning, Baker (2012) also found that a plan for integrating educational technology is only the first step of implementation; the technology also must be adapted to the individual school and the teachers’
needs. Communication between various departments, facilitated by the technology director, can assist in this adaptation.

Bauer and Kenton (2005) indicated that additional planning was needed to address integration issues such as substandard infrastructure, lack of sufficient teacher planning time, and lack of appropriate software. Without this, the researchers found that there was technology use in the schools in the study, but not technology integration. Corn (2010) identified the lack of a method to evaluate and assess the needs of school districts relative to technology as a significant barrier to successful integration, and proposed a tool to assist with such planning through a needs assessment. The findings of Corn’s (2010) study suggested that when educators in schools and districts have evaluation data showing linkages among technology support, professional development, classroom practices, and impact of technology on teaching and learning, they can use that information to improve current strategies, design new ones, or identify and correct inequities in access and resources in their technology projects. Earle (2002) addressed questions about the potential of overcoming barriers to integration through planning based upon approaches and lessons learned from previous, older technology implementations. The author opined that the focus must remain on curriculum and learning, and not the tools used to deliver content or implement practices more efficiently. Earle (2002) further stated that planning for successful technology integration should grow from a mission of improving education for all students.

A study by Glazer et al. (2005) touched upon the need for planning through a focus on technology integration strategies utilizing collaborative professional development. Specifically, the researchers advocated using Collaborative Apprenticeship, a professional development model that utilizes strategic approaches to initiate and sustain technology integration efforts among
teachers at different levels of expertise. Glazer et al. (2005) indicated that this approach promoted internal leadership among teachers, which helped to overcome many obstacles to successful technology integration. In a study of private schools in Turkey, Gülbağar (2007) focused on the technology planning process and found a lack of guidelines that would lead to successful teacher integration of technology. While planning should precede any technology purchase, the author stressed that it is equally important to continuously evaluate and revise any plan that has been made due to ongoing rapid changes in technology.

As a result of frequent challenges to successful technology implementation, Hall (2010) sought to identify tools to use for effective planning in order to improve success rates. Hall (2010) stated that the first assumption in his research was that change was a process, not an event. Therefore, it is necessary to plan for change success based upon the amount of time that will be necessary to achieve successful implementation (i.e. shorter for a quick software update, or longer for a major operating system change). Hixon and Buckenmeyer (2009) indicated that even planning to address lack of time, training, equipment, and support sometimes cannot overcome teachers’ values that are barriers to technology integration. However, properly planned professional development can make an impact on these values. Hixon and Buckenmeyer (2009) stated that this training must be planned to address individual teacher’s context so that each one can see how the technology is directly related to the curriculum from the beginning of the integration process.

In an early article on the importance of proper planning for technology integration, Meltzer and Sherman (1997) stated that since school leaders will be held accountable for the money spent on technology integration, the manner in which the implementation program is designed is as important as how much money is spent. The authors suggested that it is necessary
to spend one quarter to one half of the overall budget on staff development to achieve positive results. In a study of the status of technology in schools in South Africa, Mentz and Mentz (2003) identified responsibilities at the district and school levels for different aspects of technology implementation planning. However, the researchers indicated that the planning and management of a technology integration project should be done at the school level, and the principal should play a vital role in the process. In another study, Mooij and Smeets (2001) explored the implementation process in Dutch secondary schools and found five successive phases of implementation, each requiring discrete planning. The results of this study suggested that the schools might progress from one phase to the next based upon specific choices with respect to how to achieve the next phase, which Mooij and Smeets (2001) indicated is of importance for the creation of both school practice and government policy.

Planning for optimal implementation as a means to overcome various barriers was a finding of a study of American high schools in the Southeast by Peck et al. (2011). The researchers offered five recommendations for administrators to avoid these barriers: plan early for long-term support, determine teacher technology needs, formalize informal technology support networks, showcase successful instructional adaptations, and adopt student personal media device appropriate-use guidelines. A study by Shapley et al. (2010) analyzed three year longitudinal data on a middle school technology immersion program and found that proper planning and support of the implementation resulted in statistically significant effects on teachers’ technology knowledge, skill, and levels of classroom integration. The findings showed that a comprehensive, school-wide plan for the integration of technology in schools and classrooms was more likely to yield positive outcomes for the money invested. Looking at a somewhat different approach, a study by Smith (2010) focused on training school librarians to be
technology integration leaders who, as part of the planning process, would be on the ground leaders with knowledge of integrating technology and managing change. The researchers studied a pre-service program that trained school librarians to become transformational leaders, especially in the area of technology integration, by connecting technology, pedagogy, and content.

The studies related to planning also developed several new themes, as well as further supported the concepts previously associated with leadership. A number of studies identified the importance of planning for the adaptation of the technology to meet the specific needs of the context into which it will be implemented (Baker, 2012; Bauer & Kenton, 2005; Corn, 2010; Gülbahar, 2007; Hixon & Buckenmeyer, 2009; Peck et al., 2011; Shapley et al., 2010). Several other studies highlighted planning with a focus on the curricular application of technology tools rather than a focus on the tools themselves (Earle, 2002; Glazer et al., 2005). Additionally, there were studies that contributed to the leadership themes of developing certain attributes to support successful implementation (Smith, 2010), planning based on the complexity of the integration project (Hall, 2010), and planning for school level leadership involvement from the beginning of new initiatives (Mentz & Mentz, 2003).

**Other factors influencing implementation.** In addition to the studies on leadership attributes or planning, there were a number of studies that either combined leadership and planning attributes or identified other elements related to implementation such as teacher values, social capital, or digital equity. Baylor and Ritchie (2002) conducted a quantitative study that investigated factors that impacted technology integration, including planning, leadership, curriculum alignment, and teacher openness to change. The findings of the study revealed that not only should administrators actively model technology use, but that long-range planning for
software developers and schools of education should include a vision that nurtures decision-making and development by teachers, rather than implementing systems solely from the level of policymakers. Baylor and Ritchie (2002) indicated that involving teachers from the start of the planning process would help them to accept and implement technology changes in their classrooms that are aligned to the curriculum.

Berrett, Murphy, and Sullivan (2012) looked at the characteristics of schools that move technology forward when combined with competent leadership. One understanding that emerged from their analysis was that the culture of the school dramatically impacted the successes and failures of the technology implementation at each school site. Berrett et al. (2012) recommended that future research in the area of integrating technology synthesize perspectives and data from all of the stakeholders, such as administrators, mentors, teachers, and students.

Schnellert and Keengwe (2012) explored 1:1 laptop initiatives in American schools and found that school leaders must effectively plan in order to ensure that technology integration practices result in successful implementations that benefit the students. The researchers indicated that this planning needed to consider implementation timelines, staff training, and commitment to the school’s learning goals. Schnellert and Keengwe (2012) concluded that sound fiscal investments, appropriate technology integration practices, and changes in technology policies are important to enhancing innovations in learning and teaching with technology. Vanderlinde, van Braak, and Hermans (2009) found that when the government mandates technology planning and implementation, the school technology coordinators must display leadership in assuming the roles of curriculum managers and change agents. Additionally, the researchers argued that schools should jointly establish technology policy plans
so that, in combination, these two factors will focus on the goal of using educational technology to support teaching and learning processes.

Eteokleous (2008) looked at organizational factors that influenced teacher use of technology in elementary school classrooms in Cyprus and found they fell into three categories: structural, normative, and resource related. Structural related to the fact that teachers had to teach to a prescribed curriculum that did not allow for variation. Normative referred to the finding by Eteokleous (2008) that professional culture and school climate were not favorable to promoting instructional change. Restrictions of resources included both available support personnel as well as provision of sufficient and appropriate hardware and software. Based on the findings, Eteokleous (2008) strongly suggested that teachers be involved in the decision-making processes whenever the implementation of changes and innovations are introduced.

Two studies, one by Li (2010) and one by Li and Choi (2013), focused on changing teacher practices to allow for technology integration not through changing their perceptions or beliefs, but through changes in social capital. According to the authors, social capital includes collegial trust, support for risk taking, and access to expertise within an organization. Li (2010) found that social capital provided a supportive network that enhanced teachers’ receptiveness of the implementation of educational innovations. Li and Choi (2013) found that social capital played a pivotal role in effecting changes in the pedagogical use of technology social capital’s distribution shaped the implementation of the change.

A study by Ricard and Rodriguez (2013) highlighted the need to improve teacher training in technology integration in order to benefit underserved populations such as bilingual and special education students. The researchers noted that while all students benefit from the enrichment experiences provided by access to technology in school, technology has the potential
to provide compensatory experiences for diverse special needs or disadvantaged students. Because of this, Ricard and Rodriguez (2013) indicated that school districts must continue to increase staff development in technology integration to overcome the challenges of reduced exposure for these students. In their study, Voogt, Knezek, Cox, Knezek, and ten Brummelhuis (2013) found the importance of involvement from those in policy, research, and leadership in order to successfully benefit from technology investments in education that address issues such as the individual needs of students and the potential for digital equity. The authors in this case were looking at digital equity on a global scale, and proposed action steps that would allow students in developing countries to collaborate with students in developed countries on projects that would enhance their skills. Research by Wachira and Keengwe (2011) highlighted the challenges and barriers faced by teachers in urban school districts to successfully integrate technology into the classroom. The researchers found that, contrary to national statistics on the improvement of technology availability in most schools, the teachers in this study cited a lack of technology, unreliability of existing technology, poor administrative and technical support and a lack of pedagogical knowledge in using technology as major barriers to technology implementation in their classrooms. In order for technology to have a meaningful impact in urban classrooms, the authors cited the need for simultaneous improvements in the availability of technology, training of teachers in the appropriate use of these tools, and availability of both administrative and technical support.

Overall, these studies may be categorized under one of the themes that were developed for either leadership or planning. Several studies advocated utilizing the perspective or involvement of multiple stakeholders from the start of the technology planning and integration process in order to facilitate acceptance of change (Baylor & Ritchie, 2002; Eteokleous, 2008),
understand school culture (Berrett et al., 2012), or further enhance the possibility of digital equity (Voogt et al., 2013). The ability of leadership to develop and utilize the attribute of social capital was seen in studies by Li (2010) and Li and Choi (2013). The distribution of leadership across district schools to support teaching and learning processes was observed in the study by Vanderlinde et al., (2009). Finally, adequate planning to focus on the curricular application of technology tools was depicted in relation to addressing the needs of bilingual and special education students (Ricard & Rodriguez, 2013), and overcoming the challenges faced by teachers in urban school districts (Wachira & Keengwe, 2011).

**Conclusion**

This chapter commenced with a broad review of literature related to technology integration in schools, and the result was the identification of five factors that had a significant influence on the success of such a project. The capabilities of the network into which new technology tools will be introduced, as well as the availability and skills of the support staff that will maintain that network, are key elements in determining success. Implementation planning concerns how to achieve the optimal method of adding new technology while anticipating and preparing for any potential obstacles. New technology tools will not realize their intended benefits unless the users are trained in their proper use; therefore, teacher preparation is another key factor that must be considered. A portion of the preparation of teachers may also concentrate on the need to make adjustments in how curricular concepts and assessments are delivered in a manner that derives the most gains from the newly integrated technology. Finally, technology by itself will not address the inequities in the availability of resources to disadvantaged student groups without a concurrent strategy to provide additional support for these students.
Further review, concentrating on studies that had conducted research focused on the leadership and planning associated with school technology integration, identified several additional themes. The need for the involvement of the stakeholders in the planning and integration process, combined with a distribution of leadership throughout those processes, demonstrated a relationship with successful outcomes. Additionally, success was also associated with leadership characteristics such as vision, creativity, innovator, motivator, and facilitator. Meanwhile, several studies also demonstrated the importance of a planning process that concentrated on the context into which the technology would be integrated, and ensured that it was the curricular application of the technology, and not the tools themselves, that was the overall goal of the project.

There remains, however, a scarcity of research that specifically looks at the involvement of all of the stakeholders who will be affected by a technology integration project in a school district’s decision-making process concerning new technology selection, adoption, and integration. As was stated earlier, many schools and districts implement technology without a holistic planning process that involves all of the stakeholders that will ultimately be impacted in the decision-making process. This underdeveloped strategy of schools related to technology implementation is a problem that can undermine technology’s use as a means for education improvement and, therefore, provides a basis that further study will produce benefits for the stakeholders involved.

Finally, the complexity that surrounds the many aspects of technology integration in schools also supports the need to utilize a theoretical framework appropriate to meet the challenges of the 21st century knowledge era. The Complexity Leadership Theory (Uhl-Bien et al., 2007) moves away from previous attempts at simplification of decision-making processes by
proposing the interaction of three leadership roles (adaptive, administrative, and enabling) that constantly strive to maintain a balance in order to address ever-changing situations faced by those involved in a decision-making process. This theory will assist in the study of how the factors and themes identified in the literature may have been addressed by those in the leadership roles during the decision-making process. Through the exploration of the experiences of the stakeholders in their roles throughout the process, the study will seek to provide additional understanding about the relationship that exists between all of the stakeholders involved in a technology investment selection decision. Furthermore, this may provide additional insight as to how to improve those stakeholders’ level of participation throughout the process, which can further contribute to effective 21st century school district leadership.
Chapter 3—Research Design

Methodology

Overview. This study explored the distribution of leadership roles played over time by stakeholders during the technology selection decision-making process of a New England school district through the lens of the Complexity Leadership Theory (Uhl-Bien et al., 2007). The project utilized a case study research methodology in order to capture the participant stakeholder’s views of their leadership roles within the bounded context of the three phases of a technology selection decision-making process (initial development of plan, selection and integration of the tool, rollout and adoption of the technology) (Creswell, 2013).

Research questions. The study sought to answer the following research questions:

Central Question:

• How does a school district make technology investment decisions?

Sub-questions:

• How were leadership roles distributed throughout the decision-making process?

• How did the stakeholders describe their experiences in each phase of the process?

Paradigm and role of the researcher. The constructivism-interpretivism paradigm best aligned with this approach as it proposes that there is no one single truth or reality as was espoused by the positivists but, rather, hidden meaning which must be brought to the surface by “reflection . . . stimulated by the interactive researcher–participant dialogue” (Ponterotto, 2005, p. 129). This interaction between the investigator and the participant is a key departure from the positivist school of thought. It is through this relationship, according to Ponterotto (2005), that deeper understanding can be discovered, and that the “researcher and her or his participants jointly create (co-construct) findings from their interactive dialogue and interpretation” (p. 129).
This is primarily because the researcher is not an objective observer; instead, he or she is a part of the story that is being observed. There is no single truth, and the interpretivist paradigm “does not attempt to adjudicate between competing truth claims in order to determine the one best answer; rather, interpretivism suggests that all one can do is accurately and thoroughly document the perspective being investigated” (Butin, 2010, p. 60). This study sought to describe a decision-making process through an analysis of the stakeholders’ experiences over time during each phase.

**Research Design**

In order to address the research questions concerning the roles played by the various stakeholders in a school district’s technology decision-making process, I used the qualitative approach of a single-site case study of the phases (i.e. initial development of plan, selection and integration of the tool, rollout and adoption of the technology) involved in the process. Using this approach allowed me to develop meaning through an inductive process from the experiences of the study’s participants utilizing interviews and examination of artifacts (Creswell, 2013). During the study I looked at one technology selection process at a single site that took place over a period of time. Over the course of that process, various stakeholders played different roles corresponding to those defined in the Complexity Leadership Theory (Uhl-Bien et al., 2007). I sought to describe the interactions among those roles over time that led to a selection decision that was acceptable to all of the stakeholders, and was also sustainable into the future. This approach was appropriate for this study because it allowed for the “collection of data in a natural setting sensitive to the people and places under study” (Creswell, 2013, p. 44). Furthermore, the use of this approach allowed the final project presentation to include “the voices of participants,
the reflexivity of the researcher, a complex description and interpretation of the problem, and its contribution to the literature” (Creswell, 2013, p. 44).

**Research Tradition**

The project utilized a case study research methodology in order to capture the participant stakeholder’s views of their leadership roles within the bounded context of the phases of the technology selection decision-making process. As such, this approach aligned with the characteristics of a case study described by Creswell (2013):

Case study research is a qualitative approach in which the investigator explores a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information (e.g., observations, interviews, audiovisual material, and documents and reports), and reports a case description and case themes. (p. 97)

The case study research approach essentially utilized a general inductive approach, which Thomas (2006) defined as one that “primarily use[s] detailed readings of raw data to derive concepts, themes, or a model through interpretations made from the raw data by an evaluator or researcher” (p. 238). The general inductive approach also allowed me to create meaning from complex data by summarizing raw data through the use of themes and categories (Thomas, 2006).

Likewise, Hodgetts and Stolte (2012) observed that case studies are “designed to produce nuanced, particular and practice orientated knowledge about specific contexts and human actions” (p. 381). These types of studies draw upon the field of social psychology and, although not generalizable like a quantitative study, they are important in that they “facilitate a deeper understanding of what is happening in a particular context and what might be helpful in
addressing people’s concerns and needs” (Hodgetts & Stolte, 2012, p. 381). Creswell (2013) reinforced this concept and stated that case study research includes a description of the case (sometimes referred to as “thick description” by other analysts, such as Geertz, 1973) that can lead to a discovery of themes or issues by the researcher studying the case.

Creswell (2012, 2013) traced the origins of case study research to the development of ethnographic research during the late 19th and early 20th centuries. Case studies began when researchers would explore other cultures by going to observe them over extended periods of time. The researchers would attempt to remain objective during their observations so as to write an account of the culture, sometimes in comparison to similar activities in America. Creswell (2012) illustrated this with the example of the famous anthropologist Margaret Meade who studied the influence of culture on personality in Samoa during the 1920s. Also cited as early pioneers in this approach were sociologists at the University of Chicago in the 1920s through the 1950s who “focused on the importance of studying a single case—whether that case was an individual, a group, a neighborhood, or a larger cultural unit” (Creswell, 2012, p. 463) in order to provide an inside perspective on certain aspects of life. In addition to the Chicago researchers, Creswell (2013) noted that the work of Hamel, Dufour, and Fortin (1993) also cited anthropologist Malinowski’s work in the Trobriand islands, and the French sociologist LePlay’s study of families as predecessors of qualitative case study research. This evolution continued during the 1950s to the 1990s with forays into the field of “educational anthropology” (Creswell, 2012, p. 463) through references to such approaches as the study of classrooms as tribes with their own culture and social structure, or the examination of educational decision-making and curriculum content.
Case study research is essentially a type of ethnographic research, with a few key differences. Among these, according to Creswell (2012), are the fact that researchers may focus on a program, event, or activity that involves individuals rather than a particular group; the focus may be on describing the activities of the group rather than identifying shared behavior patterns; and the case study researcher is focused on the exploration of the case itself rather than a pre-determined cultural theme (p. 465). One of the challenges of planning and conducting a case study is the constraints or boundaries of the case in terms of time, events, or process. Creswell (2013) proposed that sometimes “case studies may not have clean beginning and ending points, and the researcher will need to set boundaries that adequately surround the case” (p. 102). Overall, for a researcher seeking to develop an in-depth description and analysis of meanings of a case or cases, setting appropriate boundaries within which to constrain the case is the preferred method.

Participants

The case for this particular research study was purposively selected because of the insight that it might provide in understanding the research questions that inform the study with regard to the leadership roles of stakeholders in a decision-making process. The specific case involved the selection of a one-to-one technology device for the students in the single public high school in a suburban New England community with a population of approximately 16,000 residents. The high school has over 900 students, and the selected devices were to be provided to the members of each incoming freshman class over the course of four years.

The individual participants in the study were members of the team assembled to make the technology selection decision in the New England school district. Based upon preliminary information gathered prior to the commencement of the study combined with that developed
during the interview process, this included the Superintendent of Schools, the Director of Business and Technology Operations, the former High School Principal, the High School Library Media Specialist, the High School Science Department Head, the Lead District Technician, and the library media Student Teacher (who was later hired as an additional library media specialist). Each provided their informed consent in order to voluntarily participate in the study. The participants in this qualitative research study were a “purposeful sampling” intentionally selected in order to “learn or understand a central phenomenon” (Creswell, 2012, p. 206).

Specifically, the type of purposeful sampling that this study employed is “maximal variation sampling” (Creswell, 2012, p. 207). This selection, according to Creswell (2012), allows the researcher to “present multiple perspectives of individuals to represent the complexity of our world” (p. 207). This concept aligns with the theoretical lens of the Complexity Leadership theory of Uhl-Bien et al. (2007) in that it allowed for the exploration of the various leadership roles played by each of the stakeholders at various stages of the decision-making process. In order to ensure that all stakeholders in the decision-making process were included, I utilized “snowball sampling” (Creswell, 2012) by asking the participants to recommend others who might be able to provide additional insight to the study. However, as was anticipated at the outset, it was not possible to generalize any findings of the study outside of the subject school district.

**Recruitment and Access**

The participants in this study were initially accessed by means of what Creswell (2012) refers to as a “gatekeeper” (p. 211). A gatekeeper is “an individual who has an official or unofficial role at the site, provides entrance to a site, helps researchers locate people, and assists in the identification of places to study” (Hammersley, & Atkinson, 1995 as cited in Creswell,
There were, in fact, three levels of gatekeepers involved in securing permission from the school district to collect data. I first made contact with a mathematics teacher at the high school through the referral of a colleague. After presenting a preliminary plan for the study, I was able to arrange to meet with the high school’s current principal. At this meeting, the goal was an introduction to the district superintendent, who had the authority to grant permission for research to occur. This initial meeting took place when I was still in the process of refining the study during the Research 2 course, and the principal indicated it would be prudent to wait for a meeting with the superintendent until the goals of the study were clearer. Following the completion of that course, and the commencement of Research 3, a subsequent meeting resulted in the principal agreeing to facilitate a meeting with the superintendent. At the meeting with the superintendent, an overview of the proposed research project was presented and he gave his permission to proceed.

Following approval from the Northeastern University Institutional Review Board (IRB), I made contact with the targeted population via e-mail to invite them to participate in an interview session lasting approximately forty-five minutes to one hour. At these sessions, I left open the possibility of following up with some additional questions via e-mail, if information collected during the course of the study warranted. Participation was voluntary throughout this process, and all participants signed an Informed Consent document (Appendix C), and received a copy for themselves. The participants were offered a $10 Dunkin Donuts or Starbucks gift card as a token honorarium for their assistance in this project.

**Data Collection**

Creswell (2012) stressed that the researcher needs to collect data that is relevant to the research questions. In order to meet the data collection needs of a qualitative research study, I
sought to obtain the views of the participants by asking them general, broad questions. Additionally, I looked for other data sources in order to assist in answering the research questions (Creswell, 2012). Since the study collected data from various stages of a decision-making process, some stages of which had already occurred, the primary methods used were interviews with the stakeholders and the review of documents relevant to the phases of that process.

**Interviews.** All of the interviews conducted for this research study were one-on-one, semi-structured interviews with the participants utilizing open-ended questions (Appendix D). The resulting open-ended responses to this type of question allowed the participant to generate responses from their own perspectives (Creswell, 2012), and provided me with information that assisted in understanding the participants’ experiences relevant to the research questions. Each participant was interviewed once. The individual interviews all took place in a location that was comfortable for the participant, and each lasted approximately forty-five minutes. At these sessions, I left open the possibility of following up with some additional questions via e-mail, if information collected during the course of the study warranted.

All interviews were recorded on an iPhone using the Rev application. As a backup, the interviews were also recorded on a hand held Sony digital recording device. The audio files were transcribed to a Word document for coding and analysis using the transcription service provided by Rev. Once transcription was completed, the audio files were destroyed. All interview recording procedures met the Protection of Human Subjects requirements, and followed the data collection protocols established in Appendix C.

**Document review.** In order to supplement the participant’s recollection of experiences that took place in the early stages of the decision-making process, I also reviewed documents
from that time period. Documents provided me with valuable background information to help understand the process that was being studied. As Creswell (2012) indicated, documents are “in the language and words of the participants” and they can provide insight into the activities of the members of the selection committee, as well as information related to others in the school and town community with a stake in the selection process. It was anticipated that these documents could support the identification of the roles played by various members of the technology selection committee at various stages of the decision-making process that analysis of interview transcripts would reveal. The documents reviewed included: The 2011-2012 Superintendent’s Budget containing the rationale for the tablet initiative within the district’s five-year strategic plan; a Board of Education presentation summarizing the complete budget, including the technology initiative; an article from the journal *Library Media Connection* written by the Library Media Specialist that provided an overview of the goals, preparation, and early stages of the initiative; correspondences from the high school to the students and parents with FAQs and details about the program as it was about to roll out; a Skills 21 Prezi presentation providing an overview on the class focus on digital citizenship; and several articles from the local newspaper that were published before and after the initial rollout highlighting the impact of the initiative on students, parents, and teachers. As the documents were reviewed the concepts identified in the literature review and the theoretical framework, which informed the structure of the study and the interview script, were considered and applied to each document. Document review further helped me to understand the district’s process, goals, and their rationale for beginning the project. Subsequently, no additional documents were identified by the participants as being relevant to the study during the interviews
Data Storage

All electronic files—audio recordings, word processing documents, scanned documents—were stored on a password protected laptop computer accessible only to me. Likewise, all recorded interview backup files were stored on a password protected iPhone accessible only to me. Once audio files were transcribed, they were destroyed from both the laptop and iPhone locations.

Paper documents that were collected, and electronic files that are printed out during the course of the data analysis phase of the project, were kept in a locked file cabinet in my home, accessible only to me. The identities of the participants and the site were protected through the use of pseudonyms throughout the course of the project.

Data Analysis

Thomas (2006) cautioned that while the collection of qualitative data is a common practice of researchers, the “knowledge about strategies for efficient and defendable procedures for analyzing qualitative data is less common” (p. 237). As previously indicated, however, it is his recommendation that a general inductive approach to data analysis be utilized with a qualitative study. Thomas (2006) defined inductive approaches as those that “primarily use detailed readings of raw data to derive concepts, themes, or a model through interpretations made from the raw data by an evaluator or researcher” (p. 238). Further, Thomas (2006) indicated that the inductive approach might provide a way to summarize or categorize raw data through the use of set procedures for creating meaning from such data.

Coding process. This research project involved the collection and analysis of data from open-ended interviews and supplementary documents. When conducting qualitative research Saldaña (2013) points out that “[a]ll research questions, methodologies, conceptual frameworks,
and fieldwork parameters are context specific” (p.2). Therefore, there are many ways in which to analyze the data. For the transcriptions that resulted from the interviews, coding was the method of analysis used to attempt to derive meaning or concepts from the data. Saldaña (2013) defines a code as a “researcher-generated construct that symbolizes and thus attributes interpreted meaning to each individual datum for later purposes of pattern detection, categorization, theory building, and other analytic processes” (p. 4). Documents, for the most part, were utilized as support and validation for information gathered through interviews, and to provide background information that informed the interview process.

As far as the specific methods of the coding of the data for this project, I used an “exploratory approach” (Saldaña, 2013, p. 63) in that three coding passes were made through the data using a different approach each time. During the first pass through each of the interview transcriptions, the In Vivo Coding method was used. This method is particularly appropriate for novice qualitative researchers learning how to code data (Saldaña, 2013) because it uses the participant’s own words as the code for a particular passage. Next, in the second pass through the interview transcripts, Descriptive Coding (Saldaña, 2013, p. 88) was employed in order to capture the basic idea of larger chunks of the transcription passages than those coded with In Vivo Coding, and to better align these ideas with the overall research questions. As described by Saldaña (2013), this approach “summarizes in a word or short phrase—most often as a noun—the basic topic of a passage of qualitative data” (p. 88). Finally, Provisional Coding (Saldaña, 2013, p. 144) was utilized to analyze the transcripts related to a list of codes based upon this study’s theoretical framework and literature review. This provided a basis to determine alignment with previous research done on school technology integration and leadership.
**Interpretation process.** Once the initial data was coded, LeCompte’s (2000) suggested three additional steps in the analysis process in order to interpret it and find meaning. The first was to organize identified items into groups or categories using meaningful criteria (pp. 148-149). Following this, the categories were joined to create patterns so that they “begin to resemble a coherent explanation or description of the program, event, or phenomenon under study” (LeCompte, 2000, p. 150). Finally, groups of related or linked patterns were assembled into structures to build an overall description of the case being studied. According to LeCompte (2000), “[i]f the data are good and the analysis skillfully done, such descriptions can help participants see more clearly how to solve problems, improve programs, assess their effectiveness, or develop theories explaining what happened” (p. 151).

**Trustworthiness**

One of the goals of this qualitative study was to explore the roles of the many different stakeholders and constituencies involved in a technology selection decision-making process for a school district. As such, a number of techniques were utilized in order to maintain both the trustworthiness and validity of the data and analysis that comprise the study. Creswell (2013) pointed out that much of the language surrounding validity and trust is an attempt to “use positivist terminology [to] facilitate the acceptance of qualitative research in a quantitative world” (p. 246). The preference is to follow and document a validation strategy, which is what the researcher attempted to incorporate in this study.

The study used participant interviews as well as the review of documents to collect data concerning different phases of the decision-making process. In order to ensure that the data collected is a true representation of what occurred, I employed triangulation, which is defined by Creswell (2013) as a process that “involves corroborating evidence from different sources to
shed light on a theme or perspective” (p. 251). In other words, evidence from multiple sources, interviews and documents, was sought in order to validate concepts or themes that were identified or developed. Member checking, which allowed participants to review the accuracy and fairness of the findings of the researcher (Creswell, 2012, p. 259) following the collection and analysis of data, was also utilized. This was accomplished by sending the participants a transcript of the interview along with a summary of themes developed in order for each one to provide feedback on accuracy (Guba & Lincoln, 1982). Researcher bias related to past or present work experiences that are related to the topic under study have been disclosed at the beginning of the research study. However, as the reflections of a researcher are an integral part of qualitative research, I did not necessarily seek to eliminate such bias from the study. To further enhance the ability of the reader to potentially transfer findings from this study to other settings, I sought to use “thick descriptions” (Creswell, 2013, p. 252) to provide details about the participants and the setting in which this study takes place.

With regard to some of the concerns related to the validity this study, the research was conducted at a neighboring school district from the one in which I am employed to further reduce any bias associated with the collection of data related to previous interactions with participants. As previously indicated, the participants were selected based upon their involvement over the course of the decision-making process under review, and they were apprised of the voluntary nature of their participation in accordance with the National Institutes of Health Protection of Human Subjects protocols, as well as the IRB procedures of Northeastern University. As all of the study participants were adults who are established in their careers, they did not have any significant changes in terms of characteristics or maturation over the course of the study. Data from early phases of the process was also be collected through the use of document review,
which mitigated potential loss of data due to participant mortality through voluntary exit or unavailability during the course of the study. There was no instrumentation used to collect data, per se, beyond the recording devices previously mentioned in the Methodology section. The primary testing methods were the use of data coding of interview transcripts to answer the research questions and to develop themes about the case study. I had no familiarity with the study participants, and accessed them through the use of a “gatekeeper,” as previously described.

**Protection of Human Subjects**

The intent of this study was to explore the leadership roles played during the technology selection decision-making process of a New England school district through the lens of the Complexity Leadership Theory (Uhl-Bien et al., 2007). The study was conducted following the guidelines and approval of Northeastern University’s IRB by a researcher who had completed the National Institutes of Health (NIH) online certification training for human subjects research.

**Ethical considerations.** The study was conducted in a school district other than that of the researcher, so as to remove any undue influences or biases that have been present from previous interactions with teachers or administrators. Participation was voluntary, and the participants received no compensation beyond a token honorarium for their assistance. All were offered the opportunity to review interview transcripts for accuracy, and they will receive a copy of the final report when completed.

**Protection of human subjects.** As all of the potential participants in the study were either administrators or teachers from the school district, there were no at-risk individuals or minors involved. The study involved review of documents and interviews with the participants and, as such, did not inflict any harm on the individuals. The nature of the interviews concerned meetings at which technology selection decisions were discussed; therefore, subjects that might
have traumatized the individuals were not covered. The participants will benefit from receiving a copy of the final report analyzing their decision-making process that may inform future deliberations concerning similar technology selections.

**Confidentiality.** Confidentiality and anonymity were maintained through the omission of individual or location names throughout the study. Pseudonyms were utilized, and a key was maintained separately from the interview transcripts by the researcher. I provided for the secure storage of printed study materials in a file cabinet in my home. Electronic materials were kept on a password protected laptop computer only accessible to me.

**Informed consent.** The participants were provided with the standard Informed Consent Document utilized by Northeastern University to apprise them of their rights as well as the voluntary nature of their participation. This included their right to terminate their participation in the study at any time. Each individual signed this document, and each received a copy. All participants were autonomous individuals, capable of understanding and giving consent.
Chapter 4—Report of Research Findings

The purpose of this chapter is to present the findings of an analysis of the data gathered during this research project. It is organized into several sections, beginning with a restatement of purpose and research questions, followed by an overview of the school district and study participants, and then a description of the technology acquisition process in the district. A description of the themes that emerged from the participant interviews, guided by the interview question topics, will comprise the majority of the chapter. Finally, a summary will provide some conclusions and lead the reader into Chapter 5.

Research Purpose and Questions

The purpose of this doctoral research project was to explore the leadership roles in a school district’s decision-making process concerning technology selection, adoption, and integration for a New England high school. Specifically, this single case study explored the involvement of various stakeholders at different stages of the process (initial development of the plan; selection and integration of the tool; and rollout and adoption of the technology) to ascertain the leadership functions they assumed over time in order to facilitate the decision-making process associated with technology investment for a high school. In order to understand stakeholders’ experiences related to one technology selection investment decision in a New England school district, the following research questions were utilized:

Central Question:

• How does a school district make technology investment decisions?

Sub-questions:

• How were leadership roles distributed throughout the decision-making process?

• How did the stakeholders describe their experiences in each phase of the process?
School District and Study Participants

The school district that was the subject of this study serves a town with a population of approximately 16,000 people, and consists of four public schools. There are approximately 3,000 students in the four schools, divided into a primary school with grades K-1, an elementary school with grades 2-4, a middle school with grades 5-8, and a high school with grades 9-12. The school budget represents approximately 64% of the town’s overall expenditures and is approved as a single line item by the town leaving the Board of Education the discretion to allocate the funds within the school system.

Interviews were conducted with six primary stakeholders who were involved in the decision to select a one-to-one technology device for the students at the high school that was the subject of this case study. Each of the participants will be assigned a functional title by which he or she will be referred to going forward in order to protect their anonymity. The order in which the participants are listed in the following descriptions represents no significance other than the order in which they were interviewed.

The first participant was the high school library media specialist (LMS) at the time of the technology selection process. In addition to running the library, the media specialist’s role also involved working with teachers on integrating technology into their classroom curriculum. This individual is a self-described “earlier adopter of new technologies [who] got very excited about the possibilities” of using tablet technology with the high school teachers and students when asked by the principal to do some research in that area. This person played a key role in coordinating the testing of the technology devices that were evaluated during the selection process.
The second participant was the Director of Finance, Technology, and Operations for the school district (Director) at the time of the technology selection process, responsible for overseeing, among other things, equipment purchases, budgeting expenditures, and day-to-day operations within the school district. When approached by the high school principal and library media specialist about the possibility of a technology integration project for the high school, this individual became a part of the project team by virtue of the fact that “my role is how do we make that work and how do we procure the equipment and what device do we use”. This meant not only how would the devices be funded over the life of the project, but the need to ensure that whatever device was chosen would be compatible with the existing technology infrastructure within the school.

The third participant was the high school principal (Principal) at the time of the technology selection process. The Principal was actually the catalyst for this entire initiative. During the interview, this is how he described the initial idea for the project:

It started with a concept really. As the technology was evolving and we saw the trends in educational technology and what was happening and we saw the mobile really coming to life with the iPhone coming out in 2007 and different things that were happening … I went to the superintendent and sat down and had a conversation with him and the assistant superintendent and shared with them that I believed it was the time we could go towards digital textbooks … I told them all my career I thought about when it would come, when the technology would get to a place where we were comfortable doing that, and I think that we’re there, and I asked them would they be comfortable with us moving in that type of direction … They both gave me their blessing to go ahead and start to do some research around this.
This was the key moment when a concept that the Principal had been tracking for a number of years had reached a critical point where it could become a reality for this school district, and the district leaders agreed. Following this, the process of assembling a project team to begin the technology selection process for the high school commenced.

The fourth participant was the lead technology technician for the school district (District Technician) at the time of the technology selection process, and worked under the Director of Finance, Technology, and Operations. This individual’s primary role was to ensure that any new devices would work seamlessly with the existing infrastructure within the building, and that there was a system in place that would allow management of the applications on the devices. This involved conducting research on both devices and management systems while also participating in the evaluation of tablet functionality.

The fifth participant was a library media specialist student teacher (Student Teacher) at the time of the technology selection process. This individual worked directly with the high school’s library media specialist (LMS), and assisted that individual during the early stages of the process. Subsequently, she was hired to an additional library media specialist position that was created as a part of the decision to provide one-to-one technology devices to the students in the high school. As described by this interview participant, the primary role of this additional position was “to provide the digital citizenship education component which the Board of Ed insisted on as an important component of the entire process” through the introduction of a new class entitled Skills 21. This class was mentioned by all of the interview participants as a very successful element in the rollout of the iPads to the students at the beginning of each school year.

Finally, the sixth interview participant was a ninth grade science teacher (the grade that would be receiving the first wave of one-to-one devices) as well as the Science Department Head
(Dept. Head) at the time of the technology selection process. However, she described an initial role related to the project that was not as a department head: “First I was involved as a teacher. Then it was as a department leader because since we rolled it out with ninth grade first, it only impacted ninth grade teachers which I was one of three”. Over the course of the interviews, several other interview participants portrayed the Dept. Head as a leader in utilizing the new technology for the benefit of the students through the innovative methods employed in this individual’s classroom.

**District Technology Acquisition Process**

Overall, the district’s budget process is overseen by the Board of Education, as established by state statute. On a yearly basis, each school district’s board puts together a detailed budget proposal for approval by the town or city in which it is located. This is based upon input and requests from all of the schools in the district, as well as overall administrative needs. Once approved, the school district’s funding is a single line item in the overall civic budget, and acquisitions that are contained in that approved amount require no additional oversight or authorization outside that of the school district. In the case of the technology acquisition that was the subject of this study, there was a directive from the Board of Education that it had to be “revenue neutral”. That is, the cost of purchasing new technology devices for the high school would have to be offset by decreased spending elsewhere in the district. As the Director explained it:

All the technology purchases run through the Technology Department, so we were involved. Then we had to figure out if we could afford it, because the dictate from the Board of Ed was it’s great, do it, grade level at a time, but you can’t increase your budget; we want to keep this flat.
While the concept for this process was initiated at the building (high school) level by the Principal, the involvement of district level personnel both from the financing and technology sides was integral in moving it forward. Before the district ultimately selected Apple iPads as the most viable tool from an educational standpoint, students, teachers, technicians, and administrators inside and beyond the high school evaluated several other devices.

**Themes Emerging from Participant Interviews**

Eleven themes emerged from the data as a result of in vivo coding. The themes were as follows: *Project goals, initial involvement, project team, communication, device evaluation, final decision, preparation, device distribution, support for users, instructional practices,* and *stakeholder involvement.* A definition for each theme is provided in Table 1.
Table 1

Summary of Themes and Related Definitions

<table>
<thead>
<tr>
<th>Theme</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project goals</td>
<td>The overall goals of the project with respect to the district, the school, the teachers, and the students.</td>
</tr>
<tr>
<td>Initial involvement</td>
<td>The manner in which interview participants/stakeholders began their association with the integration project.</td>
</tr>
<tr>
<td>Project team</td>
<td>How the project team was made up in terms of specific roles or areas of expertise of the participants/stakeholders.</td>
</tr>
<tr>
<td>Communication</td>
<td>Methods by which the project team communicated, formally or informally.</td>
</tr>
<tr>
<td>Device evaluation</td>
<td>Specifications/considerations for the devices evaluated, and the process of that evaluation.</td>
</tr>
<tr>
<td>Final decision</td>
<td>How the final selection decision was made, and any additional approval required.</td>
</tr>
<tr>
<td>Preparation</td>
<td>User and infrastructure preparation prior to and during the introduction of new devices.</td>
</tr>
<tr>
<td>Device distribution</td>
<td>Options considered for the manner by which devices were to be distributed to the students.</td>
</tr>
<tr>
<td>Support for users</td>
<td>Ongoing support for users’ (teachers and students) utilization of the devices for educational purposes.</td>
</tr>
<tr>
<td>Instructional practices</td>
<td>Changes in teachers’ practices with regard to the delivery of the curriculum, assignments, feedback, or grading.</td>
</tr>
<tr>
<td>Stakeholder involvement</td>
<td>Participant’s opinion on whether the selection process would have benefitted from the additional involvement of other stakeholders.</td>
</tr>
</tbody>
</table>

**Project goals.** In the data collected, the goals described by the participants aligned with different phases of the decision-making process. There were goals that were present during the initial development of the plan and the selection discussions, and there were goals that expanded the scope of the project as the adoption and integration of the technology commenced.

**Initial goals.** The three individuals involved in the earliest stages of the project—the high school principal (Principal), the high school library media specialist (LMS), and the Director of Finance, Technology, and Operations (Director)—all indicated that one of the primary, initial goals was to reduce the number of textbooks that students carried and replace these with a digital version. According to the Director, this was one of the key selling points to
the Superintendent and the Board of Education. Additionally, the LMS and the District Technician described the early goals as including a move to a paper-free environment, which would cut down on expenses for consumable items; the Director mentioned transforming the instructional and educational processes in the classroom; the District Technician and the Student Teacher added having an entire classroom of students online at once with constant, ready-access to independent research; the Dept. Head suggested a goal was integrating technology to make learning better, and ninth grade more exciting; the Student Teacher opined that it was the district’s desire to make students more comfortable with the use of technology in a variety of formats; and the LMS indicated that substituting the use of technology devices for things that were already done was another anticipated outcome.

**Expansion of goals.** The connecting force for the expansion of scope of the goals as the project progressed into the adoption and integration phases was an initial vision of the Principal that involved transforming the school to a one-to-one environment with the selected devices at the center of the students’ digital world. This occurred during his early research steps conducted in conjunction with the LMS through which both developed a philosophy that students in the 21st century need to become, as the Principal described it, “discerning consumers and responsible producers of information”. In order to do this, the Principal saw that the selected devices had to be desirable for students to use all the time, rather than to leave in their locker like a textbook. The device, however, had to be combined with some instruction on the responsible and appropriate use of technology, which also led to the development of the Skills 21 course. Through this process, the Principal saw that students and teachers could bridge the difference between personal and professional use of their digital devices, and make those skills transferable.
As the project progressed, and the adoption and integration of the devices commenced, the LMS indicated that their goals grew beyond the basics of substituting iPads for previous tools or procedures towards things that were more transformational. Sharing of documents and better student-teacher communication, begun under a move to Google Apps the previous year, expanded with the integration of the tablets according to the Director, the District Technician, and the Student Teacher. However, the Dept. Head saw an even larger transformational movement from the teachers’ side based upon what was described as the Principal’s support of an organic vision coming from the staff. She indicated that the goal in this school was to always have adult learners inspire students so, with regard to the new one-to-one devices, there was no specific direction given on their use in the hopes that teachers would figure out the direction of what could potentially happen, thus leading students to the understanding that they can also learn on devices with which they are already familiar.

**Initial involvement.** The six interview participants were the key stakeholders who were involved in the technology integration project from its inception based upon the role that each played either within the high school or within the district. As previously indicated, the Principal conceived the idea to initially replace textbooks with individual technology devices for each student. This concept was presented to the Superintendent and Assistant Superintendent, who agreed that further research was warranted. In order to conduct this research, the LMS stated that the principal “strategically gave iPads” to the LMS, the Director, the District Technician, and the Superintendent so that they might find educational applications for teachers as well as figure out how the devices would work within the school’s infrastructure. The LMS self-characterized herself as an “earlier adopter” of technologies, and was selected as a partner in the
initial steps of the project by the Principal because, as described by Principal, the LMS was very
detail oriented and provided a counterbalance to his visionary approach.

On the district side, the Director became involved early as well because of the dual
responsibility around procuring devices that would fit into the district technology infrastructure,
as well as paying for such equipment. For similar reasons related to technology, the principal
gave an iPad to the District Technician, asking her what needed to be done to make it work, and
leading to research to answer that question.

Back within the high school building, the Student Teacher was, at this time, a library
media specialist student teacher, whose role was described in the interview as assisting the LMS
in daily tasks and projects. Subsequently, the Student Teacher was hired as an additional library
media specialist and teacher of the Skills 21 class beginning with the first year of the device
rollout. There were also a few key teachers who initially received an iPad during the early
phases of research, but the Dept. Head was not one of them. The Dept. Head received an iPad
towards the end of the school year prior to the students receiving their iPads, with instruction to
use it over the summer in order to become familiar with it. As she described it, once the students
were in front of you it was pretty much “free reign” to drive your own exploration into finding
ways to make technology meaningful for interaction.

**Project team.** The Director described the project as always having a “core group” that
consisted of the Principal, the library media specialist, and himself. Other key stakeholders were
brought in along the way. This was echoed in the interview with the Principal, who confirmed
kicking off the project and, based on knowledge of leadership theories around partnering a
person with vision with a person who is detail-oriented and can work on the specifics of putting
things together, immediately involved the LMS to begin the process of brainstorming and
gathering ideas. The Principal also indicated that the initial conversations would include the Director and the District Technician to ensure that the financial and infrastructure sides were covered as well. As momentum grew, the Principal stated that the high school department heads were added to the conversation so that updates could flow to the teachers in their respective departments. Through the Director, the Superintendent and the rest of the district administrative office were also a part of the process from the beginning since, as the Director related, technology and finance were both direct responsibilities of that office.

As device evaluation moved toward approaching a final decision, other key stakeholders were involved. The Director stated that parents and other community members were involved through presentations by the Superintendent, the Principal, and himself. Further, the Board of Education was involved because policy related to acceptable use of the devices and insurance to cover damages needed to be approved. This was an example of what the Student Teacher described as an expansion of the circles of those involved as the project developed. It began with a concept, then the technology people were involved to see if it was feasible, then the financial aspect was examined to see if it was possible, so that with each expansion another key stakeholder was involved. Also, the team was structured in that there was one person all along the way who coordinated the important aspects of the technology integration needs of the teachers (LMS), as well as one person focused on how to integrate and manage the devices within the existing technology infrastructure of the district (District Technician). These two individuals also organized and managed the testing of potential technology devices by various teachers and students during the evaluation phase, thereby ensuring that additional stakeholders were a part of the selection decision process.
As the project moved into the integration phase, the Dept. Head explained that there were teachers from all of the different content areas who had to “figure out how the tool would support” learning in their respective classrooms. She went on to indicate that there were some teachers who embraced the technology and found innovative ways to use it. However, there were others who decided to wait until they received further direction from the building administration. Despite this, the Dept. Head concluded that there was a definite positive in the organic development that came out of this process. This lack of a rigid structure to the project and the team was also seen in the interview with the Student Teacher who reflected on the collaboration of “smart, bright, capable people” who brought this project to a successful completion, which might not have occurred in a district that required a stricter process.

**Communication.** The fact that during the early stages of the process there was a somewhat informal approach to the formation of a project team was also reflected in the way those team members communicated. The LMS stated that the high school was a small building so many of those based there—herself, the Principal, and the District Technician—saw each other all of the time. The LMS also spoke to the Director while the Principal usually communicated with the Superintendent. The Director confirmed that there was never really a formal committee, and that most of the communication was by phone or e-mail. The focus of the Principal and the library media specialist was on the instructional piece while procurement and installation of the equipment were the Director’s responsibility, and that of the District Technician. The Director explained that everyone did get together when it was time to draft the policies around the technology integration program so that one can “kind of make everybody happy in this process”. The Student Teacher agreed that communication was pretty informal during the evaluation of the devices in that people would research ideas and report back later.
Once the iPads were selected, there was a bit more formality in terms of proposals and Board of Education presentations.

Some communication did occur through regular meetings, according to the Principal. The department heads in the high school were kept apprised of the progress of the project along the way at department meetings, and then brought information back to their individual department meetings. The high school also had monthly faculty meetings that, according to Principal, had changed a few years prior to be structured more like professional development opportunities where best practices around things like technology integration could be showcased. The Principal also participated in regular administrative council meetings at the district level where the members were kept up to date on the status of technology evaluation at the high school. The idea that, despite the relative informality of the project team, there were still regular meetings between the core group of stakeholders working on the selection of a technology device to integrate was also stated by the District Technician.

After the initial rollout of the iPads, the Dept. Head saw much of the communication as being driven by the teachers through their collaboration on different ways to utilize the iPads in lessons either based on ways the teachers had conceived them or on students’ suggestions. The Dept. Head confirmed the importance of communication between teachers and students, who are both important stakeholders in this project. In her role as a department head, she sought to model what was expected of teachers through communication. To do this, department meeting agendas and discussion links were made available through the iPad so that teachers, especially those of upper grades whose students did not yet have iPads, would have opportunities to “rehearse the use of the device” before they had to use it in class. Also during this time, the Dept. Head stressed that there was continuous communication with the Board of Education and
the community through presentations, an iPad Fair for parents at which students showcased what
they had been doing in class, and visits and interviews from other schools and media outlets.

During the interview with the Principal there was a statement that captured the
philosophy of what was needed to continue to move this project forward, not only in terms of
communication, but leadership as well:

I believe it’s a leader’s responsibility in part while working through these things to get
people to the level of commitment. We can stay in the area of conversation and
consideration, but there comes a point where the leader has to know when is the right
time to say okay, we’re going to do this. That really shifts people’s focus away from “if”
to “how”.

That is, while communication can be an important tool to keep people updated on the events
related to a specific project, it can also be an important tool to spur them forward to go beyond
the talking stage and to take action.

**Device evaluation.** The evaluation of the devices to be used in the high school was
coordinated by the LMS who called manufacturers and obtained samples for testing by teachers,
students, and administrators. The LMS indicated that there were some basic tests that were used,
such as how does the screen look, how good was the sound, how easy was it to use Google Apps,
how portable was it, and were the applications locked down. The last test item tied in with the
philosophy of the Principal that, if the students were not allowed to manage their own
applications on the device, it would just become another textbook to be left in a locker.

According to the Principal, the group would get back together after the testing of a device to talk
about its strengths and weaknesses. The Principal stated that the evaluation process was
basically a field study where devices were put out there for a while and then the users were asked
what they thought about each one. This information gathering process was an important consideration for the decision-making group because, as the Principal characterized it, we “took that perceptual feedback from the people who would be the end users as a really serious consideration in making the decision”.

Additionally, there were other specific considerations concerning device capabilities that were mentioned by the stakeholders. These included the requirement of the LMS to view a TED Talk; the Director’s need for having a double camera for student-created videos; the Principal stated that the uptime (reliability) of device needed to be 100%; the Principal’s other important concerns were the life span of the device (e.g. Droids were about 2 years compared to Apple’s 4 years), a mobile device management option to allow applications to be pushed out as well as let students manage the devices, and a device that was intuitive; the District Technician looked for applications focused on education; the Student Teacher focused on instant access (which eliminated laptops early on), and access to multiple tabbed web pages at same time; the Dept. Head centered on collaboration and engagement related to the previous year’s move to Google Apps (which was termed as an “essential step” prior to the integration of one-to-one devices), and reliability and longevity in terms of maintenance.

Ultimately, according to the Principal, while the group looked at a number of devices, the hardware is only as good as the software it runs, and the iPad had a “rich array of software available to it”. The LMS confirmed that Apple was further ahead on software for the educational market, and it always won in comparison to the other devices tested. The Director stated that the iPad was selected because it was the best instrument for educational purposes, as well as the most reliable in comparison to the others. The District Technician and the Student Teacher also commented on the fact that after testing the group agreed that the iPad performed
the best in relation to the criteria that had been established. Also in comparison to others, the Director indicated that the iPad had a price point that made it more realistic from a financial affordability standpoint for the district since many other early tablets were very expensive. While this process also did not follow a formal project management protocol, it did lead the group to come to a consensus agreement that the iPad was the best choice for their district.

**Final decision.** Since the project had not been following a strict process, the final decision to select the iPad also came about informally. As the LMS described it, the decision “just evolved. This was a better machine, so we’re going to use this one” because the teachers, students, and administrators all agreed that it was better. According to the Principal, the decision was essentially made at the building level by himself, the LMS, and the District Technician. The Principal went on to state that the decision was shared with the Director, who was involved in some of the meetings and was kept apprised of everything along the way, as well as with the Superintendent. However, during an interview, the Director indicated he was involved in all of the decisions along the way in conjunction with the Principal and the LMS. Nevertheless, the decision was not a surprise to anyone, and the Director emphasized that there were very few unilateral decisions made since those at the high school were considering the instructional side of the project while those in the central office were concerned with the technical and financial aspect. As the Student Teacher pointed out, those in the central office had a great deal of trust in those in the high school testing the devices, which made it possible to move the project forward. She added that the iPad met the criteria of each of the individual testers, and was the device that was likely to have the most tools developed for it in the future.

Following the decision, there were some presentations to the Board of Education to secure approval for how the money was to be spent for this project, as well as for the necessary
policy changes that it would entail. However from a financial standpoint, as the Director indicated, the board had previously decided that this project needed to be revenue neutral, so it was already a part of an approved budget. What did need to occur at the central office level was a reconfiguration of some existing capital leases to allow for the new iPads to be purchased over a period of 4 years. These changes in how the board was spending the allocation of funds from the town were the subject of presentations and board approval. According to the Principal, there were also presentations to the community at large to provide them with information about the changes at the high school, but the project did not need any additional approval at that level. Essentially, the presentations to the board for formal approval were the only points when the selection decision-making process needed to follow an established, prescribed set of rules in order to proceed to the next step.

**Preparation.** All of the interview participants spoke of the manner in which both the people who would be impacted, as well as the physical infrastructure of the building itself, were prepared for the technology integration project. The LMS shared the fact that the Principal “hand-picked” teachers who were strong in technology and moved them to teach ninth grade classes during the first year of integration. The Principal confirmed this during his interview, and added that these teachers also received professional development focused on differentiated instruction in a one-to-one environment. Additionally, the ninth grade teachers received their iPads during the spring of the school year prior to rollout and there were voluntary professional development workshops, as well as drop in sessions with the LMS, to allow the teachers to become familiar with using them. The teachers also took the iPads home over the summer and, according to the District Technician, used a collaborative Google Doc to share and comment on various applications that they had found. However, the Dept. Head, speaking from a teacher’s
perspective, did not recall any extensive training beyond learning some basic operational skills prior to the rollout. She saw the technology savvy teachers embracing the use of these new devices, and these individuals became the “go to” people for others to get answers to their questions.

Another manner in which the teachers were prepared for the introduction of new technology was that the LMS had collected hundreds of educational applications for the iPad from the very beginning of the project, and had catalogued these for the teachers before they actually received their devices. Further, the LMS, the Principal, and the Director all mentioned the change to a block schedule at the high school during the first year of the rollout, which allowed the teachers to have a collaborative learning period of about 80 minutes every fourth day during which they could focus on sharing experiences about teaching technology rich lessons. The Principal mentioned that having several changes occur at the same time was intentional because, while it may have created some initial chaos, the duration was of a shorter term and, therefore, easier to accept. After the rollout in the first year, the Dept. Head worked with the LMS to try to inspire teachers to embrace and use the new technology. There were voluntary after school sessions arranged, as well as attempts to have teachers use technology with the students during a daily 20 minute flex time period. Additionally, the Dept. Head also modeled the use of technology during department meetings as previously described under the Communications section.

**Student preparation.** Prior to the rollout of the devices, the students did not have any specific preparation for their use, unless they had some personal experience with the iPad. According to the Student Teacher, that training did not come until the students were in the Skills 21 class at the beginning of freshman year. The importance of that class in teaching technology
skills to the students was echoed by the LMS, who stated that even though “technology is ubiquitous, it doesn’t mean that the kids understand how it works”. The LMS went on to opine that a bring your own device (BYOD) policy doesn’t give everyone equal access in the same way that one-to-one does because the differences in the devices used don’t allow the students and the teachers to utilize technology to its full capabilities. The Director also indicated that the Skills 21 class instructed students in the concepts of digital citizenship, information literacy, and the school’s expectations around use of the iPads. In addition to the Skills 21 class, the Principal stated that the students have in a sense been prepared for technology use all along because the school district does look at the continuum of that use throughout grades K-12. Once the devices were implemented, the Dept. Head related that the teachers needed to provide some structure for the students about the manner in which the iPads were to be used in class through setting rules or communicating roles that would apply in a particular classroom.

**Parent preparation.** The students’ parents received some preparation prior to the rollout as well as during its early stages. The Director recalled that there were several parent information sessions over the summer before the rollout to answer questions and address concerns. Also, the district worked with the local cable company to ensure there was home internet access for anyone who was in need of it. The Principal confirmed this, and added that there were also televised Board of Education meetings where the project was discussed. The District Technician pointed out that there were pamphlets and policy documents distributed prior to implementation, and that parents were given the opportunity to call or e-mail with questions. The Director added that information was available through newsletters, the district website, and local newspaper articles. Following implementation, as described by the LMS and the District Technician, there was an iPad Fair at which students could showcase the applications they were
using in class, and parents got additional information or had questions answered. The Dept.
Head added that at these fairs the parents also received information on safety features and
restrictions, and had concerns about device use and internet access in general answered. Also,
the Student Teacher indicated that after taking on the role of the Skills 21 teacher in the first year
of implementation, there were numerous direct inquiries from parents of ninth grade students to
address specific concerns.

**Infrastructure and administrative preparation.** On the infrastructure and administrative
sides, a great deal of preparation had been done prior to the rollout of the one-to-one technology
initiative. The Principal recalled that there was a renovation of the high school in 2007/8 that
upgraded the technology infrastructure, and a “revamping” of the wireless followed this in
2009/10. Also, in the year prior to this project, the Director stated that the district moved to
Google Apps as its instructional platform, which set the tone for the integration of a one-to-one
environment (and saved the district money by avoiding some software licensing expenses). The
BYOD environment was also set up in the high school prior to the implementation because the
District Technician needed to make sure it worked beforehand. This was an important element
because not all students would be receiving the new devices and would, therefore, have to rely
on access through their own device. Following the Wi-Fi update, the District Technician did
further research on the best cloud-based management system for the network and devices. This
also allowed the district to realize a cost savings through a decrease in the need for equipment
purchases. The Director stated that the District Technician was also responsible for the physical
setup of each of the iPad devices before it could be given to the students. This included adding
each item to inventory, labeling it, putting it in a case, and setting up the initial suite of
applications. The Director and the central office staff also handled the financial aspects of
obtaining the devices and arranging for the appropriate leasing agreements to meet the district’s requirements. Also on the administrative side, the Director, the LMS, the Principal and the District Technician worked with the Superintendent and Assistant Superintendent to modify policies related to acceptable use, parental permission, and student expectations. These then were presented to the Board of Education for acceptance and approval.

In summary, the Principal concluded that this was a well thought out plan from the beginning. The stakeholders consulted a researcher with whom they were able to work, and from whom they learned quite a lot. They then followed a thoughtful process that allowed all those who would be affected to be, at least to some degree, prepared for the changes that were coming. As the changes unfolded, that preparation allowed others to step in and also assist in continuing to move the project forward.

Device distribution. In their responses to the question on the manner by which the devices were distributed, the interview participants referenced both the activities surrounding their physical distribution as well as the wider context of distribution to one grade at a time. The LMS outlined how the researchers they consulted early in the process suggested piloting the devices with a portion of the freshman class in order to collect data. However, when the Principal suggested that idea to the Board of Education it was rejected because of the perceived lack of equity in the selection of those who would receive new devices and those who would not. For that reason, the district chose to roll the devices out to an entire grade, and continue that for the following three years until all students had a one-to-one device. The LMS indicated that distributing the iPads one grade at a time over four years was partly a financial decision, however it also gave the teachers time for additional professional development with the new tools. The District Technician confirmed that it was not feasible to obtain devices for the whole
school at once budget-wise, so it had to be done over four years. The Student Teacher indicated that a rollout of the devices to more than one grade at a time would have been unmanageable. Additionally, the Dept. Head pointed out that the whole school had access to the BYOD network in order to allow everyone to take advantage of the technology curriculum that was being offered. However, the Principal reflected that while the BYOD was a benefit for everyone, the four-year rollout was difficult for some, especially the 10th grade students who would never “reap the benefits” of receiving a one-to-one device throughout their entire time at the high school.

**Physical distribution of devices.** In terms of the physical distribution of the devices, the Principal referenced the thoughtful manner in which it was approached that resulted in the development of the Skills 21 class for the students that was taught by the newly funded library media specialist (the former Student Teacher). According to the Principal, this class taught the students digital citizenship, time management, and organizational skills. The Dept. Head agreed that the Skills 21 class was crucial in teaching the ninth graders basic operational and responsibility skills. Further, the Director stated that the Skills 21 class set school and district expectations for the students concerning the use of the devices, both in school and at home. This class was also the means to collect the required paperwork for the new devices, according to the LMS, such as signed Acceptable Use Policies, permission slips, and a $50 insurance fee. The devices had been inventoried and set up over the summer by the technology staff however, in the first year (according to the Student Teacher), it took several weeks to get all of the iPads distributed. Subsequently, that was all done in the first four days of school.

**Support for users.** One of the primary ways in which teachers and students have received ongoing assistance with the use of their iPads is through a student-run technology team
that is based in the library. Although the library is its base, according to the LMS, the students can go to a classroom if needed to answer questions or solve problems. The Principal termed it a “help desk for peers”, however he stressed that students often find solutions to their own problems, which is in line with the overall vision of the district. Additionally, the Principal pointed out that this was the only feasible approach because there would not be enough technology services people to provide level one support for all of the additional devices now in the high school. The District Technician added that the student team assists in setting up students who are new to the district. Students can also find and install applications for their iPads. This is true for teachers as well, according to the Director, since there is no need for technology department approval as in the past. Both the Student Teacher and the Dept. Head also mentioned the importance of the peer support of the tech team. The Dept. Head emphasized that the fact that students are now helping teachers in the classroom demonstrated how the culture in the school has gone completely collaborative, which is fantastic. The Director concurred by citing how this ties in to the concept of the student-centered classroom.

**Support via collaborative learning time.** The other important method of ongoing support for users is the collaborative learning time (CLT) built into the school’s block schedule. Since there was not much formal training, according to the Director, this is when teachers become resources for one another concerning questions about the use of the iPads. The Student Teacher also indicated that CLT is when the library media specialists can meet with teachers concerning technology maintenance and growth, or teachers with specific technology skills can be paired with those who have questions. The Dept. Head mentioned that there are occasionally professional development days that involve a workshop of choice format in which teachers present sessions on certain topics and others may opt in to the class. She also stated that the staff
and students have presented at the state university’s school of education “iPad Day”, and that these presentations are shared back at the high school. Overall, while not provided in a formal manner, the students and teachers all support one another in the best use of the iPads for learning.

**Changes in instructional practices.** When asked about changes to instructional practices as a result of the introduction of one-to-one technology, the LMS replied that it did not seem as though the teachers’ practices changed, rather the skills within them did. Lessons became more engaging and allowed for greater use of multimedia by students (e.g. filming a science experiment instead of just writing a lab report gave the students more choices of the products that they could use). The Director saw this as an expectation on the teachers to do things differently, not to just replicate what had been done by now using a new device. He emphasized that the hope was to see flipped classrooms, more student-centered teaching, an increased use of electronic textbooks, and a lot less printing of assignments. For the most part this was realized, with the exception of a large increase in electronic textbooks due to their continued high costs and limited availability. Taking this further, the Principal saw this change as an opportunity to “get away from this idea around technology for instruction and you get into technology for learning”, and move from what is the teacher doing with the device to what are the students doing with the device. The Principal felt that the 83-minute periods in the block schedule also allowed the teachers to make better use of the technology in the classroom and to be more fluid in accessing resources throughout the period. The District Technician also felt that teachers generally taught the same way, just with a different tool to use. Meanwhile, the Student Teacher indicated that it varied teacher by teacher, with some better maintaining their websites
and making information available to students online, and others still printing and handing out materials.

**Inside the classroom.** The Dept. Head, with a dual view of teacher and leader, saw that instruction began to slow down because it was so different. Teachers had to pay attention to classroom management because the students were excited to have these new devices. Therefore, the teachers needed to reinforce the value of how the iPads change the students’ time in class. The Dept. Head characterized the students as trusting of this approach. The introduction of the iPads furthered the teacher-student collaborative goals that had started with the previous move to Google Apps by giving students constant access to the possibility of extending learning outside of the classroom. The Dept. Head indicated that students became involved in the creation of instruction by suggesting applications that might be used in class, while at the same time, their level of responsibility and accountability increased dramatically.

While some teachers pushed back on the introduction of the technology, the Dept. Head stated that many others wanted to try new things. As a department head, she saw that teachers had to look much farther ahead when planning their lessons. They had to think about the whole process including distribution of materials, student use and personalization of information, assignment hand in, and teacher’s feedback to students. If this was not done, the lesson would have to stop and the teachers “had to retool” because they needed to allow the students to take different paths than they had previously to now complete an assignment. All of this ties in to a concept mentioned by the Director related to the necessity for the district to now have to administratively allow some risk taking so that people will try new things. The Director called this a need for an “incubator” in which to try new things, otherwise the teachers will never be inclined to try anything innovative.
Stakeholder involvement. When asked about the benefits of additional stakeholder involvement in the technology integration selection process, the LMS recalled that the project didn’t follow a formal process in this district but, rather, grew in an organic manner, so adding other stakeholders would not have resulted in the same benefit as it might in a larger district. The Director indicated that the addition of more teachers might have been beneficial, however, including too many people is a hindrance to making decisions. The Student Teacher also suggested that a broader range of teacher buy-in on the project, especially from those in the upper grades, might have led to better adoption of the project down the road. However, the District Technician felt that adding more teachers would not have helped, since they were already represented to some degree by the department heads. The Dept. Head, though, thought that being involved in the early selection decisions would have forced her to only look through the lens of the science department, whereas individuals like the Principal and the library media specialist likely provided more of a whole school approach. The Dept. Head also did not know if students had been involved in the early stages (they were), but thought they likely were since the Principal was very good at getting information from people who would help before making a decision. In looking at this question in the bigger picture, the Principal suggested that it might have been better to have rolled out the devices to two grades in one year. But, that would have involved some type of partnership with the business community through the Chamber of Commerce, or some other group, to provide the necessary funding. Another thought regarding stakeholders that the Principal proposed was a partnering around a parent education piece through a group like the Parent Teacher Organization that would have focused on managing student time in a digital world and understanding the teenage brain. However, when considering
whether additional parent involvement would have helped, the Student Teacher rejected the idea since parents don’t always have the same perspective as educators.

Summary

This chapter has presented the themes that emerged from an analysis of the interview data gathered from the key stakeholders in one specific technology selection process in a school district. Guided by the topics that were covered in the interview questions, the 11 themes that emerged begin to answer the central research question: How does a school district make technology investment decisions? Some of the key points related to each of those themes are presented in Table 2.
<table>
<thead>
<tr>
<th>Theme</th>
<th>Key Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project goals</td>
<td>Started small—replace textbooks. Grew as project developed to include more transformational objectives by making the selected devices the center of the students’ digital world.</td>
</tr>
<tr>
<td>Initial involvement</td>
<td>The Principal came up with the concept and gave devices to key stakeholders who were necessary to move the project forward from perspective of instruction, technology, and finance.</td>
</tr>
<tr>
<td>Project team</td>
<td>Not formal. Circles expanded as project grew and additional stakeholders were involved. Group of capable people who succeeded without the need for a strict overarching process.</td>
</tr>
<tr>
<td>Communication</td>
<td>Also informal during early stages; everyone saw each other frequently. Once device selected, presentations and proposals to Board of Education. Expanding group of stakeholders kept informed. The Principal and the Dept. Head saw communications as a means to motivate teachers.</td>
</tr>
<tr>
<td>Device evaluation</td>
<td>Coordinated by the LMS. The Principal called it a field study of devices based on consultation with university researchers. Feedback from end users was an important consideration. Ultimately, hardware only as good as the software it runs.</td>
</tr>
<tr>
<td>Final decision</td>
<td>Informal as well—it just evolved. Core group involved had the trust of the district central office. The selected device met the individual criteria of the stakeholders. Approval from BOE followed.</td>
</tr>
<tr>
<td>Preparation</td>
<td>Related to both people and infrastructure. Teachers with strong technology skills moved to ninth grade for initial rollout, and given professional development. The LMS collected apps for teacher and student use. Teachers helped one another in collaborative learning time. Students had Skills 21 classes. Infrastructure had several years of preparation, including move to Google Apps, rewire of high school, upgrade of Wi-Fi network, and install of BYOD environment.</td>
</tr>
<tr>
<td>Device distribution</td>
<td>Physical distribution done through Skills 21 class, which also sets student expectations. Decision to do one grade at a time was based on equity and financial considerations.</td>
</tr>
<tr>
<td>Support for users</td>
<td>Student tech team set up to assist peers. CLT allows teachers time to help one another. Some ongoing professional development presentations were also included for teachers.</td>
</tr>
<tr>
<td>Instructional practices</td>
<td>Gave teachers and students more options in completing assignments. Move from technology for instruction to technology for learning. Teachers had to pay more attention to classroom management. Furthered student-teacher collaboration. Teachers now have to think up front about whole process from assignment handout to return of grades. District must allow some degree of risk taking by teachers.</td>
</tr>
<tr>
<td>Stakeholder involvement</td>
<td>For the most part, participants felt that the right amount of people were involved in the process. Additional teachers or parents might have helped, but could have actually hindered progress.</td>
</tr>
</tbody>
</table>
While the interview participants that have provided the data for this research study characterized much of the process as “informal”, further analysis reveals that many of the steps that one might expect in a more traditional project management approach were in place during this technology selection decision. Key stakeholders (or their representatives) representing instruction, technology infrastructure, and finance were involved on a project team from the very beginning. This team started out with modest goals and then made adjustments to their scope as additional research into the capabilities of the technology furthered their knowledge. By virtue of having a small project team, communication between the members, as well as the expanding circles of individuals within the district who needed to be informed, was fairly easy to accomplish.

Although it may not have been written down in a formal manner, the testing process that each individual followed to evaluate the potential devices had specific criteria that related to each individuals’ area of expertise and that of the larger body of stakeholder that he or she represented. This led to the selection of the iPad as the device that best met the criteria of each of those groups. Furthermore, the district prepared both its technology infrastructure and its teachers for the integration of these devices prior to their actual arrival. This was done through improvements to the physical wiring of the building, finding an appropriate system to manage the new devices that were being added to the network environment, and providing teachers with formal and informal opportunities to receive instruction on the effective use of the new technology.

The students were also well prepared through the creation of a class that stressed the importance of digital citizenship and the school’s expectations for the use of the iPads both inside and outside of school. Distribution also took into account the financial prudence of
acquiring the devices over the course of four years, as well as the equity in providing devices to an entire grade rather than just a pilot group of students. In the area of instructional practices, the changes that began to appear in classrooms were in response to the expansion of the initial project goals in that students and teachers now had more options by which assignments could be completed and evaluated. Finally, in retrospect, the interview participants were able to reflect on the process to determine if additional stakeholder involvement would have benefitted the outcome. On the whole, they did not see great additional value that would have resulted from including others beyond the key stakeholders that made the technology selection decision.

In chapter 5, we will look at these findings in relation to the theoretical framework and the literature review to see what insights they provided to the problem of practice of this research study. How these findings addressed the significance of the problem from the standpoint of planning and preparation in educational practice will be evaluated in order to address the relative value of this case study to other similar processes either within the same district or in another. Recommendations for future practices, as well as further areas of potential study, will also be provided.
Chapter 5—Discussion of Research Findings

The purpose of this single-site case study was to explore the leadership roles of the stakeholders involved in a New England school district’s decision-making process surrounding the selection, adoption, and integration of technology for that district’s public high school. The following research questions guided me in exploring how the experiences of the stakeholders directly impacted by the technology selection decision might reveal a process in which multiple leadership roles were played by each individual at various stages of the decision-making process: How does a school district make technology investment decisions? How were leadership roles distributed throughout the decision-making process? How did the stakeholders describe their experiences in each phase of the process? The questions were informed by the themes developed through a review of the extant literature on school technology integration and its related planning processes, as well as through a lens based upon the concepts proposed by Uhl-Bien et al. (2007) in their development of the Complexity Leadership Theory, which is a model of leadership based in complexity science that recognizes leadership as an “interplay of many interacting forces” (p. 314).

In answer to the central question, interviews with the study participants established that the school district made this technology selection decision by having a process in place, regardless of how formal or informal that process was, that involved all of the relevant stakeholders in the decisions. Further, analysis of the participants’ responses revealed an almost continuous distribution of the roles associated with the Complexity Leadership Theory (administrative, or bureaucratic and controlling; adaptive, or flexible and innovative; and enabling, or a bridge between the previous two extremes) among these individuals throughout the entire project lifecycle. Finally, in terms of their experiences, the key stakeholders described
involvement in the process from the beginning, with continued participation throughout the decision-making process all the way through to the implementation and acceptance phases (Keengwe et al., 2009; Lee et al., 2013; Rice & Miller, 2001; Stuart et al., 2009; Tan, 2010). Because this was a relatively small district, the participants were able to communicate with one another, both formally and informally, so that everyone was kept up to date on the status and progress throughout the process.

This chapter includes a discussion of findings in response to the research questions, and the relationship between the findings and the theoretical framework and existing literature. A conclusion with recommendations for use of the “best practices” will be offered. What follows is a discussion of the key points concerning the technology selection decision-making process, including what worked well and what areas may need improvement.

Creating a Process

The data resulting from the interviews with the participants all point to the existence of a process that was in place from the very early stages of this initiative. This also aligns with themes that emerged in the literature with regard to the importance of planning for the adaptation of the technology to meet the specific needs of the context into which it will be implemented (Baker, 2012; Bauer & Kenton, 2005; Corn, 2010; Gülbahar, 2007; Hixon & Buckenmeyer, 2009; Peck et al., 2011; Shapley et al., 2010). While it may have been somewhat informal in some respects, the steps it contains may form the framework of a best practices model for similar situations in the future. The steps in the process that emerged from this analysis are as follows:

1. Start with a goal for the project.
2. Assemble a project team to oversee the initiative that represents all stakeholders.
3. Document the needs/requirements of the users/stakeholders.
4. Document the capabilities/constraints of the existing infrastructure and support.

5. Put together a project plan with deliverables and due dates.

6. Test potential solutions and make a selection based upon criteria that meet user/infrastructure requirements.

7. Develop training to prepare the users/stakeholders for the implementation of the solution.

8. Implement, monitor, and support the use of the new solution.

The process was also guided by the overarching presence of shared leadership that was
demonstrated at various times by each of the stakeholders. This distribution of decision-making
and leadership will be discussed in the section following the analysis of the process steps.

**Project goals.** This technology integration project started with a goal from the leadership
that was driven by student need (Earle, 2002). More specifically, the project was born from a
goal envisioned by the Principal, who had been tracking trends in technology related to
education throughout his career, to replace students’ print textbooks with electronic versions.
The goal of providing one-to-one technology to the students coincides with the findings of a
study by Lei and Zhao (2008), who suggested that having constant access to their own
technology device allowed students to improve their proficiency with the technology while
working on various assignments and tasks. The Principal’s goal was two-fold in that he wanted
to use up-to-date technology in the school environment, but this decision was also driven by
student learning. Not only did the Principal think of ways to improve learning through
technology, but he acted on his vision. In this way, the Principal demonstrated adaptive
leadership (Uhl-Bien et al., 2007).
After receiving approval from the Superintendent to proceed, the Principal teamed with the LMS (a self-described early adopter of technology) to initially take on the administrative role of researching the opportunities of technology integration with university level experts who had already studied this prospect. The educators quickly adopted adaptive roles related to the project goals when they saw the potential of transforming learning at the high school to a more collaborative process for both students and teachers through the distribution of technology devices to everyone. Therefore, they expanded the goal of the initiative to incorporate the vision of making students discerning consumers and responsible producers of information through the distribution of one-to-one technology devices.

**Project team.** Multiple stakeholders were involved with the technology selection process from the early stages of the project including instructional and administrative representatives. Hewitt et al. (2012) suggested that the success of educational technology integration depends on the teachers’ sense that they are in control of their own participation in the ongoing changes. Likewise, a study by Kumar and Altschuld (1999) found that an environment conducive to teacher innovation, strong administrative commitment, and active faculty involvement were additional factors in the successful implementation of technology projects. From the interviews conducted, it is evident that this district supported teacher innovation, that there was strong commitment from all levels of administration, and that the faculty were involved in the decision-making process along the way. This was best reflected in the interview with the Principal in which he related how the project team “snowballed” within the building from just himself and the Library Media Specialist to include, first, the department heads and, then, a number of teachers who were “taking off” with the idea of using technology to
replace textbooks. He further indicated that the Superintendent and the rest of the Central Office administration were also part of the process from its earliest stages.

Since the team was small, and for the most part located in the same building, the interview participants indicated that communication did not follow any formal channels. There were no regular meetings where all participants gathered to report on the status of their area of expertise, however all indicated that they were kept informed of the progress at each stage of the project. Mentz and Mentz (2003) indicated that the planning and management of a technology integration project should be done at the school level, and the principal should play a vital role in the process. This was certainly evident in the subject high school, in which the Principal stated that the decision to select the iPads was made at the school level by himself, the Library Media Specialist, and the teachers and students who assisted in the testing, and then communicated up to the district offices.

**User requirements.** The needs and requirements of the users who will be affected by a change in technology are usually recorded in a formal user requirements document at the beginning of an implementation project. However, in this case, each of the stakeholders representing his or her constituency came to the evaluation step with specific criteria against which the devices to be tested were held. The results of the testing process on each potential technology device were communicated to the other team members on a regular basis through normal interaction with one another since the building was relatively small. While these requirements were informal in nature, the move to a more student-centered learning environment was evident in the interviews conducted.

The interviews with the Principal, the Director, the Department Head, and the LMS highlighted the changes in approaches in the classrooms since the introduction of the iPads in the
high school to what is now a more student-centered environment, with students more responsible for their own learning. Assignments and resources may be accessed online outside of school hours, and the ability of student-student and student-teacher collaboration has been greatly enhanced. This aligns with the findings of Oliver (2010) in a study of North Carolina Early College High Schools that demonstrated how the integration of technology allowed more efficient distribution and collection of assignments, better differentiation through access to more resources, student-directed projects, group work, and presentations.

From a broader scope, the Principal had been studying trends in the integration of technology in education for some time, and found that an appropriate opportunity to fit into the district’s overall vision for technology had arrived. This aligned with a study by Hew and Brush (2007) in which the researchers examined concerns about whether new technology is compatible with the overall technology vision of the school or district. Furthermore, from the interviews with the Principal, the Department Head, and the LMS it is evident that the high school was focused on allowing students to collaborate with teachers to create their own learning experiences, and that the teachers and administrators had embraced that model of teaching. This is reflective of the fact that while some requirements may not be evident at the outset of the project, as was seen in a study by Blair (2012), teachers must continue to evolve, and facilitate the use of technology so that students can create their own learning experiences.

**Infrastructure and support.** Through the inclusion of the Director and the District Technician on the project team, the capabilities and constraints of the technology infrastructure and of the support team to take on the addition of new one-to-one devices were addressed. Furthermore, based on interviews with the participants, modifications and upgrades to the building’s infrastructure had been occurring even prior to the advent of this project, and these
facilitated the additional improvements that occurred to address the specific needs of distributing one-to-one devices to all of the students. The technology staff also worked with those on the instructional side to ensure that a suitable device management system was put in place that would allow students and teachers to access all of the applications needed to meet curricular goals.

Concerns about potential obstacles related to infrastructure and support were addressed by the actions of the Director, the District Technician, and the LMS during the early stages of the project (and, in fact, prior to the project commencing based upon the work previously done on the wireless network). Additionally, the plan for this district did not involve the sharing of devices designed for individual use. This reflects the findings of a study by Crichton et al. (2012) that looked at barriers related to infrastructure and support, including whether the existing network can accommodate the new devices and applications, and the problems of sharing “I” devices, which are designed for personalized, individual use. In a similar vein, the Director and the District Technician, with assistance from the LMS, made sure that the district was prepared to support the new devices by acquiring knowledge concerning their use. This addressed a study by Raths (2012) in which the researcher revealed concerns about whether the technology department was aware of, and skilled in supporting, new devices and applications that were to be added.

Finally, from an educational perspective, challenging technical issues such as resolving technology problems with minimal disruption of instructional time has been a serious problem facing teachers who were attempting to implement technology (Lu & Overbaugh, 2009). The Department Head indicated in her interview that any time the network went down, even briefly, there were immediate steps taken to correct the problem so that classes were not affected. Also,
the upgrade of the high school’s wiring infrastructure and wireless coverage in the year prior to
the rollout of the new devices also mitigated disruptions due to technical issues.

**Project plan.** There was planning (Bauer & Kenton, 2005) prior to and during the
process to select and gain acceptance of new technology, albeit informal. Planning centered on
understanding the organizational factors that influenced the success of technology integration
(Baker, 2012). For example, the district planned and executed projects to rewire the high school
and increase the capabilities of its wireless network. The Principal and the LMS monitored the
progress of the evaluation of the potential devices, and maintained communication with the
district office with regard to infrastructure and financial concerns. There was also a plan created
for the distribution of the devices to students as the implementation phase began, as well as
planned instructional sessions for teachers on the use of the devices. Baker (2012) identified
organizational factors that affected technology integration success. These factors included
teacher perception of technology, technology director’s actions, and the influence of so-called
“early adopters” of technology on their peers during the integration process. In the present
study, the Principal moved teachers who were more comfortable with technology to the ninth
grade during the first year of the iPad rollout, the technology director was involved in the
planning and implementation from the start, and teachers who were early adopters of technology
made themselves available to assist their colleagues during collaborative learning time.

Bauer and Kenton (2005) indicated that additional planning was needed to address
integration issues such as substandard infrastructure, lack of sufficient teacher planning time, and
lack of appropriate software. Without this, these researchers found that there was technology use
in the schools in the study, but not technology integration. In the high school that is the subject
of the present study, infrastructure issues were planned for well in advance by the District
Technician, and monitored as the final selection of the iPad was made. Teacher planning time concerns were met by the Principal through the change to an A/B block schedule that gave teachers weekly collaborative learning time for planning. Appropriate software for teacher and student use was researched and collected by the LMS to ease the transition to technology use for the teachers.

In a study of American high schools in the Southeast, Peck et al. (2011) proposed a list of recommendations for administrators to adopt in order to avoid technology implementation barriers. These included: Plan early for long-term support; determine teacher technology needs; formalize informal technology support networks; showcase successful instructional adaptations; and adopt student personal media device appropriate-use guidelines. Based upon the interviews, the stakeholders ensured they had support during the early planning stages; teacher technology needs were considered from the start by the inclusion of stakeholders who would be affected; informal support such as student-run tech services were formalized; uses of the iPads by students and teachers were showcased in presentations to the Board, to parents, and through the media; and acceptable use policies were updated to reflect the use of the new devices by students.

**Test and select a solution.** Involving multiple stakeholders in the evaluation and selection process for a new technology tool is key to faculty and staff acceptance of technology integration (Keengwe et al., 2009). The next step in the process was a testing phase that was primarily coordinated by the LMS, the District Technician, and the Student Teacher. During this time the LMS coordinated the testing of the devices through their vendors, communicated with the stakeholders, and ensured that criteria specific to the district’s infrastructure environment were met. The Student Teacher facilitated the involvement of teachers and students in the testing process, while the District Technician ensured that the wireless network would allow the teachers
and students to seamlessly use their new devices. Involvement of teachers is key to the success of technology integration. Baylor and Ritchie (2002) noted that involving teachers from the start of the planning process helps them to accept and implement technology changes in their classrooms that are aligned to the curriculum. Similarly, Eteokleous (2008) suggested that teachers be involved in the decision-making process whenever the implementation of changes and innovations are introduced. The involvement of stakeholders in the testing and selection process was important for this district because, as the Principal indicated, there were already many teachers using technology in their personal lives and involving them in the planning for this project would bridge that use into their professional lives.

While the testing and selection process was conducted by teachers, students, and support staff—the people who the technology directly impacts—it is important to note that this was an informal process. The process worked in this instance because there was a great deal of trust between those in the district office and those in the high school who had come together to coordinate this effort. The Student Teacher characterized its success as being based upon the fact that “bright, capable” people within this district were involved as the key stakeholders. Having a more formal planning process might allow the district to replicate the steps if a similar decision-making situation should arise in the future, or it may allow other districts to utilize a similar approach. However, the Student Teacher indicated that similar successful results might not have occurred in a district with a more formal planning process, or in one that did not have the confluence of talented people in the right positions at the right time.

Training to prepare the users. Technology training for the students was a key element of the technology implementation process. Even though they are digital natives, who use a myriad of technology tools like “extensions of their brains” (Prensky, 2005), students are not
well versed in the etiquette and efficient use of technology as a learning tool. Therefore, the primary distribution and training vehicle for students was the newly created Skills 21 class in which they received their iPads after getting instruction in digital citizenship, time management, application use, and organizational skills. This class, primarily designed by the Principal and the LMS, also set school and district expectations for the students concerning the use of the devices, both in school and at home.

Because teachers facilitate learning through technology use for students, training for these stakeholders was also critical. For this reason, the teachers received their iPads well in advance of the rollout to students so that they might become comfortable with them. Teachers were trained on the use of the iPads themselves (hardware) and were also trained on how to incorporate the iPads into their pedagogy prior to the distribution of the iPads to students. Training included mandatory and optional professional development sessions (Buckenmeyer, 2010) conducted by the LMS and the Student Teacher. Teachers could also attend the student Skills 21 classes for additional information and to learn new skills. Buckenmeyer (2010) suggested that training need not be confined to formal sessions with the entire staff in one place, but could also employ informal group activities where early adopters can assist their colleagues and demonstrate enthusiasm. The LMS, the Student Teacher, and the Department Head all facilitated activities such as these, most on a voluntary basis, prior to and during the implementation of the iPad rollout to students at which teachers were available to assist their peers.

In order for technology integration to work, the literature indicates that professional development for teachers should include considerations of pedagogy, training approach, and teacher engagement. For example, An and Reigeluth (2011) cautioned that problems can arise
when teacher preparation programs are solely focused on technology knowledge and not the combination with pedagogy and content. Further, the researchers stressed that these sessions need to also address differentiation in the approach to learning, and give the teachers time to try out the new technology. From the interview data, the Principal, the LMS, the District Technician, and the Student Teacher referenced training related to pedagogy that focused on differentiated student learning in a one-to-one environment as well as the use of iPad applications in the classroom. Furthermore, the Director, the LMS, and the Department Head indicated that there were a number of professional development sessions offered on how to utilize the new technology, small group and individualized instruction sessions during collaborative learning time, and modeling of technology use in department and faculty meetings. A study by Lawless and Pellegrino (2007) found that another concern related to technology integration was that schools must provide rigorous, flexible, and at times non-traditional professional development that is engaging for teachers in order to overcome ineffective professional development that may lead to fewer teachers with the necessary skills to successfully integrate technology. According to the Department Head, the District Technician and the Student Teacher, efforts were made to allow the teachers to become comfortable with using their iPads in the period prior to the rollout to students. Teachers were allowed to explore applications and uses in workshops, one-on-one sessions, or on their own, and to then share these with their colleagues. The Director even noted that students became a resource for teachers to further develop their skills with the iPads.

**Implement, monitor, and support the new solution.** In addition to the aforementioned support offered in the Skills 21 classes, students were also able to receive ongoing support through the creation of a student-run “tech team” that offered peer support to those needing
assistance with hardware or software application questions. Teachers were also able to benefit from this service, as these students were available to visit classrooms to assist with basic technology issues.

The other main source of ongoing support for the teachers was through their own peers when they meet during the collaborative learning time that was built in to the high school’s block schedule. During this time, the Principal, the LMS, the Director, and the Department Head indicated that teachers become peer resources for one another concerning questions about the use and functionality of the iPads. Additionally, the library media specialists were available to meet with individual teachers or small groups concerning specific technology maintenance and growth issues. This led to teachers doing things differently in a more student-centered environment, rather than just using a new device to replicate what had been done previously. The students also had better opportunities to collaborate with their teachers in order to be much more involved in the creation of instruction in their classes, which led to an increased level of responsibility and accountability. Overall, the students and teachers worked together throughout this project to support one another in the best use of the iPads for learning.

Continuous monitoring of how students and teachers were utilizing the new technology was important to the success of technology integration in this district, since the rollout of the iPads to students occurred over a period of four years. Not only did the district monitor the project, but they also adjusted their plans according to feedback. Likewise, a study by Gülbañar (2007) found that while planning should precede any technology purchase, it is equally important to continuously evaluate and revise any plan that has been made due to ongoing rapid changes in technology. The Department Head related an example of the continuous monitoring of this project when she explained how the use of the iPads in the classrooms continued to evolve as
new applications became available, and as teachers and students further developed their collaborative efforts regarding how to best integrate these tools into the learning process. Though not measured in this study, proper planning and support of the implementation improves teachers’ technology knowledge, skill, and levels of classroom integration (Shapley et al., 2010).

**Shared Leadership**

The importance of leadership as an overarching guide to this technology implementation project aligns with several studies on this topic. For instance, Anderson and Dexter (2005) examined technology leadership characteristics and their effects on technology outcomes and confirmed that technology leadership played a very central, pivotal role in technology-related results, greater even than technology infrastructure or expenditures. In relating this to the subject school district, the leadership and vision of the Principal was a key factor in getting this project started. This was further enhanced by his early decision to partner with the LMS, who was an advocate of the innovative use of technology in schools. In a 2012 study, Chen’s findings indicated that teachers perceived both transformational and instructional leadership for technology integration was distributed among the principal, the subject head, and the technology head, which supported successful integration. This is similar to the distribution in the district in the current study where the infrastructure changes were overseen by the Director and the District Technician while the instructional changes were primarily the focus of the Principal, the Department Head, and the LMS.

Hewitt et al. (2012) suggested that education needs to be disrupted in order to think about new ways of learning and the purposes of public education. The authors go on to state that the success of educational technology integration depends on the teachers’ sense that they are in control of their own participation in the ongoing changes, and that they are receiving leadership
and support from the district level. Similarly, the Principal did purposely introduce disruption through the combination of technology integration with several other changes in the high school. Additionally, the teachers were involved in the early stages of the project by participating in the testing and selection of potential devices and, throughout, it was evident that they received leadership and support from the district level.

**Relation to the theoretical lens.** Leadership and decision-making responsibilities were distributed among the stakeholders throughout the process that evolved to manage the selection and integration of a new technology device for this high school. An analysis of the interview data focusing on the distribution of the leadership roles associated with the Complexity Leadership Theory revealed several takeaways that tend to support the concepts detailed by Uhl-Bien et al. (2007) in the initial proposal of their theory, which was aimed at the “knowledge economy” of the 21st century.

**Complex approach.** The researchers’ view of a distinction between leadership and leaders became evident in the analysis of this district’s technology selection process. While the district did not make a knowing choice to follow the Complexity Leadership Theory in order to make this particular technology selection decision for the high school, analysis of data from the interviews revealed that the participant stakeholders did indeed follow the concepts of the theory by the manner in which each one was involved in the process and reacted to specific situations throughout that process. Each participant played a different role (administrative, adaptive, or enabling) at different points in time in order to continually move the process forward and keep it from skewing too far to either the administrative or adaptive side. This ties in to elements of the theory proposed in the study by Uhl-Bien et al. (2007), especially the fact that “leadership should be seen not only as position and authority but also as an *emergent, interactive dynamic*—a
complex interplay from which a collective impetus for action and change emerges” (p. 299). A related idea from the study’s conclusion highlights the overall complexity of the entire process, and the underlying science upon which it is based, in its characterization of leadership as “too complex to be described as only the act of an individual or individuals; rather, it is a complex interplay of many interacting forces” (Uhl-Bien et al., 2007, p. 314).

**Complex environment.** Complexity did indeed extend beyond just those involved in leadership. This school district, while small, was itself a complex environment that needed a complex approach to making a decision on what technology device to select, as opposed to using a more traditional response focusing on top-down influences aligned around a single strategic goal or vision. There were a variety of needs that had to be met with this one decision, and these contributed to the overall complexity of the environment:

1. Students’ need to successfully consume and produce information.
2. Teachers’ need to effectively deliver curriculum designed for 21st century learners.
3. Building administrators’ need to motivate teachers to accept change.
4. District administrators’ need to prudently spend annual budget.
5. District technicians’ need to incorporate new devices that would work well with existing infrastructure.

Uhl-Bien et al. (2007) contend that utilizing a more complex approach to leadership is a method to overcome the problems associated with older, top-down management that often “can stifle a firm's innovation and fitness” (p. 315).

**Complexity science.** A final connection drawn from the analysis of the data collected in this study is a relation of the Complexity Leadership Theory back to the underlying theory of
complexity in science and the concept of complex adaptive systems. Uhl-Bien et al. (2007) defined complex adaptive systems (CAS) as:

A basic unit of analysis in complexity science. CAS are neural-like networks of interacting, interdependent agents who are bonded in a cooperative dynamic by common goal, outlook, need, etc. They are changeable structures with multiple, overlapping hierarchies, and like the individuals that comprise them, CAS are linked with one another in a dynamic, interactive network. (p. 299)

In the subject district, I would envision the creation of a temporary CAS network that was linked by the common goal of selecting a new technology device for the high school. This network would consist of one CAS for the individual agents within the school, one CAS for the agents within the district administration, and one CAS for the agents within the district technology department. Each of the agents within a particular CAS are interacting with one another, while each of the CAS units within the network are also interacting leading to the eventual emergence of a solution to each situation that is encountered along the way.

**Implications for Practice**

While this district did employ a process that led to the successful selection and implementation of a new technology device for the teachers and students at the high school, there are some implications that could help improve educational practice.

**Goals.** Goals are an essential part of a technology acquisition and integration process (Keengwe et al., 2009; Schnellert & Keengwe, 2012). While the expanded goal for this project was successfully achieved, it does represent what is normally termed in the business world as “scope creep”. Scope creep refers to changes or growth in a project’s original outcome, and may develop if a project is not well documented or controlled. On an ongoing basis, this is not a
viable manner in which to run a project. Instead, as Keengwe et al. (2009) suggested, I believe that it is important for an institution to develop an overall vision and corresponding goals related to technology integration.

**Planning to meet technology needs.** The importance of developing a plan to address the requirements of the users, concerns about technology infrastructure, and alignment with an overall educational mission were found in several studies (Bauer & Kenton, 2005; Corn, 2010; Earle, 2002). The lack of formal documentation of all requirements worked for this particular project, however it would be difficult to replicate for other projects, especially if the players changed. The recommended approach, similar to that advocated by Baker (2012), would be to create a plan not only for technology integration, but also for its adaptation to the needs of individual curricular areas and teachers within the school.

**Teacher preparation.** Offering relevant professional development training sessions to effectively prepare teachers for the integration of new technology is a key factor in the acceptance and adoption of that technology (An & Reigeluth, 2011; Buckenmeyer, 2010; Kayler & Sullivan, 2011). This district did offer a mix of mandatory and voluntary professional development sessions, as well as one-on-one peer training opportunities. However, not all of these sessions were well attended according to the data, especially by teachers who were not going to be immediately impacted by the iPad rollout. Since the variety of the training programs offered apparently did not meet the needs of all teachers, the recommended approach would be similar to that suggested by Lawless and Pellegrino (2007) to examine why certain teachers volunteer to participate in professional development programs and develop best practices based upon those findings. In that way future initiatives that require professional development training will be able to draw upon the lesson learned from this project.
**Complexity Leadership Theory.** The Complexity Leadership Theory (Uhl-Bien et al., 2007) moved away from previous attempts at simplification of decision-making processes by proposing the interaction of three leadership roles (adaptive, administrative, and enabling) that constantly strive to maintain a balance in order to address ever-changing situations faced by those involved in a decision-making process. In order to enhance the acceptance of decisions that result in change, the stakeholders impacted should be involved in the process from the early stages. An organization seeking to benefit from such involvement should strive to provide an environment that is conducive to the shared leadership activities working towards a balance between the extremes of bureaucratic and visionary that form the basis of the Complexity Leadership Theory.

**Plans as a Scholar-Practitioner**

Based upon the findings of this study I will seek to share the recommendations in a number of ways. First, I will share this thesis document with the district that was the subject of the study so that the administrators and other stakeholders may review the findings in order to determine methods to replicate actions that resulted in positive outcomes in this initiative. I will also share the findings with the administrators in the district and the high school in which I work as a tool to review the technology selection decision process there to ascertain if a different approach that might result in better acceptance of future changes is warranted. Finally, I plan to present my findings at a research conference or a conference for practitioners.

**Implications for Future Research**

This research study looked at a technology selection decision that had already occurred, and gathered data based upon the recollections of the participant stakeholders in that process. A future approach should follow an actual decision-making process as it happens with a
combination of interviews and observations providing the data for the researcher. Another area of research would be a decision-making process that followed a different methodology, such as one that was more of a top-down approach. A study such as this could look at whether the needs of the affected stakeholders can be adequately addressed through a more bureaucratic process, or if some of the identified elements go unmet. Still another study could look at a school district in either an urban or a rural area, as opposed to the suburban district that was the subject of this study. This might be combined with looking at school districts of different sizes as well to determine if there are differences in the manner in which technology selection decisions are made. Finally, even though I believe this study is an example of dynamic leadership involving multiple stakeholders, the voices of teachers and students were largely missing. While, I agree with the Director that all teachers could not have been involved, it is important to know how the teachers experienced the planning process and the implementation process from their perspectives. Also, the experiences of students who participated in the technology integration process would be important to know for this district.

Conclusion

This case study of the technology selection decision-making process of a school district included the experiences of the primary stakeholders on both the administrative and instructional sides who would be affected by the changes. It was an attempt to add to the body of research on how technology integration decisions are made in a public school system, and to identify if there were any best practices present that could be shared.

Overall, while it occurred on a relatively small scale, this district’s decision-making process did a number of things aligned with extant literature (An & Reigeluth, 2011; Baker, 2012; Bauer & Kenton, 2005; Baylor & Ritchie, 2002; Buckenmeyer, 2010; Chrichton et al.,
It did include the participation of the key stakeholders, which organizational change literature has shown can increase acceptance, adoption and sustainability of changes such as technology integration (Yukl, 2010). This contributes to the gap in existing literature concerning school technology integration projects identified in the Significance of the Problem section of chapter 1. Also, the process was approached in a fiscally responsible manner that did not incur any additional costs to the town or its taxpayers beyond the already approved budget, which addresses another point of concern about significance. Furthermore, although it was somewhat informal, there was a plan with goals from the outset, as well as a project timeline to meet. Important considerations related to creating a student-centered learning environment, expanding the technology infrastructure, and providing support for the new devices were included in the planning. Time for training of the teachers prior to rollout of the iPads to students, both from the hardware as well as the pedagogical perspective, was also considered and provided. Finally, concerns about the equitable distribution of the devices, first to an entire grade and then for those without internet access at home, were also addressed by the district.

In addition to the small size of the district, there are some other potential limitations that should be noted. While the idea for the project had to start somewhere, the fact that it originated with the principal could cause some concerns for teachers who might see him as “driving” the technology change initiative. Also, as was touched upon earlier, the working relationship
between the key members of the project team was very positive, which may have facilitated the successful implementation of the plan. This may not translate to other districts with different relationship dynamics, or even within this same district if there is a change in the key players involved. Finally, while teachers were represented both through the project team and several individual teachers who assisted in the testing of the technology devices, not all teachers had the same voice in the process. Invariably, there are going to be individuals who are technology savvy and who would welcome such a change, and others who prefer a more traditional approach to teaching and learning. It was outside the scope of this study to capture the experiences of all of the teachers at the high school who were affected by the change.

In conclusion, this research project set out to examine a process that helps schools purchase, integrate, and monitor technology use in order to give students the access they need to modern technology tools. It determined that this school district did have an effective process in place. That process was based upon a goal that was aligned with the district’s overall vision of technology use by students, and it was overseen by a shared leadership decision-making process that allowed the project to succeed. Although this study is based upon a limited number of participants in a small, suburban school district, it adds to the conversation concerning school technology integration. Relevant aspects of this study may be used in the future to help other similar organizations ensure that they can also put successful processes in place to meet the needs of all of their stakeholders.
References


Appendix A

Site Permission Letter

Public Schools

OFFICE OF THE SUPERINTENDENT

May 23, 2013

Human Subject Research Protection
Northeastern University
960 Renaissance Park
360 Huntington Ave.
Boston, MA 02115-5000

Dear Human Subjects Committee:

Mr. Michael McNiff, a student at Northeastern University, has provided the district and high school with a thorough outline of his proposed research project, Leading Complex Decision-Making in Technology Integration Investment: A Descriptive Case Study Over Time of the Leadership Roles in the Decision-Making Process of a New England School District. It is understood that this study will collect data through one-on-one, semi-structured interviews with the participant stakeholders who were involved with the technology selection decision that is the subject of this study. As the Superintendent of Schools I led this process, and will confirm for Mr. McNiff the selection of the appropriate individuals involved in the process. Based upon preliminary information gathered by the researcher, this would include the Superintendent of Schools, the Assistant Superintendent, the Director of Business and Technology Operations, the High School Principal, the High School Library Media Specialist, and the High School Science Department Head.

All participants in the study will be adults, and each will be provided with a consent form to sign that will indicate their agreement to voluntarily participate in the study. It is understood that all participants will be given pseudonyms, as will the district itself, to protect the identity of all participants. It is further understood that the participants will receive no compensation beyond a possible token honorarium for their assistance in this project.

I further understand that to supplement the participant’s recollection of experiences that took place in the early stages of the decision-making process, the researcher will make use of documents from that time period. Mr. McNiff has provided a preliminary list of potential documents to review, including: minutes from technology selection team meetings; Board of Education meeting minutes; correspondences to high school parents about the technology integration initiative; presentations created for students, parents, or faculty; and any relevant articles published in the local media. Finally, it is understood that all data collected through interviews or documents will be stored in a secure environment under the sole control of Mr. McNiff.

In conclusion, Mr. McNiff is granted permission, for up to one year, to collect the required data and conduct his study in the Public School system. Mr. McNiff has agreed to inform me of significant alterations to the study, such as changes in the methodology or participant group. Please contact me at [Redacted] if you have any questions.

Sincerely,

[Redacted]
Superintendent
Appendix B

Introductory Email

Dear [Participant]:

My name is Michael McNiff, and I am a library media specialist at Xxxxxx High School. I am also in the research phase of my doctoral studies at Northeastern University and am in need of study participants. The purpose of this doctoral research project is to look at the leadership roles in a school district’s decision-making process concerning technology selection, adoption, and integration in order to explore the involvement of various stakeholders at different stages of that process. In order to give students the access they need to modern technology, there must be a process in place that helps schools purchase, integrate, and monitor technology use. This research will help to contribute to refining the method by which organizations put effective processes in place in order to do so.

I am interested in interviewing you about your experience during the selection process of iPads for the students at Xxxxxxxx High School. This would take approximately 45 minutes and can be conducted at a time and place of your choosing. If you are willing to participate, please respond to me at this email address and I will contact you with further information. If you have any questions about my study, please feel free to contact me.

Thank you very much for your consideration, and I look forward to hearing from you.

Best Regards,

Michael McNiff
[contact information supplied]

Principal Investigator:
Dr. Corliss Brown Thompson
[contact information supplied]
Informed Consent Form

Appendix C

Template 1 Format for Signed Informed Consent Document

Northeastern University, College of Professional Studies, Department of Education

Name of Investigator(s): Dr. Corliss Brown Thompson, Principle Investigator; Michael McNiff, Doctoral Student

Title of Project: Leading Complex Decision-Making in Technology Integration Investment:
A descriptive case study over time of the leadership roles in the decision-making process of a New England school district

Informed Consent to Participate in a Research Study
We are inviting you to take part in a research study. This form will tell you about the study, but the researcher will explain it to you first. You may ask this person any questions that you have. When you are ready to make a decision, you may tell the researcher if you want to participate or not. You do not have to participate if you do not want to. If you decide to participate, the researcher will ask you to sign this statement and will give you a copy to keep.

Why am I being asked to take part in this research study?
We are asking you to participate in this study because you were a member of the team assembled to make the technology selection decision of a one-to-one technology device for the students in the public high school of a suburban New England school district. The goal of this study is to explore the distribution of leadership roles played over time by stakeholders during a technology selection decision-making process.

Why is this research study being done?
The purpose of this doctoral research project is to look at the leadership roles in a school district’s decision-making process concerning technology selection, adoption, and integration in order to explore the involvement of various stakeholders at different stages of that process. In order to give students the access they need to modern technology, there must be a process in place that helps schools purchase, integrate, and monitor technology use. This research will help to contribute to refining the method by which organizations put effective processes in place in order to do so.

What will I be asked to do?
If you decide to take part in this study, we will ask you to:
- Participate in a semi-structured interview exploring your experience in the technology selection decision process.
- If needed, be available by e-mail for follow-up questions.
- Review a written copy the interview after it is transcribed along with a summary of themes. This is to ensure that the researcher has accurately represented your point of view.
• Provide access to any pertinent documents (e.g. presentations, meeting minutes, correspondences, media articles) that might help the researcher to understand the process that is being studied.

**Where will this take place and how much of my time will it take?**

The interview will last approximately 45 minutes and will take place at a time and location that is convenient for you. Following transcription and initial analysis of the interview, a copy will be sent to you via e-mail so that you may confirm its accuracy for the researcher. If subsequent interviews raise additional questions that are pertinent to the study, the researcher may ask you to respond in one additional e-mail request.

**Will there be any risk or discomfort to me?**

There are no foreseeable risks or discomforts to you for taking part in this study.

**Will I benefit by being in this research?**

There are no direct benefits to you for participating in the study. However, by doing so you may help us learn more about the processes involved in making technology selection decisions so that these may be made more efficient for school districts in the future.

**Who will see the information about me?**

Your part in this study will be handled in a confidential manner. Only the researchers will know that you participated. Any reports or publications based on this research will not identify you, your organization, or any individual as being of this project. Pseudonyms will be used to identify both the individuals and the organizations that are a part of this study.

All written and recorded data will be maintained in a secure location at the home of the student researcher. All digital recordings of interviews will be destroyed once transcription has taken place.

In rare instances, authorized people may request to see research information about you and other people in this study. This is done only to be sure that the research is done properly. We would only permit people who are authorized by organizations such as the Northeastern University Institutional Review Board to see this information.

**What will happen if I suffer any harm from this research?**

There are no foreseeable risks or discomforts to you for taking part in this study.

No special arrangements will be made for compensation or for payment for treatment solely because of my participation in this research.

**Can I stop my participation in this study?**

Your participation in this research is completely voluntary. You do not have to participate if you do not want to and you can refuse to answer any question. Even if you begin the study, you may quit at any time. If you do not participate or if you decide to quit, you will not lose any rights, benefits, or services.
Who can I contact if I have questions or problems?
If you have any questions or concerns regarding this study, please contact Michael McNiff, the person mainly responsible for the research, at 917.861.4644 (voicemail is confidential), or by email at mcniff.m@husky.neu.edu. You may also contact Dr. Corliss Brown Thompson, Principal Investigator, at co.brown@neu.edu.

Who can I contact about my rights as a participant?
If you have any questions about your rights in this research, you may contact Nan C. Regina, Director, Human Subject Research Protection, 960 Renaissance Park, Northeastern University, Boston, MA 02115. Tel: 617.373.4588, Email: n.regina@neu.edu. You may call anonymously if you wish.

Will I be paid for my participation?
You will be given a $10 gift card to your choice of Starbucks or Dunkin’ Donuts as soon as you complete the interview.

Will it cost me anything to participate?
You will not incur any costs to participate in this study.

I agree to take part in this research.

____________________________________________
Signature of person [parent] agreeing to take part

Date

____________________________________________
Printed name of person above

____________________________________________
Signature of person who explained the study to the participant above and obtained consent

Date

____________________________________________
Printed name of person above
Appendix D

Interview Script

You have been selected to participate in this study because you were a member of the team assembled to make the technology selection decision of a one-to-one technology device for the students in Xxxxxxx High School. The purpose of this doctoral research project is to look at the leadership roles in a school district’s decision-making process concerning technology selection, adoption, and integration in order to explore the involvement of various stakeholders at different stages of that process. In order to give students the access they need to modern technology, there must be a process in place that helps schools purchase, integrate, and monitor technology use. This research will help to contribute to refining the method by which organizations put effective processes in place in order to do so.

Because your responses are important and I want to make sure to capture everything you say, I would like to audio tape our conversation today. Do I have your permission to record this interview? [if yes, thank the participant and turn on the recording equipment]. I will also be taking written notes. I can assure you that all responses will be confidential and only a pseudonym will be used when quoting from the transcripts. I will be the only one privy to the tapes, which will be eventually destroyed after they are transcribed. To meet our human subjects requirements at the university, you must sign the form I have with me [provide the form]. Essentially, this document states that: (1) all information will be held confidential, (2) your participation is voluntary and you may stop at any time if you feel uncomfortable, and (3) we do not intend to inflict any harm. Do you have any questions about the interview process or how your data will be used?
I have planned this interview to last no longer than about 45 minutes. During this time, I have several questions that I would like to cover. If time begins to run short, it may be necessary to interrupt you in order to push ahead and complete this line of questioning. Do you have any questions at this time?

OK, let’s begin with the first question:

1. What was your initial involvement in the project to provide one-to-one technology devices to students at Xxxxxxx High School?

2. What was your job title/description at that time?

3. How did you come to be a part of the project team?

4. What were the initial goals of the project?
   a. For the district?
   b. The school?
   c. The teachers?
   d. The students?

5. How was the project team constituted? By that, I mean did each person have a specific role or area of expertise?

6. How did the team communicate? In regular meetings, smaller subcommittee groups, email, phone?

7. What were the specifications/considerations for the technology tools that were to be evaluated?
   a. How did these tools get selected for review?

8. What was the process used to evaluate each proposed tool?
a. Were there vendor presentations? Specific criteria to move to the next round? A vote of the project team?

9. How was the final decision on tool selection made?
   a. Who was involved?
   b. Did the selection decision need further approval for funding?

10. How was the decision on the manner in which to distribute the tablets to students made?
   a. What options were considered before the final decision was made?

11. How were the teachers and students prepared for the changes that were coming? What about parents and other community members?
   a. Is there ongoing support for users?

12. How was the technology support staff involved in the preparation for the new tools that were to be introduced?

13. Were there changes to the teachers’ instructional practices prior to or while the tools were introduced?
   a. How did teachers deal with multi-grade classes where not all of the students had received tablets?

14. Would the overall process have benefitted from the inclusion of any other stakeholders during the process?

15. Is there anything else you would like to share about the one-to-one selection planning process?
   a. Is there anyone else that I should seek to interview for this project?

16. Were you able to bring copies of any supporting documents that I may have to review as a part of this study?
a. Are there any other documents that you think would be beneficial to review?

*Ask participant if they have any questions and thank them for their participation.*