Framing Innovation: The Impact of the Superintendent's Technology Infrastructure Decisions on the Acceptance of Large-Scale Technology Initiatives

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FRAMING INNOVATION: THE IMPACT OF THE SUPERINTENDENT’S TECHNOLOGY INFRASTRUCTURE DECISIONS ON THE ACCEPTANCE OF LARGE-SCALE TECHNOLOGY INITIATIVES

Dissertation in Practice
by

ERIK P. ARNOLD

with Peter D. Cohen, Gina E. Flanagan,
Anna P. Nolin and Henry J. Turner

submitted in partial fulfillment
of the requirements for the degree of
Doctor of Education

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FRAMING INNOVATION: THE IMPACT OF THE SUPERINTENDENT’S TECHNOLOGY INFRASTRUCTURE DECISIONS ON THE ACCEPTANCE OF LARGE-SCALE TECHNOLOGY INITIATIVES

by

Erik P. Arnold

Dr. Vincent Cho and Dr. Diana C. Pullin, dissertation co-chairs

Abstract

A multiple-case qualitative study of five school districts that had implemented various large-scale technology initiatives was conducted to describe what superintendents do to gain acceptance of those initiatives. The large-scale technology initiatives in the five participating districts included 1:1 District-Provided Device laptop and tablet programs (DPD), a Bring Your Own Device program (BYOD), and a Blended program that included a district-sponsored Lease-To-Own laptop and tablet program (LTO). Superintendents and other personnel that were identified by each superintendent as having a key role with the technology initiative were interviewed. Key documentation regarding the large-scale technology initiative was also reviewed. To help bring perspective to the actions of superintendents surrounding large-scale technology initiatives, frame theory was used as a theoretical framework for the overall study.

This study sought to determine the factors considered by superintendents in making decisions about technology infrastructure, the factors considered in making decisions about funding a large-scale technology initiative, and how technology infrastructure or funding decisions impacted the perceived acceptance of the initiative. The study found that the decisions made by superintendents with regard to the technology initiative can have an impact on the acceptance of the initiative by all stakeholders. The
importance of robust and reliable Wi-Fi networks, funding for technology initiatives from multiple sources, and the significance of device capabilities and reliability were also identified as significant factors in the acceptance of large-scale technology initiatives.
Executive Summary

Dissertation in Practice

Erik Arnold, Peter Cohen, Gina Flanagan, Anna Nolin & Henry Turner

March 2014
Research conducted and report produced in partial fulfillment of the requirements for the degree of Doctor of Education.

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We extend our gratitude to our dissertation committee for their time, support, and advice every step of the way of this study. You challenged us to look at things differently and calmly guided us to the end.

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Context and Background

In recent years, school districts across the country have begun to identify the academic promise and possibilities that technology may have on teaching and learning. Despite inconclusive research on the impact of technology use on teaching and learning, school districts have moved ahead with securing the funding and acceptance from stakeholders to support 1:1 laptop/tablet, Bring Your Own Device (BYOD) or Blended Learning Environments initiatives (Nagel, 2010).

A 1:1 initiative ensures that every student has access to either a district owned or family leased/purchased device and the wireless infrastructure at school to support these devices. A BYOD initiative accommodates family owned technology devices of all kinds. A Blended Learning Environment supports a combination of a 1:1 and BYOD environment. The focus towards these learning environments has caused school districts to look for creative ways to secure funding to purchase technology devices and improve their wireless infrastructure (Salerno & Vonhof, 2011). It is estimated that in 2009 alone, U.S. school districts spent over $7 billion on technology purchases (Dexter, 2011).

A 2010 National School Boards Association survey showed that 37% of school districts have some type of 1:1 computer initiative in place and this number continues to grow (Nagel, 2010). It is our assumption that superintendents are no longer asking whether it makes sense to move towards a large-scale technology initiative, but rather when and, most urgently, how. For many school leaders, efforts to effectively and seamlessly integrate technology to meet the goals of increased student achievement and productivity require “buy-in” from district stakeholders at all levels—central office staff, teachers, students, parents and the community-at-large.

Purpose of This Study

While superintendents often seek informal guidance on technology integration decision making from other districts that have already implemented such an initiative, these methods often provide a fragmented and broad road map that often focuses on the logistics of a technology initiative and not necessarily on the leadership moves that a superintendent should employ in order to gain acceptance.

There does not appear to be a comprehensive, individualized, research-based guide to technology integrations that takes into account the unique
political, cultural and socioeconomic characteristics of various school districts that are considering this movement. There is also no research-based study available to superintendents to help them understand and consider the leadership moves that may help them gain acceptance for a large-scale technology movement.

Guided by research related to frame theory, the superintendent’s instructional vision, distributed leadership, professional learning communities, technology infrastructure decision-making and the superintendent’s use and attitudes toward technology use, this research team worked toward gaining an understanding of the leadership moves that superintendents utilize to gain acceptance of a large-scale technology initiative. These five interconnected studies are aligned to the overarching study.

**Methodology**

This study is categorized as a multi-case study of school districts within one state where a 1:1 large-scale technology initiative was implemented. Both the overarching (how superintendents gain acceptance of a large-scale technology initiative) and the individual studies focused on specific leadership moves (instructional vision, distributed leadership, professional learning communities, technology infrastructure and the superintendent’s technology use and attitudes). All individual studies employed the same methodologies and protocols of interviews from five superintendents and individuals that they
identified as being key players in their large-scale technology initiative. Interview questions were designed to address the components of both the overarching and individual studies. This is outlined in the chart below.

### Individual Study and Corresponding Research Questions

<table>
<thead>
<tr>
<th>Individual Spoke/Author</th>
<th>Research Questions</th>
</tr>
</thead>
</table>
| Instructional Vision (Flanagan, 2014)                | • What is the instructional vision of superintendents who implement large-scale technology initiatives in a 1:1 or BYOD environment?  
  • How does the superintendent connect his or her instructional vision with the implementation of technology within the district to all stakeholders?  
  • How do district administrators make sense of the superintendent’s instructional vision for technology? |
| Distributed Leadership (Turner, 2014)               | • Who does a superintendent work with to gain acceptance of large-scale technology initiatives?  
  • How do members of leadership teams interact with each other around large-scale technology initiatives?  
  • How do members of a leadership team interact with each other around large-scale technology initiatives? |
| Decision-Making Regarding Infrastructure (Arnold, 2014) | • What factors are considered by superintendents in making decisions about technology infrastructure?  
  • What factors are considered by superintendents in making decisions about funding the large-scale technology initiative?  
  • How did the technology infrastructure or funding decisions have an impact on the perceived acceptance of the initiative? |
| Communication & Modeling (Cohen, 2014)              | • How do superintendents and other district leaders use technology?  
  • What are their attitudes about technology?  
  • How do these attitudes influence their framing? |
| Professional Learning Communities (Nolin, 2014)     | • What are the superintendent’s expectations around collaboration?  
  • What is the relationship between district expectations for professional collaboration and acceptance of large-scale technology initiatives in school districts? |
Additionally a within-case and cross-case analysis of the data collected from interviews was conducted. A description of school districts that participated in this study is reflected below. The titles of district administrators that participated in this study included superintendent, principal, assistant principal, director of technology, technology integration specialist, network manager, director of academics and district grant writer.

**Description of Participating School Districts**

<table>
<thead>
<tr>
<th>System</th>
<th>System size in number of students</th>
<th>Type of Technology Implementation</th>
<th>Grade Level of Technology implementation</th>
<th>Number of Interview Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams</td>
<td>3600</td>
<td>District Provided iPads</td>
<td>Grades 1, 4-12</td>
<td>4</td>
</tr>
<tr>
<td>Jefferson</td>
<td>2900</td>
<td>District Provided iPads</td>
<td>Grades 9-12</td>
<td>3</td>
</tr>
<tr>
<td>Madison</td>
<td>1000</td>
<td>Blended Design of DPD carts, Lease-to-Own and Bring Your Own Device</td>
<td>All grades, parent purchase dependent, carts at all schools &amp; levels</td>
<td>5</td>
</tr>
<tr>
<td>Monroe</td>
<td>2700</td>
<td>District Provided Mac Laptops</td>
<td>Grades 6-12</td>
<td>3</td>
</tr>
<tr>
<td>Washington</td>
<td>4400</td>
<td>Bring Your Own Device</td>
<td>Grades 6-12, parent purchase dependent, carts at all schools</td>
<td>8</td>
</tr>
</tbody>
</table>
Findings

As previously stated, this study included an overarching research question concerning the leadership moves superintendents employ when implementing a large-scale technology initiative as well as five individual studies on areas related to that process. The findings for the entire study are delineated below to reflect each aspect of this study.

1. Superintendents achieved resonance through leadership actions consistent with prognostic and motivational framing.

2. Superintendents considered constraints the initiative might face in conjunction with prognostic and motivation framing in order to gain acceptance of the initiative.

3. Superintendents developed strategic processes to gain acceptance of the initiative.

Achieving Resonance Through Prognostic and Motivational Framing

Frame theory identifies the development of resonance amongst stakeholders in any social movement as a key method of gaining acceptance (Benford & Snow, 2000). With any large-scale initiative, such as a technology initiative, the superintendent works to help his or her constituencies understand and accept the rationale for any movement through resonance (Park, Daly & Guerra, 2012). In this study, the use of prognostic and motivational framing was consistent with each superintendent. Prognostic framing works to create a solution to a
problem through goals and a structured plan (Coburn, 2006). All superintendents in this study had goals for what they hoped the technology initiative would accomplish. This ranged from access to devices to various teaching and learning goals. Motivational framing refers to how the rationale or a “call to action” is articulated (Park, et.al., 2014, p. 4). Throughout this study, the superintendents demonstrated that effective communication to all constituencies was important in gaining acceptance for the technology initiative. Superintendents demonstrated this through the use of informational meetings, district websites, social media and blogs.

Identification of Constraints with the Technology Initiative

Each of the superintendents that participated in this study identified and assessed constraints related to the technology initiative to their constituencies. These constraints were an element of the prognostic framing in which superintendents developed solutions to goals via structured plans for improvement (Benford and Snow, 2000). These constraints were often financial or political in nature, but also included competing interests and issues with technology support staffing. Identified financial constraints were most prominent in all the districts that participated in this study. This factor often played a role in the decision regarding what devices or implementation model would be adopted. Political constraints often centered on the lack of support from various stakeholders, whether perceived or actual. Competing interests became a constraint when local or state initiatives were in place at the same time as the technology initiative and effected time and money allocations. Nearly all superintendents identified constraints in the capacity of their existing technology staff to support the initiative.

Superintendents Developed Strategic Processes

Strategic processes are also components of frame theory that identify specific actions of the superintendent to gain acceptance within the district. In our study, we identified several strategic processes that superintendents utilized to create buy-in for the technology initiative. This included: conducting research about the technology implementation, equipment selection, identifying key players, piloting devices, conducting professional development, communicating the expectations for use, maximizing public relations and assessing the capacity of the technology staff.
Discussion

The overarching study produced contributions to both theory and practice. Theoretical contributions in the area of frame theory highlighted that the use of prognostic and motivational framing were highly utilized professional practices in developing resonance for technology initiatives (see figure below). This included the identification of specific leadership actions that could be utilized to gain resonance/acceptance of the technology.

In terms of the elements of prognostic and motivational framing, this study indicates that this is not a linear process in districts that are working to gain acceptance of a large-scale technology initiative. Districts in this study did not start by first identifying a problem. All started by the goal of integrating technology into their district. This study makes the important contribution to frame theory by highlighting the mix of leadership actions and effective communication that can help a superintendent gain acceptance for a large-scale technology initiative.

Limitations. Because this study only examined five school districts, the data were limiting in terms of identifying themes and conclusions. By expanding the number of districts, there could be more generalizability of the findings. Another limitation included the lack of urban districts in this study. It is unclear on how this demographic component would affect the findings. As interviews were conducted through the recommendation of the superintendent, this might have skewed interviews to support the superintendent. This study did not interview teachers, students or parents. This perspective might have created different findings particularly to the areas of instructional vision and communication. This study did not look at student achievement in these five districts nor did it quantify the use of technology in classrooms. It also did not look at districts where a large-scale technology initiative was attempted, but did not gain acceptance.

Considerations for Future Study. This study found that the diagnostic frame of frame theory, in which leaders identify a problem through the processing of blame and then define goals to resolve issues, was only present in one district. Since this study focuses on how leaders frame issues in a large-scale technology initiative, this would seem to have some relevance. Additionally, as this study examined only districts where acceptance was gained for the technology initiative, it would be interesting to examine what has contributed to districts that have failed to gain acceptance of a large-scale technology initiative. Lastly, another interesting future study would be to include teachers into the mix of participants. Our study did not measure the
degree of resonance in the classrooms that was achieved in each district. This perspective would be a great counter to this study’s focus on leadership actions.

The Use of Prognostic and Motivation Framing in a Large-Scale Technology Initiative
Recommendations

Districts that have not already implemented a large-scale technology initiative may benefit from this study by applying their own individualized lens of their district to the actions listed in this study that can be replicated regardless of demographics. These general recommendations are listed below and described in detail in the full study:

1. Prepare for the initiative with self-assessments, research and a strategic plan.
2. Carefully plan communication and public relations efforts to garner buy-in.
3. Ensure effective staff is in place to lead the initiative.
4. Anticipate obstacles so that you can plan solutions.

Individual Studies: Findings and Recommendations

1. What is the instructional vision of superintendents who implement large-scale technology initiatives in a 1:1 or BYOD environment?

The instructional vision of superintendents who have participated in a large-scale technology initiative is often connected to constructivist/21st century learning components such as: communication, collaboration, creativity, student engagement, real world applications and technology use. This is consistent with early studies that suggest that constructivist/21st century learning skills are supported in technology integration efforts of schools and can assist with helping to create buy-in for these initiatives (Howland, Jonassen, Marra & Moore, 2003; Jonassen, Peck & Wilson, 1999; Dede, 2010; Boschee, Jensen & Whitehead, 2003; Haertel, Means, Penuel, Roschelle & Sabelli, 2003). However,
in most of the districts who participated in this study, the superintendent’s instructional vision was not consistently re-iterated or emphasized in the district’s mission statement, technology plan or by district administrators.

2. **How does the superintendent connect his or her instructional vision with the implementation of technology within the district to all stakeholders?**

The development of the instructional vision in a district where a large-scale technology initiative has been implemented did not involve all the district administrators who were identified as key players with the technology initiative. Instead, the vision development involved primarily the superintendent and his leadership team (building principals, central office academic staff). As such, the articulation of the instructional vision in connection with the technology initiative by district administrators was inconsistent in each district. The implementation and communication of the instructional vision in these districts, specifically as it pertained to the technology initiative, was often described as much more collaborative, involving all stakeholders including teachers, parents and students. The focus was primarily on the technology initiative and how it helped students learn in general, not necessarily how technology addresses the specific teaching and learning goals of the district. Despite this factor, there was some evidence in this study that the use of prognostic framing by the superintendents helped some stakeholders see how the technology initiative could help improve teaching and learning in these districts. Motivational framing of the instructional vision and the technology initiative also helped gain acceptance by (a) emphasizing the importance of the technology initiative to teaching and learning and (b) consistently sending the message to all stakeholders that they had a part in achieving the teaching and learning goals of the district. Both prognostic and motivational framing were primarily evidenced in the utilization of strategic actions related to professional development, the allocation of resources and the communication of the instructional vision and the technology initiative. By creating resonance between the instructional vision and the technology initiative, stakeholders could understand the value of technology in their schools (Coburn, 2006).
3. **How do district administrators make sense of the superintendent’s instructional vision for technology?**

District administrators felt that the superintendent’s leadership in defining and supporting the instructional vision for the initiative was very helpful in gaining acceptance. However, in this study, although most district administrators were inconsistent in their communication and understanding of the superintendent’s articulated instructional vision, they seemed to understand and accept technology’s place in the classroom. Most district administrators often defined the instructional vision as the technology initiative. While almost all district administrators gave examples of how they support the technology initiative, they did not all give examples of how they support the superintendent’s instructional vision. Many district administrators gave their own beliefs regarding teaching and learning when describing the instructional vision for their district that was not necessarily articulated by their superintendent

**Recommendations**

1. Superintendents should develop, utilize and consistently communicate a meaningful and sustainable instructional vision in the implementation of a large-scale technology initiative. These instructional visions should include elements of constructivist/21st century learning skills to help create resonance with stakeholders.

2. Superintendents should involve stakeholders in the development and implementation of the instructional vision—particularly with the implementation of a large-scale technology initiative.

3. Superintendents should support the development and implementation of the instructional vision in a large-scale technology initiative.
1. **Who does a superintendent work with to gain acceptance of large-scale technology initiatives?**

   All five districts had a primary leader and at least two secondary leaders working to gain acceptance of the large-scale technology initiative.

   **Primary Leaders**
   With the exception of the superintendent of Washington, Brody, the superintendents relied on one person more regularly than the other members of the technology team to help gain acceptance of the initiative. This leader is referred to as the primary leader. These primary leaders did not take the sole power for the initiative, nor were they independent from the authority of the superintendent. Furthermore, in most of the districts these individuals typically described the collaborative work that they were involved in rather than their sole influence. However, in all of the districts a primary leader was identified as the key framer in gaining acceptance of the initiative. In Washington, Brody was the primary leader.

   **Secondary Leaders**
   Within each district, the superintendent identified similar positions to lead the initiative. These positions included principals, technology directors and instructional technology directors. However, despite their formal titles, each secondary member played various roles with the technology initiative. Additionally, the work that these individuals produced was different among the districts as well. The number of secondary leaders differed as well among the districts. The size of the secondary leadership that the superintendents identified ranged from 3 people to 7 people.

2. **How do superintendents interact with the members of their leadership team around large-scale technology initiatives?**
Superintendents used mainly institutional practices to interact with other leaders and the superintendents mainly took on job tasks that fell clearly within their job description.

**Institutionalized Practices.** Meetings were the more common form of interaction between the superintendent and the people that worked to gain acceptance of the technology initiative in his district. In all of the districts, meetings were an institutionalized practice of interaction between the superintendent and other members of the district. These meetings mostly occurred formally during regularly scheduled meetings.

**Intuitive working relations.** Intuitive working relations were demonstrated in three ways: (a) the technology leaders reached out to the superintendent based upon his skills, (b) the superintendent included non-administrators in an administrative meeting, and (c) the primary leader and the superintendent began working together on this initiative based upon a shared history when the superintendent was in a previous position.

**Coordinated Tasks of Superintendent.** During the interactions between the superintendent and members of the technology leadership team, tasks were coordinated. The superintendents’ tasks were implicit, meaning the tasks fell within their job responsibilities. Generally, the superintendents took responsibility for funding the initiative and communicating the initiative. Around these topics, the superintendent interacted with critical stakeholders around this initiative, which included school leadership, municipal leadership and consultants. Many of these groups made important financial decisions for the initiative. These groups included the school committee in all districts, which approved the budgets in all of the districts that purchased devices for students. In nearly all of the districts, the school committee approved budgets for the devices in the schools as well as approved budgets that included backend infrastructure in the district.

3. **How do members of a leadership team interact with each other around large-scale technology initiatives?**

Members of the leadership team interacted with each other through various interaction structures and took on both implicit and explicit job tasks.
The primary leaders and secondary leaders regularly interacted through institutionalized practices, collaboration and intuitive working relations. During these meetings they coordinated tasks that fell within and outside of their job descriptions.

Institutionalized Practices. Respondents described regular practices of interaction an institutionalized practice in the school district. These patterns of interactions typically occurred as part of regular meetings or planning and implementing professional development.

Collaboration. Primary and secondary leaders identified informal meetings to discuss and plan the initiative. Some of these less formal meetings were spontaneous meetings in which the group collaborated to address a problem.

Intuitive working relations. Members described working with other leaders individually based upon their history of working with the leader or based upon leaders skillset. Many of these meetings were used to troubleshoot issues with the initiative. For example, many people described working with the technology director or network administrator to troubleshoot infrastructure challenges or issues for the initiative.

Coordinated Tasks. During the meetings primary and secondary leaders coordinated working tasks on the initiative. Some of these tasks were completed jointly, while other tasks were completed individually. Additionally, some of these tasks were implicit and fell clearly within the job description of these leaders, such as supporting teachers in the classroom. However, some tasks were explicit and fell outside of the job description of the leaders, such as meeting with community groups.

Recommendations

1. Superintendents should empower leaders with an interest and knowledge in technology leadership.

2. Superintendents should interact and coordinate jobs with technology leaders and encourage technology leaders to interact with each other.
3. District leaders should create structures that allow leaders to take on responsibilities that fall within and outside of their job responsibilities.

Framing Innovation: Technology Implementation and Existence of PLCs in Districts

The findings of this study indicate that the combination of framing and PLC constructs constitute the creation of an important learning medium—a technology learning ecology—with which to nurture educator learning about technology and increase acceptance of large-scale technology implementations in districts.

Superintendents created their own technology learning ecologies that functioned as PLCs for technology implementation teams, but did not necessarily “scale up” PLCs for district-wide technology learning. Key framers (primary leaders) of the technology initiative were identified in each district. Four superintendents (Jefferson, Madison, Monroe and Washington) created technology leadership ecologies with their technology leadership teams and one superintendent (Adams) did this through connections with his key framer/primary leader (leader of initiative) and through the use of social media and virtual learning networks. These PLC learning ecologies helped the superintendent to understand and implement the initiative.

In districts where more PLC constructs were described in relation to the technology initiative, participants identified more moments of resonance within the initiative and identified fewer constraints around the initiative. A possible synergy between PLCs and motivating educators to accept the initiative is sketched, as is the possibility that PLCs serve as a potential buffer to minimize worry over political or financial barriers to gaining acceptance for the initiative.

1. What are the superintendent’s expectations around collaboration?
All superintendents identified shared collaborative time as a formal part of their technology initiative and provided district resources to support it. Collaboration time existed in formal and informal ways. The term “PLCs” or PLC constructs were not directly used as a part of any superintendent’s deliberate strategy to support technology implementation or gain acceptance, even if the system claimed to formally implement PLCs. However, all five superintendents and their leadership teams described PLC construct expectations for shared time, collaborative teams, an action orientation and expectations for continuous improvement in their descriptions of educator work involving the large-scale technology implementation in their districts.

2. What is the relationship between district expectations for professional collaboration and acceptance of large-scale technology initiatives in school districts?

Professional learning communities as a formal part of the district’s overall instructional vision existed only in Washington and Monroe. However, across all five districts, superintendents described research tasks, formal professional development and informal professional development opportunities and provided collaboration around the technology initiatives.

**Research:** In all districts, superintendents actively connected professional collaboration and the technology initiative by creating technology PLCs for their own learning and planning through the use of their technology leadership or vanguard teams and by modeling technology use. Collaboration occurred through strategic planning meetings (virtual and in person), research visits to implementing districts, use of technology to model technology collaboration, and social media and online collaborative platforms.

**Formal Professional Development:** Formal professional development was described by all superintendents using PLC constructs. These experiences were described as a key forms of collaboration around the technology implementation. This professional development collaboration around technology was described as district-coordinated full and half day professional days and graduate workshops. Graduate workshops, due to their formal arrangement, staff’s autonomy in choosing the courses and the fact that many courses were taught by the district’s initiative’s key framer/primary leader emerged prominently as connected to PLCs and collaborative learning.
Informal Professional Development: Informal professional development was described by superintendents as connected to the technology initiative, but were not consistently described using PLC constructs. These professional development experiences were described as job-embedded shared collaboration time, workshops provided in various forms by technology integration specialists, after-school drop in technology help sessions, use of video conference distance learning to collaborate and use of memos or social media to read about new technology practices.

Like the learning medium described in Zhao & Frank (2003), PLCs help to create a “learning ecology” that nourishes development of the work in the system. While PLCs may not be necessary to gain initial acceptance for large-scale technology initiatives, they may be critical to sustaining acceptance or maximizing the initiative in the systems. This study indicates that PLCs do have a relationship to motivating staff and leaders within the district and for minimizing the effect of district constraints that threaten to hamper or slow the diffusion of technology implementation through the school system.

Recommendations

1. **Grow PLC culture** by combining PLCs with research, choice and formal professional development for all educators impacted by the technology initiative. The act of doing so strengthens the collaborative culture and deepens organizational learning around new initiatives, policies and practices (Talbert, 2009; Honig, 2006).

2. **Create small innovation/implementation teams across the school system to aid in collaborative learning.** Such teams create a sense-making learning ecology between all levels of the school organization (Spillane, Reiser & Reinter, 2002) enable innovation, sustain adult intention and autonomy while allowing for change, creativity, chaos and variety in adult learning and growing (Eisenhardt & Zbaracki, 1992; Nonanka, Umembto & Sasaki, 1998). Such regular team learning and mutual engagement sustains connections across the new implementation (Coburn & Stein, 2006).
1. **What factors are considered by superintendents in making decisions about technology infrastructure?**

Superintendents valued the capabilities and reliability of a device and were willing to pay more (within budget) for a device that had these qualities. The capabilities of the device could include things such as: battery life, audio/video recording, full size keyboard, variety of apps or software, portability, and ease of use. A reliable device would be one that is still likely to operate correctly even when it is constantly being transported from class to class and from school to home over a several year period. All superintendents considered a device to be reliable if they got three to four years of serviceable life from each device.

2. **What factors are considered by superintendents in making decisions about funding the large-scale technology initiative?**

Superintendents funded 1:1 initiatives by seizing one-time budget opportunities and through creative financial moves. Superintendents considered the financial sustainability of the large-scale technology initiative before committing to it. In addition to the reliability and cost of the device, superintendents chose devices that they believed had the features and capabilities that their students and teachers needed in the classroom. No superintendent purchased the least expensive device available (netbook, Chromebook, iPod). Instead, given the budget they had available, they purchased the device they thought offered the best reliability and capabilities for their students and teachers. Four of the five districts in this study had a portion of their large-scale technology initiative paid for by the state as part of a new building or renovation project. Some superintendents used political maneuvers to get a fixed sum in the budget that was dedicated for technology purchases. The superintendent typically worked with members of the Town Finance Committee (FINCOM) to secure these funds. Another important finding was that superintendents of this study considered the financial sustainability of the large-scale technology initiative before committing to it.

3. **How did the technology infrastructure or funding decisions have an impact on the perceived acceptance of the initiative?**
Robust and reliable Wi-Fi networks were recognized as being critical to gaining acceptance by teachers for 1:1 initiatives. A reliable network is one that is, rarely, if ever, not functioning properly (operational 99.9% of the time). All districts indicated they put the necessary planning and funds into their wireless networks in order to support their large-scale technology initiative.

**Recommendations**

1. District leaders need to make the necessary investments in their wireless networks to ensure they are robust and reliable.

2. School districts who do not believe they have the funds necessary to sustain a 1:1 initiative should consider a lease-to-own model. This should be done with the consultation of legal counsel.

3. Superintendents should have a plan to sustain the initiative when new equipment needs to be replaced.

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**Individual Study: Peter D. Cohen**

The Impact of the Superintendent’s Attitude and Use of Technology on the Acceptance of Large-scale Technology Initiatives

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1. **How do superintendents and other district leaders use technology?**

All of the superintendents and district leaders in this study use technology in their everyday practice. The specific devices used include a range of laptops, tablets, and smart phones with the common thread to each of these tools being mobility and access to Wi-Fi. Regardless of the specific brand of device, having the capability to access email and the web from anywhere at anytime was vital to work of these leaders. The data suggests that the leaders in this study use technology almost daily and for two main purposes in their professional practice: communication and collaboration.

2. **What are superintendents’ and district leaders’ attitudes about technology?**
While the use of technology by superintendents and other district leaders is somewhat variable, the data suggests that the 5 superintendents studied are aligned their overall attitudes about technology. For example, the superintendents and other district leaders indicated that technology was an important tool for improved instruction. Secondly, leaders in each district discussed the positive influence of technology to ensure that students are college and career ready. Thirdly, there was also an indication that superintendents aspired for their districts to be on the cutting edge as innovative school districts. These leaders did not wish to be behind the technology curve, but instead worked to proactively insert the tools students need to be successful now and in the future.

3. How do these attitudes influence their framing of large-scale technology initiatives?

The superintendent in each of the five districts studied reported a positive attitude about the direction of the district in regards to technology. This attitude appears to have more of an impact on the overall acceptance of the technology initiative than the superintendent’s personal use of technology. In other words, while there is no direct correlation between the use of technology by superintendents, the superintendent’s attitude about technology is a vital factor in gaining acceptance for the large-scale technology initiative. The findings of this study indicate that a primary leader is essential to frame the initiative. That leader does not need to be the superintendent, but the superintendent needs to also frame the initiative to gain acceptance. Our findings indicate that without the support of the superintendent, the technology initiative will not gain acceptance. Ultimately it is the superintendent who needs to make the case for the funding and sustainability of the initiative.

Recommendations

1. Ensure technology leaders are in place. The superintendent will be prepared to successfully lead a district into a large-scale technology initiative when proper leadership and staff are in place at all levels of the school district.
2. **Demonstrate conviction and belief in the initiative.** Without a superintendent who fully supports the integration of technology in the schools and moving toward a 1:1 learning environment, large-scale technology initiatives will not be successfully implemented, funded, or sustained.

3. **Promote innovation and sustainability.** Because of the ever-changing landscape of technology, thorough research and planning are needed in order to ensure both technology innovation and sustainability. If a superintendent is going to give support for a large-scale technology initiative, they must insist on decisions being made only after exhaustive research and thoughtful strategic planning has been completed. A successful initiative will require a comprehensive plan where ideas have been vetted, training needs considered, infrastructure requirements delineated, and long term funding solutions created. Innovation requires leaders continuously stay current with the technology. Large-scale technology initiatives require large-scale planning and strong leadership to be forward thinking in order to maintain the direction of the initiative and plan for the future.
Overall Conclusions

As previously stated, this study looked to first understand how superintendents gain acceptance of a large-scale technology initiative. The overarching study led researchers to examine more specific aspects of superintendent leadership that could be useful in implementing a large-scale technology initiative. This included a focus on the superintendent’s instructional vision, role of distributed leadership, creation and development of professional learning around technology, technology decision-making and the superintendent’s use and attitudes regarding technology. While all five research areas presented some very unique findings relative to the area of study that are found in each individual chapter, they also uncovered some common themes across these five spokes.

Superintendents interaction with others. Whether implementing an instructional vision, developing professional learning communities or making decisions regarding the technology infrastructure, all superintendents in this study relied on interactions with district administrators and communication with all stakeholders to help gain acceptance of their large-scale technology initiative. As the study on distributed leadership concluded, superintendents relied on primary leaders/key framers of their district administrative team to develop and implement their technology initiative in all areas of the five individual studies.

The development of strategic processes. As outlined in this study, superintendents utilized a variety of strategic processes in connection with prognostic and motivational framing to generate acceptance of their large-scale technology initiative. Across all spokes of this study, superintendents identified district-wide issues related to the individual focus areas and charted out strategic plans to help address these issues. In preparing for the initiative, the instructional vision, professional learning opportunities, leadership teams, technology infrastructure and communication avenues were all considered as elements necessary to build buy-in for the initiative. These focus areas were continued throughout the implementation phase of the initiative.

Additionally, the strategic process of developing professional learning opportunities related to the initiative was also interwoven within the five spokes. Professional development focused on moving forward the instructional vision of the district, involved the assistance of primary leaders/key framers, took into
account the technology tools and infrastructure of the district and was communicated by the superintendent through various avenues including social media, blogs, newsletter and the district website to name a few.

The overall study, in conjunction with the five related studies, all focus on the leadership actions that superintendents employ when working to gain acceptance of a large-scale technology initiative. This study has shown that the superintendent’s framing of the technology initiative and the strategic actions that he or she utilizes throughout the initiative related to each of the five spokes of this study are vital to developing resonance, and ultimately acceptance by stakeholders.

Recommendations

1. Self assess and create a strategic plan.
2. Carefully plan communication and public relations efforts to garner buy-in.
3. Ensure effective staff is in place to lead the initiative.
4. Anticipate obstacles so that you can plan solutions.
References


Dedication

This dissertation is dedicated to my wife Meghan and our three children, Rylan, Teagan, and Grady. Their support and patience during this process was amazing and I’m confident they will remind me of that quite frequently. I would also like to dedicate it to my parents, Jack and Brenda, for their love and support over the past 43 years and for still serving as the best proofreaders around.
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Chapter One

Introduction

In recent years, technology companies have developed mobile devices such as tablets and laptops that allow students to transport the devices from the classroom to the home with ease. Many school systems have begun to identify the academic promise and possibilities that these devices may have on teaching and learning. Therefore, every year more school districts have secured the funding to purchase devices for students, or opened their wireless network for students to bring their personal devices with them to school (Nagel, 2010). Within each district the programs might be referred to as 1:1 tablet or laptop and Bring Your Own Device (BYOD) initiatives.

For the purposes of this study, we define large-scale technology initiatives as those technology adoptions in public school districts that seek to provide a one-to-one (1:1) computing or tablet device for every student in a section or level of the school system, for example, one tablet or laptop for all students in grades 8-12. One-to-one (1:1) is defined as one computing device per child in the classroom setting combined with ubiquitous access to the Internet and all the power of a wired Internet connection for instruction. These 1:1 initiatives can employ a District Provided Device (DPD), Bring Your Own Device (BYOD), District Sponsored Lease-to-Own (LTO), or a Blended design (Salerno & Vonhof, 2011). District provided devices are selected, paid for, and maintained by the school system. BYOD initiatives ask that, in some manner, families of students bear the financial burden of purchasing the device for student use in the classroom. BYOD initiatives can range from districts allowing any and all devices for

1 This chapter was jointly written by the authors listed and reflects the team approach of this project: Gina
classroom use to strictly limiting the choice of devices. A lease-to-own model pushes the cost of the device to families, but it allows for it to be paid for in installments, often over a three or four year period. A blended technology school district would utilize a combination of DPD, BYOD, or LTO.

As support to the work of school districts, researchers have begun to identify potential ways in which these devices can support or even transform the learning environment (Bebell & Kay, 2010; Bebell & O'Dwyer, 2010; Dunleavy, Dexter & Heinecke, 2007; Weston & Bain, 2010; Zucker & Light, 2009). There are researchers who have found that technology integration in schools can have a positive impact on student learning (Bebell, 2010; Darling-Hammond, Meyerson, LaPointe, & Orr, 2010; Roschelle, Pea, Hoadley, Gordin, & Means, 2000; Sánchez & Salazar, 2012). This research remains relatively new and faces the challenge of refuting well-established technology integration critics. These critics found technology reforms to be ineffective, inconsistently implemented or to have no aggregate effect on education and therefore remain skeptical of such reforms (Cuban, et al., 2001; Ertmer, 2005; Tyack & Cuban, 1995; Wallace, 2004; Zhao & Frank, 2003).

Despite the debate within the research, many district leaders have moved ahead and secured funding and acceptance from their various constituencies: school board, taxpayers, building administrators, and/or teachers. It is estimated that in 2009, U.S. school districts spent over $7 billion on technology purchases and that the market is expected to continue to grow with the increasing number of schools introducing 1:1 computing initiatives (Compass Intelligence, 2010, Zucker & Light, 2000). A 2010 National School Boards Association survey showed that 37% of school districts had some
type of 1:1 computer initiative already in place and if the trend continues that percentage will continue to grow (Nagel, 2010). This commitment to developing technology has occurred in schools with no guarantee of success, or at best, differing views of success.

There can be a heavy price tag for school districts to consider when implementing a 1:1 technology initiative. Even though tablets and laptops are becoming more affordable, purchasing a device for each student is still cost prohibitive for most districts, as is building up a district’s infrastructure to implement 1:1 initiatives of any sort. Many school districts are challenged to find ways to fund and sustain the initial expenses of a large-scale technology initiative as well as the many other initiatives that are being supported in their district at the same time. Additionally, efforts to seamlessly integrate technology with the goal of increasing student achievement and productivity may be met with mixed results in terms of teacher “buy-in” and learning outcomes. Bebell, Russell and O’Dwyer (2003) noted that these mixed results have been due to problems with decision-making and implementation rather than the actual technology.

While superintendents might seek informal guidance on technology decision-making from districts that have implemented technology, as well as utilizing frameworks from educational organizations that focus on technology integration such as Project Red and the Partnership for 21st Century Skills (Partnership for 21st Century Skills, 2009; Project Red 2010), these methods provide a fragmented and broad road map to technology integration, often focusing on the structural components of the integration and not necessarily the leadership moves that a superintendent should employ in order to help gain acceptance.
By themselves, these methods do not provide a comprehensive, individualized guide to technology integration that takes into account the unique political, cultural and social-economical characteristics of various districts that are considering this movement. There does not appear to be a research-based study available to superintendents to help them understand and consider the leadership moves that may help them gain acceptance for a large-scale technology movement.

Despite the many issues to consider when developing a large-scale technology initiative, it is our assumption that superintendents are no longer asking whether it makes sense to move towards large-scale technology initiatives, but rather when and, most urgently, how. As more districts move toward technology integration in classrooms, the pressure increases on all superintendents to decide for their own districts how they might implement these large-scale technology initiatives. Therefore, our aim was to study what superintendents do to gain acceptance for large-scale technology initiatives in their school systems. The overarching study will focus on the following research question: How do superintendents gain acceptance for a large-scale technology initiative?

Specifically, this includes the examination of leadership moves of superintendents that contribute to this acceptance. This aspect of the study will be presented through five individual studies related to superintendent leadership in a large-scale technology initiative.

**Preview of the Dissertation in Practice**

In order to understand the context of the overarching and individual studies related to this dissertation, we provide a preview of the theoretical rationale, research design, methodology, and the organization of chapters below.
Theoretical Rationale

The study of frame theory provides an examination of how various social movements, such as a large-scale technology initiative, gain acceptance through various strategic actions. By examining various aspects of frame theory including motivational and prognostic framing, the development and use of resonance and the strategic actions that accompany this, we look to uncover if frame theory is an effective lens that superintendents apply when seeking acceptance of a large-scale technology initiative.

Research Design

As the overarching study seeks to identify actions of superintendents that are used to gain acceptance of a large-scale technology initiative through the lens of frame theory, it also includes five interconnected studies that emerge from the overarching study. The results and discussion of frame theory and technology innovation can be found in Chapters 4 and 6. The individual studies focus on various areas of leadership that superintendents might engage in during this type of initiative. This includes how superintendents utilize distributed leadership (Turner, 2014), instructional vision (Flanagan, 2014), professional learning communities (Nolin, 2014), technology decision-making (Arnold, 2014) and the superintendent’s use and attitudes regarding technology (Cohen, 2014). These relationships to the overarching study are represented in Figure 1 below:
Figure 1. An overview of the complete study. The overarching study is in the middle with the five individual studies surrounding it. Each individual study (or spoke) provides data to answer the central research question of our overarching study.

As the overarching study utilizes the lens of frame theory to the study of leadership actions, the five individual studies do so as well.

Methodology

This is a multi-case study of districts within one state that were each independently implementing a large-scale, 1:1 technology initiative. Both the overarching and individual studies employ the same methodologies and interview protocols for five superintendents and the individuals that they have identified as being key players in their technology initiative. Additionally, all studies include a within-case and cross-case analysis of the data collected from the interviews. Throughout all sections of the study, coding was used to identify the presence of leadership actions, framing activity, and acceptance of the technology initiative. In the related individual spokes of
this research, codes represented individual research interests and the application of framing actions by the superintendent. This process helped to establish the analysis of frame theory across the five individual studies.

**Overview of Chapters**

In Chapter 2, a review of the literature related to the study of district instructional leadership, technology leadership, technology integration and frame theory provide support to the current inquiry into a superintendent’s leadership actions in a large-scale technology initiative. Chapter 3 describes the methodology employed to collect and analyze data. Chapter 4 presents the findings of the overarching study based on the synthesis of all data collected from the overall study. Chapter 5 presents each of the individual studies related to the actions of superintendents undergoing a large-scale technology initiative. Each of the individual studies identify a problem, provide a literature review of relevant topics related to the study and outline methodologies, findings, contributions to theory and practices and recommendations for superintendents implementing a technology initiative. Chapter 6 addresses the contributions of the overarching study and the individual studies to theory and practice. Chapter 6 also addresses some limitations of this study, the implications for future research and outlines recommended actions for superintendent and district leaders who are undergoing a large-scale technology initiative.
Chapter Two

Literature Review

This study describes what superintendents do to gain acceptance of large-scale technology initiatives. There is no known research on the role of the superintendent as a technology leader. The focus of this research, however, limits large-scale technology initiatives to instructional technology. Relevant research already exists on instructional leadership. Therefore, instructional leadership research was used to help frame this study as well.

This study draws from a broad range of literature from social scientists, business, organizational and education scholars to help us place this question into context. We begin this literature review with a definition of what we mean by “large-scale technology initiatives” in education and discuss our focus on instructional technology. Then this section reviews literature focused on four themes: (a) the conflicting research about large-scale technology initiatives in schools, (b) the relationship between instructional leadership and technology leadership, (c) the role of the superintendent and central office in instructional leadership, and (d) frame theory, our theoretical framework, which guided our data collection, analysis and conclusions for this study.

With this body of literature we will describe the leadership challenges of implementing large-scale initiatives within an organization such as a school district’s technology initiative. Additionally, this literature review demonstrates gaps in research, which further raises the need to study what superintendents do to gain acceptance for these programs.

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This chapter was jointly written by the authors listed and reflects the team approach of this project: Henry J. Turner and Gina E. Flanagan with Erik P. Arnold, Peter D. Cohen, Anna P. Nolin.
Large-scale Technology Initiatives in Schools

School districts are purchasing expensive technology with the hope to improve several functions of schooling. Schools have always purchased technology to improve the productivity or job-related functioning of adults in the industry, such as accounting programs and copy machines. Additionally, school districts are now purchasing technology devices directly for instructional purposes to influence student learning as well (Means, Roschelle, Penuel, Sabelli, & Haertel, 2003; Dunleavy, Dexter, & Heinecke, 2007; Bebell & Kay, 2010). Instructional technology devices will be the focus for this study. This section defines instructional technology and its role in schools.

Instructional Technology Devices

For the purpose of this study, instructional technology devices are defined as technology tools that have the potential to improve the capacity for substantial and worthwhile learning through the relations of teachers, students and the technology tool (Ball & Cohen, 1999; Means et al, 2003). These devices could include tablets, smartphones or laptop computers.

Many school districts across the nation are amassing devices such as laptop computers and tablets for students and teachers. Furthermore, some school districts are purchasing an instructional device for every student or allowing students to bring devices to school. Often referred to as one-to-one (1:1) computing in schools, within these initiatives one instructional technology device is assigned to each student for use in a wireless, Internet-connected classroom setting. Therefore, in addition to purchasing devices, many districts are building a wireless infrastructure throughout schools to
support and maximize the use of the devices in classrooms. These initiatives are expensive and typically include taxpayer dollars as a funding stream.

Despite the high costs, many schools have already taken on full-scale 1:1 computing programs. Some of these programs have occurred through statewide initiatives, such as in Maine, Michigan, and North Carolina (Corn, Osborne, Halstead, Oliver, Tigen & Stahope, 2009; Silvernail & Lane, 2004; Silvernail & Grutter, 2005). More commonly local districts have implemented programs in Virginia, Florida, California, Massachusetts, Iowa, Vermont, Texas and elsewhere (Bebell & Kay, 2010; Cavanaugh, Dawson, White & Valdes, Ritzhaupt & Payne, 2006; Penuel, 2006; Shapely, Sheehan, Sturges, Carnanicas-Walker, Huntsberger & Maloney, 2009; Zucker & Light, 2009). This type and definition of large-scale technology implementation maintains a broad umbrella of instructional technology devices. Furthermore, the definition only incorporates technology used by teachers and students. A description of how these instructional technology programs are used in classrooms follows.

**Use of Instructional Technology in the Classroom**

Emerging research demonstrates several examples of technology uses in the classroom. Means et al. (2003) found that technology influences instruction by providing curriculum resources and creating alternative instructional activities and processes. Additionally, some are teachers using a variety of teaching strategies using the technology devices in their classrooms, which have increased project based learning, student engagement, collaboration, and research skills in the studied classrooms (Dunleavy et al., 2007; Bebell & Kay, 2010). With these strategies, researchers found that technology could more adeptly meet individual learning styles for students (Collins
& Halverson, 2009; Dede, 2011; Selwyn, 2011). Therefore, researchers have demonstrated the potential of technology in the classroom for instructional purposes.

Despite growing research of its effectiveness, instructional technology is a challenging implementation initiative in many schools. In many classrooms instructional technology remains underused and ineffective (Cuban, 1993; Cuban, 2003; Cuban, 2006; Gray, Thomas & Lewis, 2010; Tyack & Cuban, 1995). Furthermore, scholars have identified teacher resistance to be one of the greatest impediments to technology acceptance into the classroom (Zhao & Frank, 2003; Weston & Bain, 2010). Therefore, while some studies showcase the successful use and potential of technology in the classroom, they also highlight the important role that teachers play in determining the success of the integration of instructional technology devices. If instructional technology devices continue to become a larger presence in the classrooms, leaders may need to think about building teacher capacity to accept devices in the classroom.

School and district leaders may be an important group to help teachers accept technology and learn to integrate it into their classrooms. Furthermore, as schools continue to purchase expensive technology, school and district leaders may have to make more decisions about the potential benefits that technology can provide their school system. They may need to provide professional development for staff on how to use technology in the classroom. Finally, leaders may feel constrained by teachers and community members due to the initiative’s high cost and newness to the classroom.

This expectation for large-scale technology to improve an organization has been an important area of focus in business research (Brynjolfsson & Hitt, 2000; Brown, 2001; Acemoglu, Aghion, Lelarge, Van Reenen, & Zilibotti, 2007). However, no known
research exists about the increased expectations for school and district leaders to adopt these initiatives. Leaders, therefore, may need to develop and utilize leadership strategies to ensure acceptance of these initiatives.

In order to achieve this goal, leaders might use both instructional and technology leadership to implement a large-scale technology initiative. If district leaders resolve technology integration problems, the potential for instructional technology to improve education may become more apparent. The relationship between instructional leadership and technology leadership is therefore important to define in today’s educational context.

The Role of Instructional Leadership and Technology Leadership

Regardless of any evidence of technology’s benefits in the classroom, technology integration into the classroom has been met with mixed results. Leadership may be one way to improve instructional technology integration in the classroom. Emerging research on both instructional leadership and technology leadership exists and is summarized for use in this study. While this study focused on district level leadership, most of the research in this field has focused on building-level leadership.

Description of Technology Leadership

Very few studies have investigated the role of leadership with respect to technology and even these few studies are focused on building-level leadership. Some studies have identified that technology leadership is unique to other forms of school leadership (Anderson & Dexter, 2005; Flanagan & Jacobsen, 2003; Gerard et al., 2010). McLeod and Richardson (2011) demonstrated the need for further study on technology leadership. Although technology leadership remains an emerging research field, early studies suggest that strong technology leadership is an important component to successful
school technology integration (Anderson & Dexter, 2005; Gerard et al., 2010; Dexter, 2011a). Again, all of these studies focus on building-level leadership, such as principals, which raises the question of the role of the central office within this leadership lens. This section will describe the research on technology leadership.

Studies on technology leadership have mostly studied the technical skill of principals, which have found that many school leaders have minimal technical knowledge (Flanagan & Jacobsen, 2003, Gerard et al., 2010). Furthermore, they found that increased technology use existed within the school, including the classroom, when principals had technical skill and knowledge (Flanagan & Jacobsen, 2003; Anderson & Dexter, 2005). These studies defined technical skill as the leader’s ability to use technology within his/her professional life, such as email. Anderson and Dexter’s (2005) comprehensive quantitative study of leadership in a digital environment confirms and correlates the role of technology leadership with increased educational technology usage and integration in schools. The study names basic indicators of administrator leadership to promote technology integration, but the indicators here, again, fall short of defining a student-achievement driven set of technology leadership actions that inspires teachers to integrate technology.

Existing research has yet to study the characteristics of technology leadership focused on student learning. Some research literature has laid the groundwork to study technology and learning; however, they vary in their manner of defining technology integration—conflating teacher personal and administrative use of technology for productivity reasons, such as student information systems, with technology used for instruction, such as instructional technology devices (An & Reigeluth, 2011; Galizio,
Ledesma, Schrum, 2011; Hughes & Zachariah, 2001; Kincaid, 2002; Leonard & Leonard, 2006; McLeod & Richardson, 2011). Therefore, more research is needed that directly links technology leadership effectiveness with student learning. Our study hopes to initiate this scholarly discussion.

Some studies examine school and district characteristics that result in increased use of technology by teachers for their own professional preparation, for delivery of instruction, and in directing students to use technology for production of academic projects (Bebell & Kay, 2010; Bebell & O’Dwyer, 2010; O’Dwyer, Russell & Bebell, 2004; O’Dwyer, Russell & Bebell, 2005). While leadership skills or actions can be inferred through examination of school and district characteristics in a school system, these studies do not directly identify leadership competencies or actions most important for elevating student achievement through technology use.

Technology leadership is an important area for further study because of the complexity of technology and its unique challenge of gaining acceptance within a school setting. Furthermore, the resistance and lack of technical knowledge that people have of technology suggests technology leadership demands leadership actions that may not be necessary for other aspects of leadership (Cuban, 2006; Gerard et al., 2010). These technology initiatives are focused on students using these devices in the classroom. Therefore technology leadership may also relate closely to instructional leadership. Additionally, an analysis of instructional leadership assists in understanding technology leadership and potential links between the two.
Instructional Leadership

Researchers have been able to connect building based instructional leadership as a factor in increasing student learning within the classroom (Leithwood, Harris & Hopkins, 2008; Robinson, Lloyd, & Rowe, 2008; Louis, Dretzke, & Wahlstrom, 2010). However, there is only one known study that connects technology leadership with instructional leadership in a school (Dexter, 2011b). Based on this gap in research, examination of the overlapping findings as well as gaps in the research between instructional leadership and technology leadership is required. Additionally, the question of whether technology leadership requires skills and knowledge beyond that required of good instructional leadership must also be contemplated.

Researchers have found that effective instructional leadership exists when teachers and the principal participate in the decision-making (Hallinger & Heck, 1995; Hallinger, 2005). These researchers found that when teachers and principals collaborate they: (a) provide clear goals around student learning, (b) utilize a range of stakeholders, (c) create a climate of high expectations, (d) develop and monitor student learning outcomes, and (e) oversee staff development. Dexter (2011b) found these factors within instructional technology decision-making as well.

Effective instructional leadership and effective technology integration have other common themes as well, such as the need for a clear vision and choosing the correct tools/methods (Ball & Cohen, 1999; Hallinger & Heck, 1996; Anderson & Dexter, 2005). However, technology leadership poses unique challenges, such as technical decision-making (Gerrard, Bowyer & Linn 2008; Gerrard, Bowyer & Linn, 2010). Therefore,
these technical decisions may require the use of several leaders, including some who have technical knowledge, such as technology directors (Dexter, 2011b).

Technology initiatives in school systems often are implemented in more than one school; therefore leadership may be needed to implement larger-scale technology initiatives across a district, requiring a study of technology leadership to include examination of the power and skill of district leadership. Increasingly, researchers are studying the role of the superintendent and central office as instructional leaders outside of a technology context. For this study, the role of the superintendent and the central office around instructional leadership must therefore be studied, which will raise the question as to how technology leadership might be described or have impact at the district level.

Superintendent and the Leadership Team

The previous section discussed the relationship between instructional leadership and technology leadership. The research described, however, focused mostly on the leadership of principals. While this study interviewed principals, superintendents remain the focus for this study due to the district-wide and large-scale, community-wide ramifications of 1:1 computing initiatives in a school system. Emerging instructional leadership research demonstrates the important roles of district level leaders in order to implement instructional reforms in schools (Corcoran, Fuhrman, & Belcher, 2001; Hightower, 2002; Elmore, 2004). Therefore, the purpose of this section is to discuss the role of superintendents and their central office staff with instructional leadership. The role of the superintendent must be examined as well as the work of central offices. We will begin with an overview of the role of the superintendent. Next we will discuss the
work of the central office. Finally, we will discuss the work of the superintendent and his/her leadership team in gaining acceptance of instructional initiatives. It should be noted that some district leadership teams include principals. For this study, every participating school district included principals as part of the district leadership team. Thus discussion of the superintendent and central office’s leadership roles will provide a stepping-stone to this research on superintendents as technology leaders.

**The Superintendent**

The superintendent’s job has become increasingly complex. Often superintendents deal with structural and organizational issues such as facilities and human resource issues within an ever-increasing political dynamic (Petersen & Barnett, 2005; Childress, Elmore, Grossman & Johnson, 2006). Furthermore, superintendents are facing increased pressure from state and federal policy, taxpayers, school councils and other municipality groups (Elmore, 2004). Researchers report that superintendents must contend with an increasingly complex system with less financial flexibility (Orr, 2006). Nevertheless, within this complexity there is a need for superintendents to remain instructional leaders in their district.

Superintendents provide the glue that connects many important district stakeholders including: school boards, parents, building administrators and district administrators. Their direct connection with these stakeholders provides a trickle-down effect of instructional leadership within each school. In working with these groups, the work of the superintendent is to provide a collective instructional vision, ensure collaboration between different departments of the district, and secure appropriate funding for instructional programs and professional development (Petersen & Barnett,
Researchers have begun to study how superintendents carry out these actions within the new dynamics of the position (Childress, et. al, 2006).

Despite the increased complexity of the job, researchers found that many superintendents’ instructional responsibilities have remained consistent with the traditional instructional responsibilities superintendents held for a long time regardless of district size. These areas of instructional responsibility include: (a) working with stakeholders such as central office administrators, principals, and school boards, (b) securing and allocating resources, (c) establishing a vision and goals, and (d) evaluating and reviewing instruction using data (Petersen & Barnett, 2005; Childress, et. al, 2006).

While these actions may not directly impact student learning, they have a district-wide impact and effect through district and building administrators, which ultimately impacts teaching and learning at the classroom level. With these strategies, superintendents are able to provide oversight and ensure consistency throughout the district during a time in which their job has become more complex. Due to the complexity of the job, however, superintendents must work with their district leadership teams in order to execute the total responsibilities of the position. This central office teamwork is important to the district’s instructional success and the district leadership team must be examined as a component of the superintendent’s instructional leadership.

**District Leadership**

Depending on the size and structure of the school district, superintendents may work with other building and central office administrators to carry out the functions of their job. Therefore, district leaders other than the superintendent can play an important role in carrying out instructional leadership.
Central office leaders possess some of the strongest understanding of education theoretical content as well as instructional best practice within their district, which can be structurally siloed within a department (Hightower, 2002; Honig, 2003). Hightower (2002) identified the isolating nature in a large school district. This structure prevented central office administrators from working collaboratively with other leaders within the organizational structure. Researchers have found that some of the most important leaders in implementing an instructional policy are the non-instructional central office leaders of: the human resource office, facilities office, and business office, etc. as well as building based leaders such as principals (Hightower, 2002; Honig, 2003; Wayman & Cho, 2008; Coburn, Tourre & Yamashita, 2009). When communication between each office occurs, districts are able to think about the total impact of large-scale programs and, by extension, act more cohesively.

Researchers have demonstrated that central office administrators can have an impact on instructional leadership. Much of this impact can be found in supporting the responsibilities of the superintendent through: (a) interpreting data, (b) building district knowledge and skills, (c) aligning curriculum and instruction and (d) targeting interventions on low performing students and/or schools (Massell, 2000). With effective central office leadership, school districts may be able to develop more district consistency and richer professional development. Still, due to the organizational complexity and politics of the district, gaining acceptance of programs within these areas can be challenging. Therefore, district leaders must frame these initiatives through effective communication and strategic thinking.
One of the critical positions that district leaders must gain acceptance from in large-scale district-wide reform work is with building principals. As previously stated, researchers have demonstrated the link of principal instructional leadership to student learning as well as a principal’s technical skill with increased technology use throughout the school. Therefore, combining the leadership power of the principal, and curricular knowledge of the central office administrators could create an effective relationship with which to provide schools collaborative and evidence-based instructional leadership (Hightower, 2002; Honig & Coburn, 2008; Coburn et al, 2009). Therefore, district leaders must utilize strategic thinking and effective communication to gain acceptance of initiatives from principals. While this process is simple and logical, superintendents must gain this acceptance from their teams while balancing all of the other organizational challenges inherent in district leadership. The work of the superintendent is to balance organizational challenges and cultivate the work of their leadership teams.

**Work of the superintendent and the leadership team.** As previously detailed, district-wide technology initiatives present leadership challenges for school and district leaders. As previously defined, the central office may include instructional or organizational leaders. Furthermore, some school districts may include principals as members of the district leadership team. Despite the complexity for district leaders implementing a technology initiative, no known research addresses the role of such leadership in implementing technology initiatives. However, a variety of research has examined the role of the superintendent and central office in implementing other instructional initiatives and is summarized below. This section describes three categories of work for superintendents and their leadership teams in gaining acceptance of
instructional initiatives: (a) collect evidence of an initiative through data and research; (b) make sense of the evidence for stakeholders, such as parents, school committee and faculty; and (c) build capacity throughout the district to accept the initiative. The rest of this section will explain these three areas of work.

**Collect evidence through data and research.** Through state and local assessments districts are inundated with data (Wayman & Cho, 2008; Honig & Coburn, 2008). Furthermore, state and federal laws mandate central office administrators to utilize and interpret data. Data specialists have become a new and important role in some districts. In turn, central office staff members have begun to focus their decision-making on the evidence collected and analyzed (Honig & Coburn, 2008). Therefore, the challenge for district leaders is not finding and interpreting data that can develop a message, but finding the data that will make an impactful and meaningful message.

One of the challenges for district leaders is the lack of data coherence and knowledge outside of the central office. Honig and Venkateswaran (2012) found that school administrators relied on district administrators to help them incorporate evidence use within their school as well as provide professional development. Another study found that school leaders who were reluctant to utilize data could: (a) focus on using data to address small scale workable problems and (b) select technology that will reduce work or improve work efficiency for school leaders (Wayman & Cho, 2008). As stated before, the relationship between the district leaders and school leaders is critical in order to create meaningful instructional leadership. Therefore, district leaders must choose data that is impactful to leaders and will energize them to use the data. In order to accomplish this successfully, leaders must make sense of the data through a political lens.
**Make sense of evidence.** Researchers have identified sensemaking as an inert task in the central office. Coburn, Tourre and Yamashita (2009) defined sensemaking in the central office as leaders understanding evidence and enacting its use within a school district. This step allows district leaders to make their interpretations of the data and think about how it impacts their district. Additionally, districts must utilize this step in making sense of policies developed by state and federal law as well as research and recommendations from outside consultants.

While districts utilize data to inform their practice, one potential challenge is the political influence for district leaders. Researchers found that district leaders and superintendents understand evidence-based strategies to improve learning, however, their decisions are largely made for political reasons (Spillane, 2005a; Coburn, et al., 2009). Therefore, there is a need to understand how leaders can work within this political structure to improve learning.

Researchers have found that success of these policies and initiatives is founded around the district’s ability to make sense of these ideas as they pertain to the needs and culture of the district (Spillane, 1996; Spillane, 2005a; Spillane, 2005b; Coburn et al., 2009). Spillane (2005a) found that school districts interpreted even the most rigid federal mandates from NCLB from their own perspective, which in many ways went against the intent of the law to mandate uniformity.

**Capacity building.** In addition to sensemaking, another related role of the central office is to provide professional development within the district. As discussed earlier, central office leaders may possess the most instructional and pedagogical knowledge within the district. If they are the most knowledgeable, then their role may be to educate
other educators within the district, including teachers and building-based leaders. Researchers, refer to this level of adult education as capacity building (Spillane & Thompson, 1997; Mulford, 2007).

In order to get stakeholders on board with an instructional reform, the district must possess the capacity to accept this reform. Spillane and Thompson (1997) define capacity for instructional reform as “a complex and interactive configuration”. Additionally, capacity is based upon the willingness of the leadership to support and teach about the initiative and the teachers to have the willingness to adopt the initiative.

Spillane and Thompson (1997) also found that capacity building requires investing in two critical forms of capital: human capital and social capital. Human capital is based upon the knowledge base of the people within the organizations and that the leadership has the knowledge, not only of the initiative, but also to teach people about the initiative. Social capital comes in the form of the trust and collaboration among educators within the district and the ability of the district to gain support from consultants outside of the district. If districts have the robust investment in human and social capital, the stakeholders are more apt to accept the initiative (Mulford, 2007; Spillane & Thompson, 1997).

Stakeholders are also more apt to adopt a new instructional program if the district has a culture as a learning organization. Cohen and Barnes (1993) identified that policymakers often fail to see themselves as teachers of the policies they create. Additionally, they point that policymaking is an opportunity for learning that often goes unnoticed. For example, they note that when the speed limit was reduced to 55, drivers needed to learn to drive slower. Even more than speed limits, some policies require
teaching for people to learn how to adapt to the policy. This is true for programs established by school districts. When creating a program, superintendents and district leaders should recognize the need to teach stakeholders the importance and impact of the program.

However, scholars have highlighted that districts fail to create structures that teach stakeholders about new instructional programs. Often, teachers complain that a new initiative is similar to a previous one that failed. The school districts that establish learning structures for teachers create great opportunities to teach stakeholders the rationale and purpose of the initiative (Ball & Cohen, 1999; Blumenfeld, Fishman, Krajcik, Marx & Soloway, 2000; Elmore & McLaughlin, 1988; Grossman & Thompson, 2004).

Professional development is the most common way in which teachers learn about new district programs. However, professional development “has been the most frequently overlooked component of technology integration since schools began using technology” (Greaves et al., 2010, p. 41). Jacobsen (2001) referenced a survey of educators, conducted by the Alberta Teachers Association Computer Council in 2000, where they were asked to identify the main reasons that were preventing them from integrating technology in their classrooms. According to the survey, over 54% of teachers chose a lack of time to develop lessons that incorporated technology as one roadblock and another 38.6% chose insufficient professional development and/or funding for professional development as a second roadblock. A thorough professional development program would provide time and support for teachers to develop lessons to integrate the technology. The literature is clear that professional development for
integrating technology should be ongoing throughout the year and not just a one-shot three-hour session (Banister, 2011; Jacobsen 2001, 2002; Vaughn, 2010; Waters, 2009).

This section discussed the different roles played by superintendents along with the central office relative to gaining acceptance of initiatives. Researchers identified three areas where district leadership can be impactful around instructional initiatives: (a) collect evidence of an initiative through data and research; (b) make sense of the evidence for stakeholders, such as parents, school committee and faculty; and (c) build capacity throughout the district to accept the initiative. These three actions fall in line with the components of frame theory, which is the theoretical framework for this study.

**Theoretical Framework**

The studies reviewed in this chapter identified the relevant literature to help understand the superintendent’s potential role in gaining acceptance of large-scale technology programs. Literature reviewed included discussion of: (a) the challenges of implementing instructional technology, (b) the need for technology and instructional leadership, and (c) the work of the superintendent and central office in gaining acceptance of instructional initiatives. In the final section, we found three areas in which the superintendent and central office can make an impact in instruction: (a) collecting evidence of an initiative through data and research; (b) making sense of the evidence for stakeholders, such as parents, school committee and faculty; and (c) building capacity throughout the district to accept the initiative. These three actions overlap with several ideas within frame theory. This final section explains frame theory’s role as a theoretical framework for this study.
Through the lens of frame theory, what superintendents do to gain acceptance of large-scale technology programs can be examined. Frame theory discusses the ways in which political or social movements are constructed. A district’s move toward technology acceptance at this time in educational history can be compared to these types of social movements. Furthermore, the day-to-day reform work of the superintendent appears to fall in line with two components of frame theory. For this study, frame theory is used as it was initially conceived in Goffman (1974), and promulgated further in analyses in different social contexts by Benford and Snow (2000), Coburn (2006), and Snow, Rochford, Worden and Benford (1986).

**Frame Theory**

Frame theory lends itself as a framework for how leaders are able to gain acceptance of large-scale initiatives such as those involving technology implementation in districts. Because of its focus on movements, this theory lends itself to study the leadership actions that are required when district leaders move towards educational innovations such as large-scale technology initiative proposals. Frame theory allows for analysis of such large-scale proposals and reform movements from different angles, such as frame analysis is able to show how competing interpretations and perspectives may lead to dramatically different policy designs and degrees of “resonance,” relative to the proposed new initiative implementation (Benford & Snow, 2000). Frame theory also helps leaders understand how to shape a policy in order for constituencies to make sense of the policy. Frame theory lends itself to the practical work of superintendents who lead large-scale technology initiatives.
Research based on this approach has mainly been used to study political communication and media discourse; more particularly, scholars have studied how people are mobilized with a social movement (Snow & Benford, 1988; 1992; Snow et al, 1986; Benford, 1993).

**Frame analysis and technology plan development.** There are many leadership actions employed by superintendents when implementing reform or policy changes in a district including: collaborating with a leadership team, modeling of skills, decision-making, communication with stakeholders and strategic planning. Therefore, we will employ frame theory to help us understand these leadership moves required to maximize “resonance” or the mobilizing potency of superintendent actions conducted to gain acceptance of a district’s technology initiative (Benford & Snow, 2000). There are three key components of frame theory that include frame “development, generation, and elaboration” (Benford & Snow, 2000). Embedded in these components are the three core parts to frame development: *diagnostic framing, prognostic framing, and motivational framing*. Each of these core parts can play a unique role in building a consensus and/or moving people toward action around proposed technology implementations in a district.

Through diagnostic framing, leaders identify a problem that they wish to change. Within social movements these problems were typically identified as an injustice (Benford & Snow, 2000). In education, it can be argued that the creation of NCLB utilized the diagnostic frame to identify an achievement gap in minority and special needs students that was caused by years of inattentive focus by educational systems toward these groups. Diagnostic framing could also be applied to the push toward a 1:1 technology initiative in that there are equity and socio-economic issues with students who
have, and do not have, access to technology in the classroom or at home. It could be argued that this imbalance puts one group at an academic advantage over the other.

Prognostic framing also identifies a problem, but instead of focusing on the aspect of blame, prognostic framing works to carve out solutions via goals and a structured plan to achieving these goals (Coburn, 2006). In the world of education, issues involving student achievement and skill development, for example, are addressed through professional learning communities, district strategic plans and technology plans.

Motivational framing can be viewed as the mechanism used to bring forth collective action particularly through the use of language/communication structures (Benford & Snow, 2000). In relation to technology implementation, the terms, college and career readiness, 21st century learning and global competitiveness, amongst others, have created an urgency to put digital tools into the hands of students and are often the motivational tools of language used to frame technology initiatives.

Superintendent leadership was examined from these various framing perspectives as well as considering various framing characteristics, processes and dynamics that are essential components in the framing implementation; specifically, including the framing concepts of resonance, strategic processes and constraints.

Resonance. Theoretical frames help bring meaning to a movement, and thereby, mobilize acceptance of an initiative. A concept similar to acceptance, resonance is an essential characteristic of framing development and implementation (Benford & Snow 2000). Park, Daly, and Guerra (2012) expand Benford and Snow’s conception of resonance and describe it as occurring when “frames motivate action or cause [a] shift [in] beliefs” (p. 4).
The concept of credibility plays an important role in developing resonance as it establishes consistency and expertise related to the movement, as well eliminates any contradictions. The use of “empirical credibility” with frame theory helps to create resonance in that it makes a connection between the movement itself and what may be happening within the organization or its surroundings. Equally important is the perceived credibility of the individual(s) who are communicating the frame itself—the frame articulators. Here, resonance is often created through the frame articulator’s experience with the movement or the manner in which they create “narrative fidelity.” Narrative fidelity utilizes the concept of “cultural resonance” whereby, the frame articulator connects the movement to specific elements of the organization’s ideology (Benford & Snow, 2000).

Through this analysis, it is the hope that school leaders can learn effective ways in which superintendents have created resonance and, therefore, acceptance in the school district of a large-scale technology initiative. With this, frame analysis becomes a lens through which to view how district leaders establish meaning within a large-scale technology initiative with their constituencies. In turn, if superintendents contemplating a future technology initiative understand the meaning-making process that garners acceptance of technology initiatives, they can more effectively envision, design, and lead such initiatives in their own school systems.

**Strategic processes.** The development and diffusion of frame theory relies on specific tasks that propel the frame into motion. Strategic processes are often constructed by the frame articulator methods to mobilize individuals toward the movement. These processes are deliberately tied to the identified goals. Some strategic processes include
enlisting supporters and resources for the movement (Benford & Snow, 2000). Identifying strategic processes utilized by superintendents and educational leaders involved in large-scale technology initiatives may help create a more effective understanding of the use of frame theory to gain acceptance.

**Constraints.** Frame theory consists of many variables that may accelerate or impede its mobilization. As it is an ongoing process, it is often affected by various elements of an organization. Constraints are identified as political, social, cultural and even financial roadblocks that slow down the movement. An analysis of how superintendents and educational leaders maneuver around or through constraints will hopefully broaden the understanding of how superintendents gain acceptance of a large-scale technology initiative.

**Frame diffusion analysis.** The aforementioned aspects of frame theory allow for examination of the design, creation and meaning-making aspects of technology implementation. Frame diffusion analysis allows for examination of the widespread acceptance of the initiative in a district. Likening the implementation of large-scale technology initiatives to a social movement, these initiatives can be analyzed by using frame theory to conduct a frame diffusion analysis (Benford & Snow, 2000). Analysis of frame diffusion relative to technology implementation allows for discussion of how constituencies make sense of a technology initiative and how the movement of ideas, collective action frames, and practices spread throughout the school system. Frame diffusion analysis also allows for examination of how the initiative affects the diffusion of beliefs, objects, and practices in the system by way of strategic selection or adaptation, or the strategic fitting or accommodation of these practices in light of the technology
initiative and its impact. A clear connection between frame theory and technology leadership actions is evident in the prognostic and collective action aspects of frame theory and this study will focus on those two aspects of frame theory and their relationship to diffusion of the initiative across a school district.

Finally, analysis of frame diffusion will allow us to discuss frame alignment employed during the implementation, that is, the actions taken by those who produce and invoke frames in an attempt to connect these frames with interests, values, beliefs and those they seek to mobilize toward acceptance of the technology initiative (Snow et al., 1986; Williams & Kubal, 1999).

The aggregate of this analysis allows for detection of potential trends or patterns of acceptance gaining that potentially allow for greater resonance between constituencies and the initiative, thereby tracing levels of acceptance to the leadership actions that brought them forward (Benford & Snow, 2000). Further, analyzing such leadership action will allow for identification of which leadership actions and framing moved the technology initiative to acceptance in the schools and at all levels of the community surrounding the school district. For this analysis we will use the perspectives of the district leadership and those they name as critical to implementation of the technology initiative.

Ultimately, we hope to inform practice by creating thick, rich descriptions of superintendent leadership actions intended to bring about acceptance of large-scale technology initiatives and illuminate themes and patterns across case studies about the actions of superintendents who have gained acceptance for large-scale technology
initiatives in their school systems. The next chapter will describe the methods that we used for this study.
Chapter Three
Methodology

The aim of this overarching study is to describe what superintendents do to gain acceptance of large-scale technology initiatives. As described in Chapter 2, Acceptance means that a district has technology devices in the hands of students in a 1:1 fashion for some regular and reliable portion of their instructional program. To address this aim, a multiple-case study analysis of five central office-led large-scale technology implementations was conducted. This chapter describes the methods for this study.

Spokes of Related Study

Our research team conducted a group study of the work of the superintendent in gaining acceptance of large-scale technology initiatives. In addition to the overarching study, five individual studies based on the work of superintendents in gaining acceptance of large-scale technology initiatives were also conducted. These individual studies are referred to as “individual spokes” of study. For the overarching study and the individual spokes, the majority of the research conducted was simultaneous and collaborative. The research methods that were unique to individual spokes of study are addressed in Chapter 5.

The topics for the five individual spokes stemming from our overarching study of what superintendents do to gain acceptance of large-scale technology initiatives are:

1. The impact of the superintendent’s instructional vision on acceptance of large-scale technology initiatives.

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3 This chapter was jointly written by the authors listed and reflects the team approach of this project: Anna P. Nolin & Henry J. Turner with Erik P. Arnold, Peter D. Cohen, Gina E. Flanagan
2. The impact of distributed leadership practices on acceptance of large-scale technology initiatives.

3. The impact of the superintendent’s technology infrastructure decisions on the acceptance of large-scale technology initiatives.

4. The impact of the superintendent's use of technology on acceptance of large-scale technology initiatives.

5. The impact of a school district’s collaboration practices and professional learning structures on acceptance of large-scale technology initiatives.

Table 1 (on the next page) illustrates individual areas of study and research questions.

**Design of Study**

To address our team’s overarching research questions, a case study methodology was employed. A case study is an empirical inquiry that “investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between the phenomenon and the context are not clearly evident” (Yin, 2009, p. 326). Case study methods are best for uncovering the “how” or “why” of events and are appropriate for this study because several of the research questions for our individual spokes of related study are “how” questions (Yin, 2009). Case studies allow us to explore and describe the complexity of contemporary situations without the ability to control behavioral events (Yin, 2009; Creswell, 2012). Specifically, a multiple-case study design was employed. While employing multiple-cases, across multiple interviewees, we were able to describe and compare the cases to enhance our understanding of the issue being studied (Creswell, 2012).
<table>
<thead>
<tr>
<th>Individual Study/Author</th>
<th>Research Questions</th>
</tr>
</thead>
</table>
| Framing Innovation: Does An Instructional Vision Help Superintendents Gain Acceptance for a Large-Scale Technology Initiative? (Flanagan, 2014) | - What is the instructional vision of superintendents who implement large-scale technology initiatives in a 1:1 or BYOD environment?  
- How does the superintendent connect his or her instructional vision with the implementation of technology within the district to all stakeholders?  
- How do district administrators make sense of the superintendent’s instructional vision for technology? |
| Framing Innovation: The Role of Distributed Leadership in Gaining Acceptance of Large-Scale Technology Initiatives (Turner, 2014) | - Who does a superintendent work with to gain acceptance of large-scale technology initiatives?  
- How do members of leadership teams interact with each other around large-scale technology initiatives?  
- How do members of a leadership team interact with each other around large-scale technology initiatives? |
| Framing Innovation: The Impact of the Superintendent’s Technology Infrastructure Decisions on the Acceptance of Large-Scale Technology Initiatives (Arnold, 2014) | - What factors are considered by superintendents in making decisions about technology infrastructure?  
- What factors are considered by superintendents in making decisions about funding the large-scale technology initiative?  
- How did the technology infrastructure or funding decisions have an impact on the perceived acceptance of the initiative? |
| Framing Innovation: The Impact of the Superintendent’s Attitude and Use of Technology on the Acceptance of Large-Scale Technology Initiatives (Cohen, 2014) | - How do superintendents and other district leaders use technology?  
- What are their attitudes about technology?  
- How do these attitudes influence their framing? |
| Framing Innovation: Do Professional Learning Communities Influence Acceptance of Large-Scale Technology Initiatives? (Nolin, 2014) | - What are the superintendent’s expectations around collaboration?  
- What is the relationship between district expectations for professional collaboration and acceptance of large-scale technology initiatives in school districts? |

A multiple-case study approach uses qualitative measures to build theory by linking “rich qualitative evidence to mainstream deductive research” (Eisenhardt & Graebner, 2007, p. 25). The rich evidence gathered are “individual cases [that] share a common characteristic or condition...[and] the more cases included in a study, and the greater variation across the cases, the more compelling an interpretation is likely to be”
(Merriam, 2009, p. 49). Thus, we were able to engage in cross-case analysis, drawing conclusions and generalizations based on how patterns held up or failed to hold up (Yin, 2009). For this reason, a multiple-case study on the workings of superintendents was necessary because little research exists describing how such leaders implement technology initiatives in their districts. Our study analyzed this unique time in implementation history—a period of potential interest to others engaged in or considering large-scale technology implementations.

Having detailed rationale for using the multiple-case study approach, the remainder of the chapter discusses the data collected, how the data was analyzed, and how we ensured the validity of the research. In what follows, we provide descriptive information about each of the study districts.

**Study Districts**

One individual state was chosen to provide a research site for two reasons: the state mandates a coordinated set of curriculum frameworks but large-scale technology initiatives remain locally controlled. Further, in the town structure of school governance, policies are made at the local level so that superintendents may champion large-scale technology initiatives, making district level leadership ideal for examination.

Districts were targeted in a manner that was purposive and criterion-based while seeking maximal variation within our district sampling. Researchers employed a criterion-based sampling approach (Creswell, 2011). Through this sampling method, participants were chosen using a predetermined list of potential characteristics. This selection process supported the building of theoretical insight using interview data (Eisenhardt & Graebner, 2007) and allowed analysis using the specific theoretical lens of
frame theory (Benford & Snow, 2000; Snow et al, 1986). Specifically, we sought to gather insights about superintendents and leadership teams who implement 1:1 device programs through the theoretical lens of frame theory. Maximal variation sampling was used as described by Creswell (2007), to the extent possible, within this theoretical sample, resulting in varied types of technology implementations at varying grade levels within the systems.

Five small and mid-sized Level 1 or Level 2 school districts implementing large-scale technology initiatives were selected for our study⁴. In the state, 6% of public schools carry no accountability level, 2% are Level 4 schools, 15% are Level 3 schools, 54% are Level 2 schools and 23% are Level 1 schools. Level 3, 4 or 5 status schools, according to the Department of Elementary and Secondary Education, require intensive, mandatory state oversight, intervention, and restructuring (Department of Elementary and Secondary Education, 2012) and, therefore, were not prioritized for this study as such sites may have introduced undue complications to the study of the technology initiative. However, three months after we concluded our interviews in the district, the Madison School District dropped from Level 2 to a Level 3 system; because one of its elementary schools became Level 3, the state designates the entire district as such. This status change did not impact our study because notice of this status and its pending state interventions occurred after the conclusion of our research in the district.

Small and medium-sized districts were prioritized because of the desire to capture a more comprehensive examination of the role of central office leaders at the local level.

⁴ The state’s Department of Elementary and Secondary Education (DESE) ranks all public schools on a performance rating of 1-5. Level 1 schools demonstrate the highest achievement and level 5 districts are the lowest performing. Level 4 and 5 districts receive state-mandated and controlled involvement.
While many studies of central office leadership exist, the majority of studies describe large and urban systems (Hightower, 2002; Honig, 2003; Coburn, Bae, & Turner, 2008; Coburn, Toure & Yamashita, 2009; Coburn & Stein 2010; Honig & Venkateswaran, 2012); no studies, to our knowledge, examine the roles of central office staff in smaller districts. It is theorized that smaller districts employ central office staff who may be required to play more or varied leadership roles in systems; indeed, in these smaller districts, central office staff demonstrated more discretion and power to implement technology leadership decisions, thus making this study that much more descriptive of leadership actions.

At the time of this study, 30 school districts in the state contained large-scale technology initiatives, constituting 13.6% of the state’s total school districts. These districts were identified through an informal email survey of member districts in the state’s secondary administrator’s association, a large, powerful, and comprehensive professional association in the state. From those 30 school districts, 12 met size and accountability designation criteria. From that sample, sites were chosen based on the following criteria:

- Superintendent must have been a leader in a targeted school system implementing a large-scale technology initiative for the past two years.
- Superintendent must have been a leader in the system at the inception of district’s large-scale initiative implementation (on the ground in schools).
- Superintendent was willing to participate in the larger study.

Superintendents were contacted by phone; all superintendents contacted agreed to participate in the study.
The districts chosen and relevant criteria for inclusion in the study are detailed in Table 2. This table recounts district size, accountability level, the grade levels into which the large-scale technology initiative was implemented, the type of technology implementation, the size of the technology leadership team identified as responsible for implementing the technology initiative, and the approximate number of students involved in the initiative. The type of technology implementation included: district-provided device 1:1 models of technology deployment (DPD), district-sponsored lease-to-own 1:1 models (LTO), a bring-your-own-device model (BYOD) and a blended model combining LTO and BYOD.

Table 2.

*Description of Study School Systems*

<table>
<thead>
<tr>
<th>System</th>
<th>Accountability designation</th>
<th>System size in number of students</th>
<th>Type of technology implementation</th>
<th>Grade level of technology implementation</th>
<th>Size of technology leadership team</th>
<th>Approx. # of students involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams</td>
<td>Level 2</td>
<td>3600</td>
<td>District Provided iPads</td>
<td>Grades 1, 4-12</td>
<td>4</td>
<td>2700</td>
</tr>
<tr>
<td>Jefferson</td>
<td>Level 2</td>
<td>2900</td>
<td>District Provided iPads</td>
<td>Grades 9-12</td>
<td>3</td>
<td>770</td>
</tr>
<tr>
<td>Madison</td>
<td>Level 3</td>
<td>1000</td>
<td>Blended Design of DPD carts, Lease-to-Own and Bring Your Own Device</td>
<td>All grades (parent purchase dependent, carts at all schools)</td>
<td>5</td>
<td>990</td>
</tr>
<tr>
<td>Monroe</td>
<td>Level 2</td>
<td>2700</td>
<td>District Provided Mac Laptops</td>
<td>Grades 6-12</td>
<td>3</td>
<td>1500</td>
</tr>
<tr>
<td>Washington</td>
<td>Level 1</td>
<td>4400</td>
<td>Bring Your Own Device</td>
<td>Grades 6-12 (parent purchase dependent, carts at all schools)</td>
<td>8</td>
<td>1200-2000</td>
</tr>
</tbody>
</table>
Washington School District

Washington School District is in a suburban community outside of a major United States metropolitan city. Based upon the state’s school district accountability system, Washington is considered a Level 1 school district. In the fall of 2011, the superintendent, Brody, and members of his technology leadership team began to plan for an initiative to allow students in the 6-12th grades to bring their own electronic devices to school. The members of the technology leadership team included principals, a network administrator, and school technology integration specialists. Pseudonyms for the participants of the technology leadership team are described in Table 3. In January 2012, Washington began their large-scale technology initiative. This program, sometimes referred to as Bring Your Own Device (BYOD), allowed students to use their personally owned devices in their classrooms and utilize the district wireless Internet connection. Students and teachers in the two middle schools and one high school participate in the initiative. The principal and building technology integration specialist work with teachers to integrate technology within the classroom. According to the district’s network administrator, in this district with 4400 total students, approximately 53% of them participate in the technology initiative—connecting their personal wireless devices to the district’s wireless network.

Adams School District

The Adams School District is in a suburban community outside a major metropolitan area and, based upon the state’s school district accountability system, is considered a Level 2 school district. In the spring of 2011, the superintendent, Norman, and members of his technology leadership team used money allocated from the district
budget to purchase tablets for all students at the district’s single high school. The members of the technology leadership team included the high school principal, the technology director, and instructional technology director. Pseudonyms for the participants on the technology leadership team are described in Table 3. Since the initial implementation in 2011, Adams School District has purchased more devices at the elementary and middle school levels with the goal that all students and teachers will have access to technology devices. Additionally, Paul, the high school principal, has moved into a central office position. Working with the high school principal, the technology director and instructional technology director have incorporated several strategies to provide professional development as well as communicate with the larger community, including a large focus on use of social media.

**Jefferson School District**

The Jefferson School District is in an exurban community between a major metropolitan city and a large city and, based upon the state’s school district accountability system, is considered a Level 2 school district. In the summer of 2012, new superintendent, David, and members of his technology leadership team, purchased iPads for high school students through money allocated through the high school new building project. Discretionary funds that accompanied the building project were allocated for device purchase. The members of the technology leadership team included the high school principal and the assistant high school principal. Since that time a technology director has been hired and contributes to the leadership of this initiative. Pseudonyms for participants on the technology leadership team are described in Table 3. During the final phase of the building project and technology purchase, the assistant
principal created what she referred to as “a vanguard technology team” of teachers to plan for the implementation of the initiative within the classrooms.

**The Madison School District**

The Madison School District is in a rural community comprised of four small towns. Based upon the state’s school district accountability system, it was considered a Level 2 school district during the time of the interviews. Since that time the district was identified as a Level 3 district. Around 2003, Bob, the superintendent, and Brett, the technology director, started an initiative to provide students technology throughout the district. This initiative has included the district using grant money to purchase technology; using money from a new building project, which consolidated four elementary schools; and creating a non-profit organization, which created a lease-to-own device program for parents. The members of the technology leadership team included principals, the technology director, the director for academics as well as the district’s grant writer/public relations director. Since the project’s inception, the district has experienced personnel changes including a change of technology director and the director of academics, who previously served as principal. Additionally, since the beginning of the initiative, Madison has purchased more devices at the elementary and middle school levels with the goal that all students and teachers will have access to technology devices. Pseudonyms for participants on the technology leadership team are described in Table 3.

**The Monroe School District**

The Monroe School District is in a suburban community outside a major metropolitan area and, based upon the state’s school district accountability system, is considered a Level 2 school district. In summer of 2011, Jackson started as
superintendent in Monroe and some planning for the technology initiative had already begun. Jackson’s predecessor, the district technology director, high school principal, and instructional technology specialist worked to conceptualize a program to provide all high school students and teachers with laptops. During Jackson’s first year as superintendent, the team continued to work on the program and the school committee approved funding for the devices; Jackson worked creatively to fund the initiative through operating funds and build understanding within the town around the initiative. In the fall of 2012, the high school began the laptop initiative. Two years later, members of the technology leadership team continue to work with teachers to provide professional development and integrate technology into classroom instruction. Pseudonyms for the participants on the technology leadership team are described in Table 3.
Table 3

*Pseudonyms for Interviewed Members of the Technology Leadership Team*

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Position</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brody</td>
<td>Superintendent</td>
<td>Primary Leader/Key Framer</td>
</tr>
<tr>
<td>Ethan</td>
<td>Former Middle School Principal</td>
<td>Secondary Leader</td>
</tr>
<tr>
<td>Grady</td>
<td>Middle School Principal</td>
<td>Secondary Leader</td>
</tr>
<tr>
<td>John</td>
<td>Network Manager</td>
<td>Secondary Leader</td>
</tr>
<tr>
<td>Rylan</td>
<td>Technology Integration Specialist</td>
<td>Secondary Leader</td>
</tr>
<tr>
<td>Ava</td>
<td>Technology Integration Specialist</td>
<td>Secondary Leader</td>
</tr>
<tr>
<td>Caitlin</td>
<td>Technology Integration Specialist</td>
<td>Secondary Leader</td>
</tr>
<tr>
<td>Grace</td>
<td>Technology Integration Specialist</td>
<td>Secondary Leader</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Position</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norman</td>
<td>Superintendent</td>
<td></td>
</tr>
<tr>
<td>Paul</td>
<td>Former High School Principal</td>
<td>Primary Leader/Key Framer</td>
</tr>
<tr>
<td>Howard</td>
<td>Director of Technology</td>
<td>Secondary Leader</td>
</tr>
<tr>
<td>Jim</td>
<td>Technology Integration Specialist</td>
<td>Secondary Leader</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Position</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>David</td>
<td>Superintendent</td>
<td></td>
</tr>
<tr>
<td>Charles</td>
<td>High School Principal</td>
<td>Secondary Leader</td>
</tr>
<tr>
<td>Grace</td>
<td>High School Assistant Principal</td>
<td>Primary Leader/Key Framer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Position</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bob</td>
<td>Superintendent</td>
<td></td>
</tr>
<tr>
<td>Teagan</td>
<td>Director of Academics</td>
<td>Secondary Leader</td>
</tr>
<tr>
<td>Theresa</td>
<td>Grant Writer</td>
<td>Secondary Leader</td>
</tr>
<tr>
<td>Rose</td>
<td>Elementary Principal</td>
<td>Secondary Leader</td>
</tr>
<tr>
<td>Brett</td>
<td>Former Technology Director</td>
<td>Primary Leader/Key Framer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Position</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jackson</td>
<td>Superintendent</td>
<td></td>
</tr>
<tr>
<td>Meagan</td>
<td>Director of Technology</td>
<td>Primary Leader/Key Framer</td>
</tr>
<tr>
<td>Tim</td>
<td>Former High School Principal</td>
<td>Secondary Leader</td>
</tr>
</tbody>
</table>

Table 3 describes the members that were interviewed for this study, which was the largest method of data collection. As described in the limitations section, some district members of the technology leadership teams were not interviewed. The next section discusses how our study data was collected.
Data Collection

Interviews and document review were the data sources for our study. The identified superintendents (i.e., one per district) from the selected systems were interviewed first. Those individuals named by the superintendent as members of the district’s technology leadership team involved in gaining acceptance of the district’s technology initiative were next interviewed, employing a snowball sampling method. While interviews were the primary source of data, a document review was also conducted. If superintendents or team members mentioned documents that were key to the technology initiative or to gaining acceptance for the initiative, they were aggregated, coded and analyzed using the same system as interview data. This section further explains the data collection process.

Interview Sample

In each of the selected school systems, using a snowball sampling procedure, all individuals named by the superintendent as holding leadership roles within each district’s technology initiative were interviewed. This type of snowball sampling is defined as "a form of purposeful sampling that typically proceeds after a study begins and occurs when the researcher asks participants to recommend other individuals to study" (Creswell, 2011, p. 217). Additionally, this sampling method allowed researchers to describe and understand the leadership team and its implementation dynamic. Table 3 details who was interviewed for this study.

In most cases, these interviews resulted in the team members naming each other as key to the initiative—corroborating the individuals suggested by the superintendent. In all districts, additional people were mentioned in the interviews, but were not
interviewed. In four districts (Washington, Adams, Jefferson and Monroe) these individuals were not mentioned by the superintendent, but were identified as important to the initiative by other leadership team members. We inquired about the importance of the person to the implementation to the superintendent who, in each case, verified that the person was not important to the initiative. Since the purpose of our study was to understand the role of superintendents and technology initiatives, the superintendent’s assessment and vision of the team and initiative dictated that these individuals were not important to the study. In Madison, the superintendent mentioned one technology team member (new Director of Technology) as he described the 2014 state of the technology initiative; however, the individual came into her position several years after the initiative was in place within the district and was not a part of the initial framing and roll-out of the initiative in any way.

**Interview Procedures**

The five researchers collaboratively conducted interviews in the following manner. Between June and November of 2013, the research team, working in pairs, conducted one-hour, in-depth interviews as described by Yin (2009), with the five superintendents and those identified by the superintendent as key to implementation of the technology initiative. The interviewing procedure was piloted with three superintendents who work in school districts with 1:1 initiatives in their districts, but were not included in the formal study.

After the pilot work, our team conducted 23 interviews. An interview guide was used for all interviews (see Appendix E for interview guide and questions), which included notes to the interviewer, including: (a) a protocol for superintendents, (b) a
separate protocol for non-superintendents, (c) follow-up prompts and probes for both types of interviews, and (d) a format for field notes. To further ensure consistency in interviewing, two interviewers attended and took notes during each interview, relying on Seidman (2006) for guidance in interviewing technique. Interviewers were encouraged to ask follow-up questions when confused or lacking understanding of what was said and were asked to explore and ask for more information about areas brought up by the participant in keeping with interview probes related to the larger study and individual spokes of study.

Interviewers maintained the semi-structured interview protocol predetermined by the group and linked to our theoretical framework and spoke areas. The interview guide itself was arranged and guided by the larger study and the individual spokes. Components of frame theory also guided the organization of the interview questions (See Appendix E for interview protocol and guide), seeking to determine if a relationship existed between the topics of individual spokes and the superintendent’s leadership actions relative to the framing of the initiative to gain acceptance in the community.

**Documents**

Document review of district strategic plans occurred as a way to validate information obtained in the interviews, but were not used to create generalizable theory on their own (Yin, 2009). The document review included district web posts/sites, district goals and/or school plans as well as technology planning documents, technology deployment and funding documents. These documents were chosen based on how and whether the superintendent and leadership team discussed the documents as part of their work to design, prepare, implement and communicate the aims of the technology
implementation. District memos, websites, curriculum documents, presentations, and other email or written communication including budget documents were also reviewed to determine leadership actions of the superintendent that may have contributed to acceptance of the technology initiative in the system. A total of twenty documents were mentioned by study participants during interviews and were therefore analyzed. Table 4 describes the documents analyzed for this study.

Table 4

Documents Reviewed by District

<table>
<thead>
<tr>
<th>Adams</th>
<th>Jefferson</th>
<th>Madison</th>
<th>Monroe</th>
<th>Washington</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central office leaders’ blogs (3)</td>
<td>School iPad program implementation documents</td>
<td>School district goals</td>
<td>School district goals</td>
<td>School district goals</td>
</tr>
<tr>
<td>School district goals</td>
<td>School district goals</td>
<td>School district website</td>
<td>School district website</td>
<td>School district website</td>
</tr>
<tr>
<td>School website</td>
<td>School website</td>
<td>Non-profit technology purchase and lease organization details</td>
<td>School website</td>
<td></td>
</tr>
<tr>
<td>Twitter feeds of leadership team members (2)</td>
<td>School website</td>
<td>Syllabi for superintendent’s technology course</td>
<td>Internal newsletters to staff (3)</td>
<td></td>
</tr>
</tbody>
</table>

Data Analysis

Detailed in this section are the specific methods used to analyze the data obtained for this study including how interview data was tracked and organized, and how transcripts were coded. Our thinking was tracked in a variety of methods as we went through a three-step analysis cycle. Miles and Huberman (1994) describe three steps in analyzing data for a multiple-case study approach that were used for this study: (a) early steps in analysis, (b) within-case analysis, and (c) cross-case analysis. Each phase of analysis required the team to code and analyze cases in pairs and then come together for group analysis. Informal research journals, individual analytic memos, and group interim
summaries assisted in this process and are all defined in this section as are code definitions and coding procedures. The three phases of analysis served as a starting point for researcher work, beginning during data collection and unifying the researchers through the coding and analysis phase of working with the data.

**Tracking and Organizing Researcher Thinking**

We used unified methods to track and organize thinking and note taking throughout the study. As noted in the interview guide (Appendix E), we took notes during the interview process as they related to the interview experience itself or to help clarify ideas stemming from the interviews. These notes served as a companion to the oral interviews, focused on further revealing the central phenomena being studied, or illuminated information relative to the individual spokes of inquiry as they arose in the interviews. These notes were the foundation for the manner of tracking and organizing our thinking. This section describes how thinking and note taking was tracked and organized in order to be useful to the analysis process.

**Informal research journals.** As described by Emerson, Fretz & Shaw (1995), researchers should strive to capture their “daily ruminations” from each aspect of their research in the field. To capture these ruminations or jottings and put them into a meaningful context, researchers wrote musings, insights, descriptions and brief summarizing paragraphs in informal research journals as a means to track thinking and aid in interpretation of data. The use of such journals allowed us to remember impressions and insights when case studies were later analyzed and composed.

**Analytic memos.** Each team participant kept a record of any memos, reflections or thoughts that emerged at any time during the entire research, data analysis and
interpretation process. These memos followed the guidance used in Saldana (2009), which suggests that researchers write about the following: (a) How the researcher personally relates to the participant’s phenomenon; (b) the study’s research question; (c) code choices and operational definitions; (d) possible networks, links, connections, overlaps, flows among patterns, categories, themes and concepts; (e) emergent theory; and (f) problems within the unfolding study and future directions for the study.

Saldana also advises that the notes themselves can be useful in later coding and theming processes as they can be coded and categorized for further review. Analytic memos “reveal the researcher’s thinking process about the codes and categories developed thus far,” (Saldana, 2009, p. 157). Additionally, memos, intended for use here, are “somewhat comparable to researcher journal entries or blogs—a place to ‘dump your brain’ about the participants, phenomenon, or process under investigation by thinking and thus writing and thus thinking even more about them” (Saldana, 2009, p. 32). Analytic memos were used to mesh our work and thinking and to inform the writing of interim summaries intended to move analysis toward agreed upon findings.

**Interim summaries.** The creation of interim summaries described by Miles & Huberman (1994) took place one-third of the way through analysis. The summaries were shared among our team as well as with our dissertation advisor (see Appendix F for interim summary format). The process of summary writing and sharing was designed to demonstrate missing pieces in the research and to begin to address and identify emerging patterns. Interim summaries were an opportunity for sensemaking within the data throughout the data collection process. Themes from the data were documented in the summaries and both connect and utilize the writings found in the analytic memos written.
immediately after time in the field. Deeper coding and theming (Saldana, 2009) of the
data occurred at this stage and was taken on again in the cross-case analysis. Themes
emerged relative to the aims of the larger study and its sub-questions in relation to the
researchers’ individual spokes of inquiry.

Coding

We employed a collaborative coding process throughout the study (Saldana, 2009). The team practiced the coding and analysis procedure detailed in the next sections
using the pilot interview transcript data and then used the exact same process to code the
actual interview transcripts. This section demonstrates how study analysis and coding
worked together to deepen and sharpen our understanding and serve as an overview of
the component parts of coding employed for analysis.

A “code” in a qualitative inquiry is a word or short phrase that “symbolically
assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion
of language-based or visual data” (Saldana, 2009, p. 3). In this study, codes were
markers for the presence of leadership actions, framing activity, and acceptance of the
technology initiative. In the related individual spokes of this research, codes represented
our individual research interests and how they related to framing actions by the
superintendent, allowing the studies to work together to provide a frame theory analysis
of leadership through five lenses. This section details coding procedures for the larger
study; individual studies detail tailored coding and analysis procedures (see Methods
sections of Chapter 5 submitted by each researcher).

A “start list,” or provisional set of codes, is a list of letter codes used to symbolize
ideas around which the research team wants to unearth further thinking. The codes used
in this study were tested with the pilot interviews and were then revised and refined as the study progressed and ideas and concepts evolved for the research team (Miles & Huberman, 1994). Frame theory components guided the provisional “start list” procedures and served to anchor the study by revealing descriptions of certain leadership actions and ways in which superintendents framed large-scale technology initiatives. Sub codes were added after initial coding had been conducted and analysis of the data had begun. Table 5 (on the next page) indicates how the prognostic, diagnostic and collective action frames were coded relative to leadership actions in a system; sub codes were added one-third through the coding of superintendent transcripts based on discernible patterns from initial coding and were further refined with sub or “child” codes.

We employed a collaborative coding and analysis process using the shared interview transcripts. This coding process required each researcher to take a copy of a single interview transcript and apply agreed-upon provisional codes (Table 5). In a second reading of the transcripts, the researchers then collaboratively developed new codes based on his/her individual transcript with the aims of the larger study in mind. Then, with newly generated codes, we created agreed-upon code definitions in a code dictionary. This process allowed for greater alignment and unity in coding across our research team.
Table 5  
*Initial Set of Provisional Codes and Revised Sub Codes*

<table>
<thead>
<tr>
<th>Description</th>
<th>Broad Code</th>
<th>Sub Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core framing tasks</td>
<td>Framing Orientation</td>
<td>D - Diagnostic Framing</td>
</tr>
<tr>
<td></td>
<td>(FO)</td>
<td>P - Prognostic Framing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M - Motivational Framing</td>
</tr>
<tr>
<td>Resonance</td>
<td>Resonance (RE)</td>
<td>CL - Connection to Learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IC - Individual Credibility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EI - Empirical Credibility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NF - Narrative Fidelity</td>
</tr>
<tr>
<td>Strategic processes</td>
<td>Strategic Processes</td>
<td>PDF - Professional Development (formal)</td>
</tr>
<tr>
<td></td>
<td>(SP)</td>
<td>PDI - Professional Development (informal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PM - Political Maneuvering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PILOT - Piloting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LOG – Logistics Planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PR - Public Relations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ES - Equipment Selection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RES - Research</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KP - Key Players</td>
</tr>
<tr>
<td></td>
<td></td>
<td>USE - Expectations for technology use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Staff - Staffing</td>
</tr>
<tr>
<td>Constraints</td>
<td>Constraints (CO)</td>
<td>P - Political Constraints</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S - Staffing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F - Financial Constraints</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C - Cultural Constraints</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T - Time and/or Competing Interests</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L - Leadership</td>
</tr>
</tbody>
</table>

Interview data was then collaboratively re-coded with newly refined and agreed upon codes; this process was practiced until a satisfactory degree of “inter-coder agreement or interpretive convergence” was achieved (Saldana, 2009, p. 27). Our team sought 85% convergence as an informal measure of skill and unity before solidifying codes and procedures. After that process, the group created a coding manual with the agreed upon definitions and example quotes for our use in coding all subsequent data. The dictionary was updated, as necessary, throughout the study and analysis process. See
individual spoke methodologies for where individual researcher practice picks up from the coding and analysis of the data sets described here.

In the early steps in analysis phase we examined the interview data while the interview occurred, and, thereafter, applied our provisional start-list codes (Table 5). After the first reading/analysis, new codes (initial coding) pertaining to the framing actions of the superintendent with his leadership team emerged and required integration, reorganization and creation of sub or “child” codes within our starting codes (also detailed in Table 5).

Throughout the analysis phase, the processes of both coding and analysis were fluid, iterative, and recursive. Therefore, analysis occurred simultaneously with coding procedures and informed next steps in processing the study’s collected data. Researchers revisited the data to write, rewrite and rethink findings as the data and codes allowed for new insights. Specific procedures to guide this process for both coding and analysis are defined below.

As noted in previous descriptions of frame theory, it was theorized that frame theory would assist in analysis in this study of superintendents and how they gain acceptance for large-scale technology initiatives. Frame theory served as a lens to view and describe the manner in which superintendents and their leadership teams worked to identify problems in a system, propose and develop solutions to those problems, and move others to collective action to solve them. In the case of this study, it also included use of different leadership actions to frame how technology was used in the district to both solve problems and mobilize communities to support learning in new ways.
The new codes, once applied, allowed our team to detect patterns within and across cases. Identifying patterns emergent from the codes was used to: (a) search for explanations and causes in the data, (b) examine social networks and patterns of human relationships, (c) form theoretical constructs and processes, and (d) unearth development of major themes from the collected data (Miles & Huberman, 1994, p. 69). Determining the code patterns helped to organize the larger body of data. The pattern of codes then became a “stimulus to develop a statement that describes a major theme, a pattern of actions, a network of interrelationships, or a theoretical construct from the data” (Saldana, 2009, p. 154). Categories emerged for analysis and probing/connecting to other ideas. Once larger study patterns were identified, the group conducted a data meeting and crafted a second interim summary, again, theming the data based on new ideas and patterns. Thereafter, our team worked individually to code for constructs for individual spokes of research using codes specific to researcher interest areas (see Chapter 5 for how individual research extends the larger study). Each researcher then conducted within- and cross- case analysis relative to his/her individual research spokes.

**Developing and Analyzing Cases**

This study employs early analysis, within-case analysis, and cross-case analysis of collaboratively and individually coded data. From the collaboratively coded data, themes emerged that allowed for the description of leadership that helped to gain acceptance for large-scale technology implementation in school districts. Theming of the data first occurred for the study as a whole and also included researchers moving to individualized areas of research. As detailed earlier, themes were developed and refined throughout the coding process. Provisional codes were reviewed and reworked as patterns emerged.
from the transcripts. Researchers identified broad emerging categories of ideas from the early coding and created more detailed and descriptive codes. The team then developed phrases that captured the leadership actions of the superintendent and his team. Saldana calls this “process coding” and indicates that this type of coding demands a sifting of the data and codes to date to create phrases (Saldana, 2009, p. 77). This process allowed researchers to describe the central phenomena and answer the research questions relative to the theoretical framework (Saldana). Examples of such phrases included “engaging in strategic processes,” and “contended with constraints.” These phrases eventually emerged as shortened descriptors of key findings from the study.

As code patterns within and across cases began to emerge from the transcripts, researchers recognized the need to create more detailed and descriptive codes to describe these broad pattern areas. For example, the area of “strategic processes” was repeatedly coded and it became clear that the strategic processes code area could be broken down into many sub code areas such as “professional development,” “equipment selection,” “key players,” and “piloting.”

It was theorized that within all phases of coding, a potential link between superintendent actions and frame theory might exist. In seeking to match superintendent actions with core frames, we identified what frame theorists call degree of resonance (Snow et al., 1986; Benford & Snow, 2000) within the technology initiative. Several common actions taken by superintendents to frame the initiative emerged from this study; these actions are described as findings in Chapter 4. However, some actions created more resonance within the initiative. During within-case analysis, coding was examined, even in the earliest stages, to reveal that the frequency of codes indicated
which superintendent leadership areas/activities were most frequently employed or were identified as important by interviewees. Certain codes were identified that matched more frequently to prognostic and/or collective action framing that also brought the greatest amount of “resonance” to interviewees’ understanding of the technology initiative. For example, Norman, the Adams superintendent, crafted a prognostic frame that likened 1:1 technology implementation to use of electricity or other utilities in the district. All interviewees in his district described Norman’s way of framing the initiative as a moment where the technology initiative gained momentum or where they gained understanding of the importance, logic, and power of the movement. Resonance moments like this one and others were coded for (a) the superintendent’s action, i.e. “strategic process”; (b) how the superintendent framed them, i.e. “technology is the next utility”; and (c) whether and how participants described the action and framing as “resonating” or building understanding and movement around the initiative. We examined all places of overlap between framing and resonance. The team was able to identify that the more frequent the overlapping coding, the more present the leadership action relative to solving problems or moving to collective action.

These areas of intensity provided greater resonance and yielded insight into the key actions that allow superintendents to gain acceptance for large-scale technology initiatives. Examining patterns of coding and frequency of coding allowed for the development of case analyses. Individual research procedures for analysis are detailed in Chapter 5; the workflow of coding and analysis for both the larger study and individual studies is detailed in Figure 2. This section further explains within-case and cross-case analysis procedures.
Within-Case Analysis

The next step of this process was *within-case analysis*. The purpose of this level of analysis was to allow us to explore, explain and predict areas of interest within each case. By analyzing each case and its coding structure individually, we studied the unique aspects of interaction between superintendents, their leadership team and their districts. With this analysis we were able to make connections between their patterns of interaction and the framing of the district’s technology program as evidenced by the emergent coding patterns in the transcripts and documentation. For example, in the Washington system, all interviewees mentioned the teaching with technology graduate course taught by Superintendent Brody as key to advancing the initiative in the system. This pattern of discussion created a topic around which coding was then more closely examined. Evidence of how acceptance was achieved relative to the superintendent’s framing
actions, could, therefore, be described within each case as a result of tracking these
descriptions across participant transcripts within each district.

**Cross-Case Analysis**

Cross-case analysis allowed the researcher team to explore and describe
connections across the cases and coding patterns linking all of the transcripts/school sites.
Through this analysis, we were able to make generalizations across five cases about how
the interactions between superintendents and their leadership teams influenced the
acceptance of large-scale technology initiatives in a manner that was more generalizable
for practitioners. For example, as noted in the prior example about the Washington
district and the superintendent teaching a course identified as key to moving the initiative
forward, this same professional development trend was noted in three other study
districts. The possible resonance of this superintendent action was noted after the strong
impact this action had within the Washington district, but then was further identified in
other districts—picking up the pattern first revealed in Washington. Informal research
journals, interim summaries, and the researchers’ analytic memos generated throughout
the early and within-case analysis/coding process, proved helpful in conducting and
tracking this kind of analysis, especially when using five researchers in the process.
From this analysis, theory emerged from the larger study and areas for further exploration
in the individual spokes of study were identified.

**Thematic Conceptual Matrix and Graphic Illustration of Findings**

A thematic conceptual matrix described by Eisenhardt (1989) and Miles &
Huberman (1994) is a visual display used in a research study to help link together items
that logically go together and is recommended when a series of research questions are
attached to a study. Given the varied spokes of inquiry linking to the overarching research study question related to acceptance, we sought to create a thematic conceptual matrix to map findings and give them “conceptual coherence,” both within-case and across cases (Miles & Huberman, p. 126-132). Within our multiple-case study, conceptual ideas emerged and researchers had to learn how those ideas connected and would constitute a useful addition to this area of research and practice. The core framing tasks of prognostic, diagnostic and motivational framing were contrasted and mapped relative to strategic processes and constraints that emerged within districts. These ideas were mapped and organized several times throughout the coding and analysis process relative to the leadership actions taken by superintendents during the technology initiative; therein, trends within each case were described and organized. This matrix also allowed for analysis and organization under the areas of frame theory within individual spokes of inquiry across the five cases in a similar fashion. The matrix was then used to create a graphic representation of the research findings to aid in conceptual understanding of research findings (Figure 3). The thematic matrices acted in concert with the memos, journals, and interim summaries to build coherent theory and ensure a core unity of understanding among the researchers.

Limitations/Delimitations and Validity/Reliability of Research

This chapter discussed the methods that were conducted for the larger study as well as for the individual spokes. Limitations, validity and reliability of the methods were considered throughout the process. This final section of methods discussion relies on the advice of Miles & Huberman (1994) relative to the validity and reliability of methods that advises researchers to check for representativeness of the data relative to the phenomena...
by “checking for researcher effects…triangulating across data sources, and deciding which kinds of data are most trustable” (p. 263). This section describes procedures employed to increase validity and reliability of the study and will discuss the limitation and delimitations.

**Limitations and Delimitations**

This study was limited to Level 1 and 2 school systems, as described by the state’s system of leveling of school district performance. This study delimited the inclusion of urban/large systems or Level 3 or 4 status systems, due to potential complicating factors that these systems bring (and possible restructuring/turnaround mandates imposed on them). However, Level 1 and 2 school systems comprise 77% of all of the state’s school systems and the descriptions recorded here should remain applicable to a wide variety of school systems within the state and country. The primary data set was obtained through interviews and is therefore limited; all information was self-reported and reliant upon participants’ memories of the initiative’s start years earlier. Nonetheless, participants relayed common narratives of the implementation and leadership actions of the superintendent.

The study sample may be limited as we purposefully chose only to study successful implementations of large-scale technology initiatives, limiting the generalizability of our results. Finally, the snowball sampling procedure was potentially biased and limited in that some of the key players named as central to the implementation were not always corroborated by other members of the leadership team or the superintendent. Allowing the superintendent to name additional interviewees per the snowball sample methodology meant that those involved may have been more loyal and supportive of the initiative and
superintendent, and therefore, resonance and acceptance may have been overly heightened or described in ways that do not reflect reality across districts. The sample may be, therefore, skewed toward certain circles of individuals in the district. Such a sampling procedure may have limited the data collection’s breadth and failed to identify variability or voices of criticism and dissention that may exist within the initiative and district; however, these limitations did not hamper the descriptions of how superintendent actions and work with identified leadership teams occurred.

**Validity**

This section explains how we worked to ensure internal and external validity in this study. To address potential threats to internal validity, we resisted making premature or incomplete inferences related to naming findings during analysis. For example, throughout the research process, we resisted a tendency to seek to name findings for the larger study that confirmed the hypotheses of our individual studies. Collaborative analysis of data and constant questioning of assumptions in team meetings allowed us to resist the urge to simply identify spoke-related findings; instead, we had to be open to a wider range of findings relative to framing that may or may not have linked to our individual studies. To test the explanations of the findings in the study, we adhered to strategies such as “ruling out spurious relations, checking out rival explanations and replicating findings” (Miles & Huberman, 1994, p. 263). Case analysis meetings among the research team also allowed us to craft both interim summaries and a thematic conceptual map. In conducting such meetings and creating these products, we (a) tested the strength of ideas, (b) reduced the likelihood of jumping too quickly to create causal relationships and (c) reduced the likelihood of jumping to illogical or weak connections.
within and across the data by seeking rival explanations for seemingly causal relationships. Additionally, using the multiple-case study data, we found patterns in cross-case display and tracked those patterns carefully through all of the cases to see if the patterns were repeated, thus increasing validity through data corroboration (p. 273). In each of the study interviews, patterns that emerged in earlier interviews were verified through new interview, coding and analysis procedures, tracked in analytic memos, and discussed and examined by our research group.

The interviews, as well as coding and analysis practices conducted in pairs, helped to address the above noted internal validity threats or biases inherent in one researcher’s ideas or another’s interpretive slant. After each interview, we created individual analytic memos; we wrote these memos as we left the field, later comparing them with the memos of our research teammates, which allowed for the drafting of collaborative interim summaries (Miles & Huberman, 1994). Partner perspectives on interview data and their meaning helped to avoid common research pitfalls such as generalizing from non-representative events and drawing inferences from non-representative processes (p. 264). Further, this strategy, as well as working to avoid generalizing by using outlier cases and seeking contrasting cases within the study sample, (districts with variance in technology initiative or in district features within our selection parameters) worked to strengthen the trustworthiness of the study. Multiple-case study analysis was used to address threats to the external validity of this study (Merriam, 2009) using the strength of five cases instead of telling the story of only one technology implementation.

Due to the study’s relatively small sample size, we are limited by how much we can generalize from this study. Nevertheless, within this limitation, specific actions were
taken to ensure external validity. According to Merriam (2009) external validity relates to how the findings of a study can transfer to other situations. In other words, external validity equates to a study’s potential for generalizability. One way to achieve external validity through case study research is through rich, thick description, which is a strategy that uses “description of the setting and participants of the study, as well as a detailed description of the findings with adequate evidence presented in the form of quotes from participant interviews, field notes, and documents” (Merriam, p. 227). This study’s description of districts and use of quotes and evidence in the findings section served to strengthen validity. A final strategy used to achieve generalizability was the use of Maximum Variation, which was used to carefully select districts to ensure a range between the studies. To ensure maximum variation we studied five districts with distinct characteristics in terms of: (a) device use (tablet, laptop, and mix); (b) initiative (BYOD, 1:1 and hybrid); and (c) demographics (rural, suburban and exurban).

This format of research strengthens the validity and applicability of our findings across varied settings to be more widely useful to educational leaders of all types and all school system demographics. Additionally, among the multiple-cases being studied, outlier, surprise, and negative case evidence was carefully scrutinized for effects on pattern and logic making within the findings, further strengthening the validity of the data.

**Reliability**

Reliability is achieved when the steps of a study are clearly delineated and can be repeated with the same results and when the data emergent from the study “can be buttressed from several independent sources” (Miles & Huberman, 1994, p. 273). To
create such buttressing of the data, five researchers executed this study—gathering data and conducting analysis in collaborative pairs and groups. We employed one unified set of overarching research methods to conduct the study; methods and steps of the research process varied only in the coding and analysis phase of our individual spokes of research in the final phases of analysis. Nonetheless, the steps for executing the larger study and the steps for our individual studies were clear, specific, and followed the same format of execution. A strong evidence and analysis chain of development was kept in the form of our researcher memos, team and individual interim summaries, and the conceptual matrix in order to document study processes as detailed in the within and cross-cases analyses sections of this chapter.

As also noted in Yin (2009), “the most important advantage presented by using multiple sources of evidence is the development of converging lines of inquiry, a process of triangulation and corroboration” (p. 115). Yin goes on to discuss the following four types of triangulation in doing evaluations, as noted in the work of Patton (2002): “(1) of data sources (data triangulation), (2) among different evaluators (investigator triangulation), (3) of perspectives to the same data set (theory triangulation), and (4) of methods (methodological triangulation)” (Yin, 2009, p. 116).

As a five-person research/evaluation team, we used collaborative interviewing and coding to strengthen examination of interview transcripts and documentation from the school district to employ data triangulation. These collaborative actions combined with study design sought to address recommendations by Yin (2009). Collaborative interviewing, coding and analysis sought to provide investigator triangulation. Finally, unified methodology for the overarching study combined with coordinated individual
research coding and analysis actions sought to meet expectations for methodological triangulation.

**Researcher Bias and Assumptions**

Bias and assumptions may exist within this research study in the following ways. We made assumptions that participants were honest and forthright, and the events of technology implementation are as they describe them. Our doctoral student research team is comprised of central office and building-level administrators with professional experience in implementing technology initiatives. A place of potential researcher bias relates to our professional roles as instructional and technology leaders in our own school systems. In some way or another, each of us has led, participated in, or extensively researched the implementation of technology in his/her own respective school systems, and, as such, has had to justify its value in an advocacy stance. Thus, inherent and strong biases based on our roles and experiences relative to technology integration were minimized through collaboration among the research group and interaction with our dissertation committee.

As researchers who work within the fields of educational leadership and technology implementation, the team recognizes that these biases must be minimized in order for the study to be meaningful to educational leaders. As a group of researchers, even with attempts to unify this work and thinking through the use of interview protocols, scripts, provisional coding, collaborative coding and analysis, as well as the iterative process of shared analytic memo and interim-summary writing, this work will never be free from flaws. In addition, Merriam (2009) indicates that it is often thought that a case study is inherently more biased than other types of research because cases are selected
based on researchers’ prior notions. We acknowledge that such bias may exist in case selections, although the overall study design seeks to reduce the impact. In employing this process, we uphold the second and third recommendations for triangulation as described by Yin (2009).

Additionally, we could be biased in two additional areas in this research: (a) by way of an over reliance on frame theory as a theoretical lens and (b) by not entertaining the potential that superintendents do not play a significant role in implementation of technology initiatives in the district. To address these potential biases, data was coded in a manner that allowed for the potential that frame theory might not be an accurate lens through which to analyze the actions of some school systems. Additionally, the multiple-case study approach was employed to limit these biases and allow for multiple leadership dynamics to exist within the study rather than just focusing on one superintendent and leadership team/technology implementation.
Chapter 4

Findings

The overarching study sought to answer the question, “What do superintendents do to gain acceptance for large-scale technology initiatives.” In order to do so, 23 central office and school administrators in five school districts were interviewed for this study. Although superintendents were the main source of data, they also identified technology leadership team members involved in the initiative who were interviewed as well. A review of pertinent documents was also conducted. The technology leadership team members identified by the superintendents held positions such as: principal, assistant principal, technology director, network director, technology integration specialist, and director of academics. As indicated in Table 2 of Chapter 3, the districts had the following types of technology initiatives: (a) BYOD in the Washington School District, (b) district-provided 1:1 iPads in the Adams School District, (c) district-provided 1:1 iPads in the Jefferson School District, (d) blended design in the Madison School District that included a district sponsored lease-to-own, and (e) district-provided 1:1 laptops in the Monroe School District.

In addition to the five thematic studies addressed by the research team, frame theory was applied to the interview data as an aid in exploring how superintendents gain acceptance for these technology initiatives. It was found that a number of the superintendents’ actions were consistent with aspects of frame theory and led to three central findings: (a) superintendents achieved resonance through leadership actions that

5 This chapter was jointly written by the authors listed and reflects the team approach of this project: Erik P. Arnold & Anna P. Nolin with Peter D. Cohen, Gina E. Flanagan, Henry J. Turner
were consistent with prognostic and motivational framing, (b) superintendents considered constraints the initiative might face, and (c) superintendents developed strategic processes to gain acceptance for the initiative. The next section discusses the three findings in detail and the findings are presented in keeping with Bem (2003) in terms of most general to most specific in nature.

**Achieving Resonance**

We found that superintendents achieved resonance through leadership actions that were consistent with prognostic and motivational framing, but not diagnostic framing. Frame theory identifies resonance as a component of framing acceptance relative to social movements (Benford & Snow, 2000). Superintendents hope that everyone understands that initiatives they promote are important for the district. The degree to which superintendents are able to motivate action or change opinions to support the initiative is what frame theorists refer to as resonance (Park, Daly, & Guerra, 2012). The methodology we used to identify points of resonance is described in Chapter 3. As discussed in Chapter 2, Benford and Snow (2000) have identified three core framing tasks in frame theory: diagnostic, prognostic, and motivational framing. Achieving resonance would indicate that the diagnostic, prognostic and motivational framing actions by the superintendents were effective (Benford & Snow, 2000). Analysis of transcript and document data revealed that the superintendents in this study created resonance through their prognostic and motivational framing of the large-scale technology initiative, but only the actions of one superintendent were consistent with diagnostic framing. Each of these framing processes are described below.
Prognostic Framing

Prognostic framing, described in more detail in Chapter 2, works to create a solution to a problem through goals and a structured plan (Coburn, 2006). Accordingly, we analyzed data to uncover the goals of superintendents around large-scale technology initiatives such as: 1:1, BYOD, and Blended initiatives.

Consistent with prognostic framing, we found that all superintendents had goals for what they hoped the technology initiative would achieve. One goal that was common to each district was to provide greater access to mobile technologies. Examples from the Adams and Washington school districts are representative of this goal. In addition to data from interviews, documentation from Adams states, “Students will have a mobile device to use throughout the school day and at home, [and this will] allow for the extension of learning beyond the classroom walls.” The Washington superintendent, Brody, saw the BYOD initiative as providing students and teachers that “just-in-time access to devices,” so teachers no longer had to worry if the computer lab was available or not.

All superintendents believed that if this ubiquitous access to technology was achieved, teaching and learning would improve in the district. Bob, the superintendent from Jefferson, indicated, “a big focus...was on student engagement and higher-order thinking skills, and making that switch from teacher-directed instruction to more student-directed learning.” He argued that “going 1:1 was really about getting ahead of the curve” and he wanted to make sure that “every student has access consistently to very rich

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6 For this study, the following terms will be defined as: (a) all – the characteristic was present in each district, (b) nearly all – the characteristic was present in at least three of the five districts, (c) do not consider or not present – the characteristic was identified in no more than one district.
dynamic materials and curriculum.” Greater access to learning, regardless of whether the students were in school, at home, or anywhere else that had free Wi-Fi access, was a common goal of the large-scale technology initiatives; this is frequently referred to as “learning without walls”. While the actions of superintendents surrounding the technology initiative to develop goals, and a plan for achieving those goals was consistent with prognostic framing, motivational framing was employed by superintendents in order to communicate support for the goals and plans of the large-scale technology initiative.

**Motivational Framing**

Motivational framing is how “the rationale for action is articulated” (Park, et al., 2012, p. 4). We found that communication from the superintendent to his leadership team, the faculty, parents, students, elected officials, and the public was important in building support for the initiative.

In general, superintendents and technology leadership team members built support for the initiative by communicating their goals at parent informational meetings, school committee meetings, town finance committee meetings, faculty meetings, and by meeting with the students. School district websites and blogs were also used to share the plan and their goals, such as making technology ubiquitous in order to increase student engagement and personalizing the learning experience.

This kind of motivational framing was evidenced in several ways. For example, when Brody communicated with stakeholders, he indicated that he wanted “the students to have the ownership of the learning, so that it’s more meaningful to them.” Jackson, the Monroe superintendent, communicated that he did not want computers to simply substitute for pencil and paper. When he viewed the classroom use of technology he
wanted to know: “Is this really engaging kids more? Is this really pushing them so they’re
doing more higher order thinking around it?” The cost of the large-scale technology
initiatives brought more scrutiny from stakeholders in the community. Superintendents
and technology leadership team members worked to reframe the argument. A good
example of this was when Norman, the superintendent from Adams, wanted to get
stakeholders to stop thinking of technology for education as a luxury, but rather as an
expense that is as necessary as textbooks or electricity:

We basically turned the conversation around and said “technology infrastructure
is our fourth utility.” I went through the whole spiel about textbooks and
electricity. We pay $1 million a year in electricity and no one bats an eye. Not
the cost of it, no one at a town meeting cares, it’s just expected that we’ll have
electricity in our buildings.

Norman also made the case that having 1:1 iPads was not a new idea: “We had 1:1 for
fifty years…our 1:1 was previously textbooks.” The ability to make an effective
argument for the large-scale technology initiative was important for the superintendent’s
motivational framing activity. Brett from Madison discussed how he used a similar
analogy when discussing the initiative with stakeholders:

[If I said] “take me to your pencil lab.” “Pencil lab? What’s a pencil lab? It’s
ridiculous.” Well, we look at technology the same way. You don’t always need
the pencil and you don’t always need the laptop, but when it’s there situationally,
you need it.
Communicating goals and arguments such as these, in the multiple forums that were used by superintendents and their team, were leadership actions that were consistent with motivational framing (See Figure 3).

**Diagnostic Framing**

As described in Chapter 2, diagnostic framing focuses on the identification of a problem and assigning blame connected to some injustice (Benford & Snow, 2000). Therefore, we analyzed the data to discover any superintendent actions that were consistent with diagnostic framing.

We found that Bob, the Madison superintendent, was the only superintendent that considered diagnostic framing in his attempt to gain acceptance for the large-scale technology initiative. Bob described the lower socioeconomic status of families in his district as a motivator for their large-scale technology initiative. Bob’s students lacked internet-connected computers and he saw their initiative as being able to close this digital divide. The other four superintendents did not connect their large-scale technology initiatives to any injustice or see the need to assign any blame to justify the initiative.
Superintendents Considered Constraints

When the superintendents planned for implementation of the large-scale technology initiative, nearly all assessed their educational community and considered constraints that might hinder acceptance of the initiative. Consistent with prognostic framing, all superintendents developed solutions to problems via goals and a structured plan for achieving those goals (Bedford & Snow, 2000). The problems were not static, however, and the superintendent’s structured plan was constantly contested and influenced by various constraints. These constraints were often of a financial or political nature. An important early action taken by superintendents was the manner in which they responded to constraints surrounding the large-scale technology initiative. We found that
superintendents considered the following constraints: (a) financial, (b) political, (c) competing interests, and (d) technology support staffing.

**Financial Constraint**

Financial constraints were considered most often (by all superintendents and nearly all technology leadership team members) in planning their initiatives. When districts are proposing large-scale technology initiatives there is usually a correspondingly large price tag that goes with it. A financial constraint may mean that the best decisions regarding the technology initiative might not be possible. If the cost of a 1:1 initiative is determined to be too large, districts will look for other options, such as BYOD. Accordingly, we analyzed data to see what financial constraints superintendents faced and how those constraints may have influenced their decision-making regarding the initiative.

As an example, the Washington School District looked at what a district-provided 1:1 initiative would cost and decided to pursue a BYOD initiative because of their financial constraint. As Brody noted, “We made the conscious choice that there was no way we could do a 1:1 from a financial standpoint, it wasn’t a sustainable solution.” Other technology leadership team members echoed the sentiments of the superintendent. Georgia, a technology integration specialist, stated, “We made it perfectly clear why we’re doing this, number one being financial.” Even though implementing a BYOD program is less costly than a district-provided 1:1 initiative, there are still costs associated with building a robust wireless network that can handle all of the devices. John, the network manager, described the financial constraints they faced building the network: “Because the wireless was so expensive, we literally took four to five years to get that to
where we wanted it at all the schools.” Districts that decide to provide devices to all students face expenses far beyond the cost of building a wireless network.

How much a particular technology device costs is a decision that affects a district’s 1:1 budget. The two districts that decided to purchase iPads for their students did so partially due to financial constraints. David, the superintendent of Jefferson indicated: “We looked at laptops…that was very tempting, but financially we couldn’t afford that so we never really got beyond that point to be honest.” Jim from Adams described their thinking this way:

Would we have done a different device if we could have spent a lot more money? It’s possible. We always talked about a MacBook-type laptop for all students, but that would have been a lot more expensive. Could we have said, “Maybe we’ll do that?” Maybe, if we had more money, but ultimately, we wanted the iPad device. These districts were referring to the cost of Apple laptop computers, which began at $999 (all prices in 2013 dollars), because there were PC based laptops that were comparable to the cost of an iPad ($499). Chromebooks were a more recent laptop product that were even less than the cost of an iPad, but for reasons that will be discussed later these districts had decided they were going to purchase an Apple product. The superintendent from Madison, Bob, described their ability to keep adding new technology and the decision to go with Apple products this way:

You can buy two iPads for the price of a MacBook Pro. We have [also] looked at the total cost of ownership, because you can buy a Dell [laptop] for around $400 compared to $1200 or $1000 for a MacBook Pro, but by the time we add the
software, the infrastructure, the support, and the rest, I think they’re not that far off.

As Bob stated, other costs were considered in addition to the cost of the device. The costs varied by district but included the following: mobile device management software, protective cases, software and apps, extended warranties, and insurance. Some of these costs were passed on to the students. For example, Adams, Jefferson, and Monroe school districts provided devices to students, but informed them that if they wanted to insure the device it would be at their own expense.

Jackson, the Monroe superintendent, had a large financial constraint removed when the town financial committee decided to increase the school operating budget in order to pay for technology purchases. The Monroe district was able to purchase Apple MacBook Air computers for all high school students. Previously, the school district would make capital spending requests of the financial committee for technology infrastructure. Jackson stated that when this change was made,

There was this influx of funds, that we could all at once put towards a lease, which in a different year might have gone towards actually paying for [network] infrastructure. [This] is mostly what the capital money was for, but we were in good shape in that regard. We didn't need to do that…we were able to apply [the money] to this lease. Once it's in your operating budget it's there, where you don't have to ask for it every year. So that stabilized us enough to have [the funds] to pay for the lease of the computers.

Making cuts to other areas of the school budget was another way to overcome financial constraints. In the Adams School District the community placed great value on not
having fees that parents would have to pay related to school. Jim indicated the
importance of this financial constraint:

   The biggest thing that was considered is that we’re a district that doesn’t have fees.
   So we knew right away that we were not going to fund our technology initiative
   with a technology fee. That was kind of off the table from the very beginning,
   which made it more of a challenge for us right from the very beginning --we knew
   that we had to fund this thing entirely.

In order to partially fund their iPad initiative, the Adams School District reallocated
money that was budgeted for new textbooks, decided not to fund a new foreign language
lab, cut the positions of one teacher aide and a permanent sub, and reallocated funds that
were earmarked for printing costs. Paul, the former high school principal, justified the
cutting of the foreign language lab by claiming that due to the 1:1 iPad initiative, “we’re
going to have a language lab in every classroom.” When a district faces financial
constraints that no amount of cutting or reallocating of funds would allow for a district-
provided device 1:1 model to take place, one option is to have the parents pay for the
device.

   The Madison School District came to this conclusion and developed a blended
model to get their students access to more technology. Madison decided to overcome
their financial constraints by creating a non-profit company that was managed by the
superintendent and some of his staff. They developed a lease-to-own model where the
non-profit purchased MacBooks and iPads from Apple and then leased them to parents
who make monthly payments on the device until it is paid off. Bob estimated that
roughly 30-40% of students in grades 7-12 were participating in the lease program.
Students that received free or reduced lunch were able to pay a reduced cost for the lease. Madison supplied carts of iPads and MacBooks in the schools for students that did not participate in the lease program. The district also permitted students to bring their own device in and use the school network. This blended model was not a true 1:1, but as Brett described it:

   We were very entrepreneurial. I would say that differentiated us from a lot of the other programs that I still see today. We did not have much money and so we always had to be entrepreneurial, especially when you have parents investing in your program, you have to be providing value.

Every superintendent faced financial constraints of varying degrees and they made decisions based on those constraints. In addition to financial constraints, nearly all districts faced political constraints that the superintendent had to consider.

**Political Constraint**

When implementing large-scale technology initiatives support may need to be gained from multiple stakeholders. These stakeholders could include school committee, town financial committee, parents, teachers, and the community. For this study, the lack of support (perceived or actual) from any stakeholder was defined as a political constraint. Nearly all school districts in this study described political constraints surrounding their large-scale technology initiative.

The Jefferson district was in the midst of building a new high school. The town had already approved a tax increase to finance the new building project and technology leadership team members did not feel they could ask the community to pay any additional
money for the 1:1 iPad initiative they were considering. Grace, the former high school assistant principal, described the perceived political constraint this way:

The biggest thing was whether or not we could pull it off within the building funds, because politically there was no way we could’ve done it otherwise. If we had to go to parent funding, that would have never flied in this town with all the money people were putting towards a new building.

David, the superintendent, agreed with this sentiment when he was asked if he ever considered asking parents to contribute money to help pay for the iPads:

It was definitely talked about…[but] Jefferson has historically prided itself on not having fees. We do not have an activity or athletic fee. The only fee we have is a bus fee and a parking fee, that’s it, and even those don’t go over too well. Politically, that would have been a tough one. I couldn’t have done it.

The concern over the high cost associated with large-scale technology initiatives was pervasive among the five districts, but districts also faced other types of political constraints.

The Monroe School District faced a greater challenge convincing parents and the community of the merit of the 1:1 laptop initiative than it did funding it. Tim, the former high school principal, described the political constraint the initiative initially faced from teachers:

We needed teacher buy-in first and foremost, and that was successfully achieved by it being a teacher-lead initiative; by going to other schools [to check out their 1:1 programs], getting a feel and talking to other teachers about what impact it has
on their instruction, but there were some who thought, “I'm teaching Math, I don't really need this...” [so] there was that element there.

The Madison School District also faced a political constraint from some of their teachers. As Brett recounted: “We tried to start with the high school teachers. We pitched the idea to them and they said, ‘No way. Ain’t going to happen’.” Due to this opposition from the high school teachers, Madison decided to implement their technology initiative in grades five and six, where the teachers were more open to the initiative.

Overcoming a political constraint from the community was another challenge in the Monroe School District. According to Tim,

With the lease program, it's something like $230k per year. The community had to be convinced this was a good thing for our school and a good thing for the community as a whole. That was tough in some ways, and not so tough in others. There are people who would say: “This is a 'well to do' community. The median cost of a home is around $600 thousand…why are we using school funds to buy computers for kids when people can buy them on their own?” There were other families who frankly had been shielding their kids from technology. “My kid doesn't have a phone, we have one computer in the house and it's in the kitchen so we can monitor it. You’re going to give them this tool and now my parenting is going to be a lot harder.” They needed to be convinced. [At the same time] it was easier because there were a lot of technology folks in town, so at these community meetings those parents would pipe up and say “This is the direction of the future, we need to get our kids ready, this is what college- and career-ready is.” There was a nice balance, but the community needed to be convinced.
The Adams School District faced a similar political constraint from their community and school committee. Howard stated:

“We had numerous fights from town meeting members and so forth, thinking it was a waste of money. The more and more education that we provided to them, the more and more buy-in we got. The first year was a little bit rough to get that approval. After that we've done numerous presentations with students and teachers, for school committee, for Ways and Mean Committee, town meeting members. We've invited all of those committees and regular town residents to visit our schools…and let them do walk-throughs of our buildings to actually see the devices in action.

In addition to financial and political constraints, superintendents that implemented large-scale technology initiatives also considered time and competing interest constraints.

**Competing Interests Constraint**

At the same time that the districts were trying to implement their large-scale technology initiative, the attention of teachers and administrators needed to be spent on other initiatives. These competing interests were locally, as well as state, driven. Nearly all superintendents considered time and competing interest constraints and technology leadership team members in all of the districts identified them as well. As Tim, the former principal from Monroe High School, indicated, competing interests can impact the implementation of a large-scale technology initiative:

If I were to give advice to any other school around initiating a 1:1 project, I would make sure that's the only thing you're doing that year. Not only did we start 1:1, we also started an advisory program. This was the intersection of things we were
talking about and planning for a long time and they just happened to come together in the same year. Then we had the introduction of the new evaluation system that we had to train on last year. So you had three really big things happening. Then we [also] had looming a [regional accrediting association] visit. So there was a lot going on and I think that had a little bit of an impact on the 1:1, or a lot [of an impact].

Jackson, the superintendent of the Monroe School District, expressed his concern over the “deluge of initiatives, most of which are fairly good, but collectively are overwhelming.” Some of these competing interests that Monroe and the other school districts identified were: the state’s new educator evaluation process, the state requirement to identify assessments that will be used to measure the impact teachers have on student learning, the state English language learner requirements, state program reviews, and updating curriculum frameworks, partially due to the adoption of the Common Core State Standards (CCSS). Ethan, a former middle school principal from Washington, expressed a sentiment heard in nearly all districts: “It's definitely had a huge impact on staff. Many of them realize it will lead to a positive place…but it's still a lot on their plates.” In most cases, the appreciation for the strain that these competing initiatives placed on teachers resulted in little more than a sympathetic attitude from technology leadership team members.

When Jackson considered this competing interest constraint and the demands it placed on his educators, he saw his role as “helping teachers and principals to focus their time, energy and resources.” Norman, the superintendent of Adams, decided to limit the

7 CCSS= Common Core State Standards, a new national curriculum implementation as part of Race to the Top.
amount of time he had teachers working on the competing interests because, “First, we'd bore the hell out of people, and second, it's not necessarily what we value.” Norman decided to prioritize professional development time around transforming the classroom through technology integration and improving student engagement, and use only what time was necessary to train the faculty on state initiatives such as the new teacher evaluation system. Charles, the high school principal from the Jefferson School District, recognized the pressure the teachers were under and wanted to make sure that teachers were not presented with any more new initiatives in the second year of the 1:1 iPad initiative: “Curriculum, [regional accrediting association], 1:1, co-teaching, level changes, brand new building – you name it, there was a lot going on. That wears on people and on the faculty, and I fully get it.” All superintendents recognized the strain that competing interests placed on the implementation of the technology initiative, but most superintendents did not have a remedy for this constraint. The last constraint that superintendents considered was with regards to their technology staff.

**Staffing Constraint**

Nearly all superintendents identified the capacity of their existing technology staff to support the large-scale technology initiative as a constraint. Superintendents recognized that the addition of large numbers of mobile devices accessing the school network in their buildings would place demands on their technology staff. Even in a BYOD environment such as in the Washington School District, the superintendent had concerns about the capacity of his technology staff. Brody noted that there would be greater demands on his technology staff, “at the start of the year when students bring in devices, but also to make sure the network is maintained. We had to be sure we had the
staffing, so we put in the budget to have additional staffing.” To try and avoid adding additional staff (technology staff were eventually hired), Norman, the Adams superintendent, was attracted to the iPad because the students could individually manage the devices.

Another way nearly all superintendents addressed the staffing constraint was by utilizing the technology skills of their students. Student help desks were created in the Adams, Jefferson, Madison, and Monroe school districts. As Grace from Jefferson stated, “We used our own kids to expand our tech capacity because we didn’t have it.” Brett from Madison recounted a student help desk story he witnessed:

I'll never forget the day I walked in and there was a seventh grader on the phone with Apple Care saying: "Listen guy, I ran triage on it, I replaced the battery, it can't be fixed here, send me a box, it's coming back." It was a seventh grader. It was just brilliant. It was just absolutely brilliant.

Grady from Washington made it clear that there were really two types of technology staff that districts needed to consider. He indicated that Washington had technology staff that worked on the network and infrastructure side and then they had technology integration specialists that worked closely with teachers to help them understand how to use the technology and how they could develop lessons around the technology. While recognizing the important work that both types of technology staff were responsible for, Grady said, “Do we have enough? The answer is no…on both sides we could use support.” Our third finding related to the actions superintendents took to gain acceptance for the large-scale technology initiative and is discussed in the next section.
Superintendents Developed Strategic Processes

As stated in Chapter 2, strategic processes are components of frame theory. Strategic processes are specific actions regarding the initiative to gain acceptance within the district. Our second finding was that there were several strategic processes that superintendents developed to gain acceptance for large-scale technology initiatives. These processes were developed in two ways. First, they helped to prepare for implementation. Second, they helped to create buy-in.

Preparing for Implementation

All or nearly all superintendents utilized the strategic processes listed below to prepare for the implementation of the large-scale technology initiative. These were large initiatives that commanded significant financial resources; the number of actions taken by superintendents indicated their understanding of the complexity of the initiative. The order of the strategic processes described below was chosen for reasons of style and it is not our intent to imply a particular order was used by the superintendents.

Conduct research and select equipment. The term “research” is used to describe the investigative practice of learning from other 1:1 or BYOD school districts, reading relevant articles, and learning from product specialists or sales representatives from technology infrastructure companies. Conducting research and selecting equipment were very much tied together. District leadership conducted investigations into what type of equipment should be selected. All of the superintendents described researching other school districts with 1:1 initiatives in varying degrees of implementation. Varying by district, superintendents and technology leadership team members visited 1:1 schools in Iowa, Maine, and Massachusetts to learn from their experiences. Jackson, the Monroe
superintendent, decided to forego a BYOD model based partially on what he saw at a 1:1 school in Maine:

I really saw when I went up to Maine how seamless the whole thing is, when everybody has the same [device]…the teacher didn't have to waste any time at all in terms of spending precious minutes [orienting the] kids in the beginning of the class for instance.

Brody from Washington stated they “did a lot of research in what successful BYOD programs were, what were the challenges and obstacles, so that we could try to eliminate as many of those as possible.” Grady from Washington concurred with the superintendent:

There was a significant amount of time, effort, and research put into what could be a good fit for our community. District leaders went to presentations on 1:1, to other schools, and talked to administrators and other people in our roles to ask, “How did you do it? What were your challenges? What worked well for you?”

We tried to match our challenges to theirs.

After conducting research, David, the superintendent of the Jefferson School District, decided that he was going to make it a priority to build a robust wireless network: “That was one thing that I heard loud and clear from superintendents. Do not skimp on the infrastructure…don’t build it for 3,000 devices, build it for 20,000 devices.”

Some of the research conducted by Tim from Monroe shaped his opinion on what type of device to purchase: “For me, it was wanting a quality machine – we've heard disaster stories when people have bought certain other things, netbooks – we [also]
wanted to make sure it was PARCC-ready.” Meagan, the director of technology from Monroe, recalled that they “chose the MacBook Air because of the solid-state drive, we thought that would be more durable, less moving parts.” Charles from Jefferson indicated that from “conversations and visiting other places, we felt the iPad was more user-friendly. The flexibility and the apps you could use.” Norman, the superintendent of the Adams School District, had concerns about the workload his existing technology staff could handle and felt that managing iPads would create less demands on their time than other devices would. “I wanted them [the devices] individually managed. Long battery life because we have an older school without a lot of outlets. We thought with a laptop we’d get three to four hours out of them and then have problems.” The Adams Technology Plan further stated why they selected the iPad as their 1:1 device:

After extensive research, discussion, and community input, Adams High School believes that the iPad currently provides students and teachers with the best option for creating a 1:1 school. The iPads will be a source of student engagement and instruction with the use of applications, web-based software, and eBooks.

In addition to conducting research and selecting equipment, identifying key players that would help lead the large-scale technology initiative and help gain acceptance for it, was another strategic process that all superintendents carried out.

Identify key players. Each superintendent identified district technology leadership team members that played important roles in the planning and implementation of the large-scale technology initiative. These individuals would be considered key

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8 PARCC = Partnership for Assessment of Readiness for College and Careers – includes online assessments to measure student progress with regards to the Common Core State Standards; not a required assessment at the time of this study.
players, but nearly all superintendents identified certain teachers, students, and parents that were also key players in the implementation of the initiative. The superintendent of Washington, Brody, acknowledged the importance of the key players in his district: “Getting the principals on board was critical, [but] the tech integration specialists were the ones that were going to help support these teachers…they would go into these pilot classrooms, and work with the teachers.” Additionally, Tim, the former high school principal from Monroe, described the important role some of the teachers played:

It was always framed as a teacher initiative. There were enough teachers on campus who were interested in and committed to increasing the amount of technology for themselves and students that I didn't really have to push all that hard. It was a matter of getting the group together and having them be the mouthpiece for the direction the school was headed.

Key players were asked to promote the initiative to the community, school board, or the town finance committee. Jackson, the Monroe superintendent, used some of his key players in this way. Tim indicated the importance of the teachers, student and parents:

There were a handful of teachers who were just phenomenal. We had faculty meetings, and with something this big, my voice better not have been the loudest…[it was important to have] a representative body [of teachers] saying “this is going to work for us”. We had students who were also involved and presented at the community meeting, so their voices were a part of it. We had parents as well. When we went to [another 1:1 school] to visit, there were parents that came, and at least one of them wasn't on board [with the 1:1 laptop initiative].
It was good [to have the parent that did not support the initiative come, because] at least [the parent could now make a more] informed decision.

The Washington School District had a group of “lead teachers” that would meet monthly with the technology integration specialists to help move the BYOD initiative forward. According to Ava: “we would all share apps we were using, things that were successes, things that weren't going so well, ways to improve, ways to expand, how to get more teachers and students on board, etc.” The Adams School District created a 1:1 parent committee that had a similar goal. Jim, the technology integration specialist, described how the committee would talk about matters such as what types of protective cases were best and iPad insurance options. Jim also indicated that they “involved the parents and community members in the conversation from the very beginning.” Key players were often involved in piloting new technology as well.

**Pilot devices.** Piloting is defined as schools conducting classroom trials of mobile devices. Piloting was typically conducted for the following reasons: testing devices to see if they should purchase more of them, identify potential technical problems, give teachers experience creating and conducting lessons that integrate the technology, and to create momentum for the initiative among students and teachers. Each superintendent piloted mobile devices as a strategic process in their effort to gain acceptance for the large-scale technology initiative. Rylan, a technology integration specialist from Washington, described how they used their key players for piloting:

The idea is if you put technology in the hands of the right people, it's just going to spread and grow. They targeted willing people, a few teachers, years ago. They were given room to play. There was no breathing down their backs; they could
take it at their own pace to incorporate it into their curriculum and classroom. I've seen that spread throughout teams, spread through the same grade level, and then different grade levels. It's almost like a virus that's gone around.

All districts piloted various devices to test them before making a final purchase for the 1:1 initiative. The Adams district initially bought a couple of mobile iPad carts that teachers could sign-out for classroom use. The iPads were used constantly and the success of the pilot helped them decide on the iPad for their 1:1 initiative. Before the Monroe School District chose MacBook Airs as their device they piloted PC laptop carts and netbooks. Chromebooks were one of the options investigated because of their lower cost. Rose from Madison described their experience piloting Chromebooks:

We piloted the Chromebooks in one room specifically just to monitor how often they need to be fixed, how often there are issues, and that teacher has been like, “Please... just take them away...” Even though they're cheaper and we could've put more of them in place rather than an Apple product, we had way more issues with them than with Macs.

In contrast, while the Adams School District was 1:1 with the iPad they were still piloting new technologies such as the Chromebook and had a more positive experience than Madison indicated. The superintendent, Norman, stated that each school in the district had at least one classroom set and they were seeing their use “grow in popularity.” When districts were introducing new technology, whether it was through piloting or a full-scale implementation, all superintendents recognized the importance of professional development for the teachers that were expected to use the technology in the classroom.
**Conduct professional development.** The superintendents in each of the five study districts supported professional development in the use of classroom technology. The professional development occurred before the large-scale technology initiative began and has continued after implementation. The value that the districts placed on professional development was evident in the interviews we conducted as well as in the documents we reviewed. The technology plan for the Adams School District states:

All Adams Public Schools teachers will receive extensive training and ongoing support to help them learn about technology and prepare students for life in a digital world. Technology professional development is administered throughout the school year and is led by both Instructional Technology staff and academic area teachers. Adams Public Schools is very proud of the staff in Adams and its commitment to technology in our schools. We are also very excited by the growing number of teachers leading professional development sessions for their peers.

Other districts had similar statements in their technology plans. All districts had limits on the amount of contractual time that was available for professional development. To overcome these contractual limitations, as well as the reality that time must be saved for professional development around competing interests, each district offered their educators optional or voluntary technology professional development that was held outside of contractual time. The most striking example of this was in the Washington School District where the superintendent taught a course on improving teaching and learning. Encouraging teachers to integrate technology into their lessons was a major focus of the course. Teachers signed up for the class and could earn six graduate credits.
that were available through a local university. Teachers who successfully completed the course were provided with classroom technologies such as iPads or laptops as an incentive. Brett from the Madison School District did something similar. Brett became an adjunct professor for a local university; teachers could take his course in educational technology for credit. At Adams the technology staff made themselves available several times a month for technology professional development sessions that were titled, “How do I do that?” or, “Open Support”. Howard indicated that they would have “anywhere from three teachers to fifty teachers” in attendance at these voluntary sessions. The Jefferson School District offered “Technology Thursdays” and “Wednesday Walkthroughs” as optional professional development for their teachers. The Thursday sessions had an open agenda, and the Wednesday sessions were for teachers to observe how their colleagues were integrating technology into the classroom.

All superintendents offered professional development related to their large-scale technology initiative during contractual times as well. Professional development began in Jefferson six months before the students were given devices and two years before in Monroe. Grace from Jefferson described the initial training they offered their teachers:

We had a couple days' training by Apple, and we broke it up so you had advanced users, intermediate, and beginners. Everyone got the self-selected level of training they needed. Those in the advanced group, many were vanguard teachers [key players], and many took the lead in offering trainings to other teachers.

As reported above, in addition to hiring outside trainers, nearly all districts used their own staff to train their colleagues. The largest example of this is the Adams School District three-day edcamp that is held before classes begin each September. According to the
superintendent, Norman, “There will be sessions certain individuals have to go to, but there’s always choice.” Over the three-day span approximately one hundred sessions are offered and nearly seventy percent are related to technology. Whether the technology professional development is during contractual time or optional, the superintendent action of making professional development opportunities available to teachers is a strategic process geared towards gaining acceptance for the large-scale technology initiative.

**Assess the capacity of the technology staff.** An additional strategic process that superintendents took to prepare for the implementation of the initiative was to assess the capacity of the technology staff. The capacity of the technology staff was defined as the ability of the technology staff to fulfill any additional responsibilities that would come if a large-scale technology initiative were implemented. This was considered a strategic process when the superintendent used the results of the assessment to add technology staff if needed to ensure that teachers and students would be properly supported for the large-scale technology initiative. As a result of this assessment, the Washington, Jefferson, and Monroe districts added at least one person to assist with the technology initiative; Adams and Madison added technology staff in their second year of the initiative. Norman, the Adams superintendent, tried to avoid hiring additional technology staff because of the cost:

> In the old world, you added about 10% on for every person you [hired] for health and benefits, but we're up to about 40% now. I get less grief adding iPads than I did adding like, a custodian, because they know that's a sustained cost over time and [they] know that health care is going to kill us.
Despite this desire, Norman hired an additional technology staff person to support the initiative in the second year. Jim described the staffing issue:

Well, there were only two members of the IT staff at the time we first started; now there are three. We were concerned. We talked a lot about the fact of putting 1100 new devices in one school; how would we ever be able to support that? Realistically, two people -- it wasn’t going to be enough.

As part of this assessment of the capacity of their technology staff, four of the five districts added a student help desk, also known as a Genius Bar, in order to utilize the knowledge and skills of their students to help with technical support issues for students and teachers. According to Tim from Monroe, they created their student-run Genius Bar “to cover the issues kids might encounter, like not being able to print, or creating presentations. The kids were trained and in the process of becoming Apple certified.”

The Jefferson School District created a student help desk, but as Charles described, they also added an additional technology support person:

The big piece was we wanted to make sure we had enough staff to help out – and we're still looking to add more staff, especially as we become a bigger building. They definitely had a role in it. The staffing is a big piece. You can have all the technology you want, but you need those people. We learned that from [another 1:1 school we visited]. Their tech people were there all the time and they communicated very well.

In addition to strategic processes to prepare for implementation of the initiative, superintendents made efforts to create buy-in for the initiative from the various stakeholders.
Create Buy-In

Not surprisingly, superintendents would like to see any new initiative they support to be successful. Creating buy-in amongst the stakeholders is one way to help achieve that success. The superintendents in our study identified that the main stakeholders they wanted to create buy-in with were the teachers, principals, school committee, parents, community, and the students. Of these multiple stakeholders, teachers were the main focus of the effort to create buy-in. The two strategic processes that superintendents took to create buy-in were communicating expectations for use (for teachers and students) and public relations efforts.

**Expectations for use.** All superintendents communicated their expectations for how the technology would be integrated in the classroom. This was communicated through speech and documents at school committee meetings, public forums, to teachers, to students, and through modeling. The expectations for use that was communicated varied somewhat between the school districts. Nearly all superintendents indicated they saw technology’s role in the classroom as a tool, like many others available to teachers, on an “as needed” basis and not a mandatory one. These comments from Norman were representative of the group:

We have some teachers here who think technology is the bane of existence and they had kids in inkwells and calligraphy is a lost art – but they're still here and we’ve got to work with them. We say it all the time – a [bad] lesson with an iPad is a [bad] lesson. Again, [we] focus on engaging high-quality instruction, [it] has nothing to do with the device. You can lecture - as long as it's engaging, that's
great. We look for engagement and we prioritize engagement. Technology is one vehicle towards that, but may not be all the time.

Nearly all superintendents’ and technology leadership team members’ communication to teachers contained a message of patience. Teachers did not need to be experts in the technology right away, but hopefully that would not restrain them from attempts at incorporating the new technology in their lesson plans. Risk-taking by teachers was encouraged. Grace from Jefferson described how she communicated her expectations for use: “I went over the SAMR Model [with the faculty]...I said it's okay to be at any one of these levels when you start, but the goal is to take risks, because we want you to move up the model.”

The superintendent from Monroe, Jackson, had a very similar message: “we’re not fully there, [but my expectation is for teachers to use the technology in] transformative [ways], as opposed to just substituting [for] paper or the textbook…If that’s all there was, I don’t know we’d want to put this huge investment into it.” The message of taking risks was repeated by Jim from Adams: “No one says you have to use technology all day long, but there's a very consistent message from the leadership that you should be trying to integrate something new, so that is a message that they hear quite often.” The Washington School District had the most relaxed expectation for use. Washington is a BYOD model and as Ava described it: “Teachers are still given the option if they want these devices in their classrooms. Some embrace them, some are really nervous about them.”

While the overall message from superintendents was partly one of patience, nearly all superintendents modeled the use of technology to encourage use among their teachers.

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9 SAMR = Substitution, Augmentation, Modification, Redefinition. Indicates the level of technology integration from low to high (Puente, 2013).
staff. The Washington superintendent taught the college course on integrating technology, the Adams superintendent blogged regularly, and the Madison superintendent was a frequent user of Google Apps. Bob stated his belief in leadership by example and said, “I often model what I want to see the principals or administrators model [for their staff]. Oftentimes I have assignments for them that require them to actually go online or use technology to get things done.” The message from superintendents of setting reasonable expectations for use, encouraging risk-taking, and personally modeling the use of technology was a strategic process used by superintendents to help achieve buy-in. In addition to communication expectations for use, public relations efforts by the superintendent were another strategic process used by superintendents to achieve buy-in.

**Public relations.** We defined public relations efforts as the actions the superintendent took (or supported) for the purpose of creating buy-in with people, often stakeholders outside of the school system and with those that have authority over the superintendent. These actions were designed to persuade people to support the large-scale technology initiative and to coordinate the message that was communicated to the public with regards to the initiative.

All superintendents engaged in public relations efforts. The most common action in all districts was to hold public informational meetings about the initiative. Howard, the director of technology from Adams, described how the district achieved some buy-in after holding multiple meetings:

The more and more education that we provided to them, the more and more buy-in we got. The first year was a little bit rough to get that approval. After that
we've done numerous presentations with students and teachers, for school committee, for Ways and Means, [and for] town meeting members. We've invited all of those committees and regular town residents to visit our schools. Not at any time of course, but as groups, and let them do walk-throughs of our buildings to actually see the devices in action.

Superintendents and technology leadership team members gave presentations on the initiative to one or more of the following groups: school committee, parent teacher organization, and town finance committee. Data was not collected to show if any group was more targeted than others. According to Grady from Washington, their meetings helped put parents at ease: “The community needed reassurance to know that within this particular BYOD initiative that if a child didn't have one of the many supported devices, we could provide [one for them].” Norman, the superintendent of Adams, tailored his sales pitch for the initiative based on his audience:

I said it's actually going to be more cost-effective if we do this a bit over time, and sustain a modern infrastructure so I don't come to you every ten years and say “I need another $10 million”. If they're bean counters, you make a bean counter argument. If they're inspirational leaders, you make the inspirational argument. But if you go in and try to make an inspirational instructional argument to people who are seventy and on fixed pensions, you're barking up the wrong tree.

Superintendents worked to get their message out to the public in other ways as well.

Superintendents promoted their websites as sources of information about their large-scale technology initiative. Jackson from the Monroe School District indicated that they have a website dedicated to the initiative: “It’s got the research. It’s got the goals.
It’s got easy access for the public.” All superintendents also indicated they used one or more of the following mediums to get their message about the initiative out to the public: email blasts, Twitter, Facebook, blogs, and electronic newsletters. Norman from Adams indicated that the press doesn’t cover public meetings as much as they use to, but that people were still looking for local news. He saw that blogging was critical to filling this void and it helped to get an accurate and consistent message out to the public. Norman stated, “A lot of newspapers now are pulling stories directly off my blog, [the assistant superintendent’s] blog, [and] our principal's blog; I think that's part of the job responsibility that didn't exist before.” The Monroe School District took a different approach to educate their school committee about the initiative and to try and create buy-in. They created a course on 1:1 initiatives and had the school committee members complete the course on the district’s learning management system. Superintendents took a variety of actions to create buy-in for the large-scale technology initiative.

Conclusion

The overall study resulted in three central findings as to what superintendents do to gain acceptance for large-scale technology initiatives: (a) superintendents achieved resonance through leadership actions that were consistent with prognostic and motivational framing, (b) superintendents considered constraints the initiative might face, and (c) superintendents developed strategic processes to gain acceptance for the initiative. These three findings, as well as the findings from the five individual studies (see Table 1), will be discussed in Chapter 6. The individual studies will be submitted for each author as Chapter 5.
Chapter Five

Framing Innovation: The Impact of the Superintendent’s Technology Infrastructure Decisions on the Acceptance of Large-Scale Technology Initiatives

Taxpayers criticize governments for wasteful spending and public school districts are not immune from this criticism. With the introduction of the microcomputer in schools throughout the 1980s and the rapid growth of the Internet in the past ten years, increasingly larger amounts of public funds have been spent on technology in schools (Dexter, 2011a; Technology in Education, 2011). The press has been critical of perceived wasteful spending on educational technology and it is in a superintendent’s interest to avoid such criticism (Donsky & Foskett, 2007; McCrummen, 2010; Richtel, 2011).

At the same time, there is pressure on superintendents to provide students with an education that prepares them for the careers of the 21st century; providing access to technology and the Internet is seen as one way of doing this (U.S. Department of Education, 2010). The 2010 National Education Technology Plan calls for every student and educator to “have broadband access to the Internet and adequate wireless connectivity both in and out of school,” and that “every student and educator has at least one Internet access device…[that] may be owned by the student or family, owned by the school, or some combination of both” (U.S. Department of Education, 2010, para. 4.2).

Given the expense of education technology purchases, it is important for superintendents to make thoughtful decisions by learning the best practices of school districts that have already implemented large-scale technology initiatives, such as 1:1 laptop or tablet

10 Author: Erik P. Arnold
programs. This study should provide valuable information for a superintendent on the challenges and successes of such a proposal. Therefore, the purpose of this study was to investigate the decisions superintendents make surrounding technology infrastructure. This study sought to answer the following research questions:

1. What factors are considered by superintendents in making decisions about technology infrastructure?
2. What factors are considered by superintendents in making decisions about funding the large-scale technology initiative?
3. How did the technology infrastructure or funding decisions have an impact on the perceived acceptance of the initiative?

The existing research is limited with regards to the considerations of superintendents when making decisions about the selection of technology infrastructure. A gap in the literature also exists on how superintendents are funding these initiatives and the factors that influence their decision. This study provides new data to inform the decision-making of technology leaders, as well as how these decisions impact the acceptance of the initiative.

**Literature Review**

In an effort to gain an understanding of the various factors that superintendents should consider when investigating technology infrastructure purchases, this review of the literature will cover the following topics: (a) strategies to improve purchasing decisions; (b) the importance of robust and reliable technology infrastructure in gaining acceptance for the initiative from all stakeholders; and (c) the advantages and disadvantages of the various ways to fund the technology initiative.
Strategies to Improve Purchasing Decisions

This section of the literature review is important for understanding some of the factors that superintendents must consider in making decisions about technology infrastructure. Superintendents must make a determination if the financial investment in 1:1 technology initiatives is worth the expense. One might imagine that if cost was not a factor, a superintendent could purchase state-of-the-art technology for every student and teacher, offer extensive training, solve equity issues, and never have to be concerned with the sustainability of the initiative. When cost is a factor, the skills of the superintendent and his or her leadership team must solve these issues based on the needs and resources of their district. While the funding solution for one district may not be appropriate for another, the literature does indicate multiple factors that all superintendents should consider before moving forward with a large and potentially expensive technology initiative.

Evaluate technology. Districts need to have a thorough review process in place before making large capital purchases of technology. For example, McLester (2012) cautions against “buying on impulse” when districts are considering purchasing new technology and instead recommends the use of technology teams to carefully evaluate new products before making any purchase. McCrummen (2010) refers to some school technology purchasing decisions as not being thoughtfully done and that they are more akin to jumping on the “technology bandwagon.” Larry Cuban states that “the value of novelty [is] highly prized in American society” and that “one way schools can say they are ‘innovative’ is to pick up the latest device” (McCrummen, 2010, para. 4). A district
that operates in these ways could end up purchasing questionable technology that may not serve the needs of students and teachers.

School districts should have technology teams that can evaluate products and make recommendations on technology that should be purchased (Eisele-Dyrli, 2011; McLester, 2012, Tapang, 2002). Making wise purchasing decisions, especially when budgets are tight, is especially important when considering technology initiatives because of the uncertainties that surround such purchases. If a town makes a large capital expenditure, such as for a new fire engine, there is a strong likelihood that it was needed for the safety of the community and that it will be used regularly. Large capital expenditures for educational technology have not had the same level of assurance that the technology is needed or that the technology will be used regularly, but getting the input from a team of teachers and administrators creates a greater likelihood that the technology will be used (Eisele-Dyrli, 2011).

**Decision-making.** One responsibility of being a superintendent is making decisions about starting new initiatives and ending old ones. Ginsberg (2008) acknowledges the attractive aspects of leadership, such as an increase in salary and power, but he also points out the difficulties associated with making decisions that directly affect people and may even challenge one’s principles. Bolman and Deal (2003) view organizations in four frames: structural, human resource, political, and symbolic. A superintendent may look through the lens of each of these frames when considering whether or not to go forward with a large-scale technology initiative. When considering a large-scale technology initiative, the superintendent will feel political accountability pressure from the school committee and the community (see Figure 4). Bolman and Deal
(2003) define the structural frame as the “goals, specialized roles, and formal relationships” that exist within an organization (p. 14). The structural frame would lead a superintendent to have a technology team heavily involved in the decision-making process. The team would make judgments on the various mobile device options and help to determine if the initiative is really worth the money it would require for implementation. The symbolic frame sees that organizations are influenced “more by rituals, ceremonies, stories, heroes, and myths than by rules, policies, and managerial authority” (p. 15). Looking at leadership through the symbolic frame, the superintendent may feel pressure to select a mobile device that is viewed as cutting-edge or trendy. Also, parents could be concerned about the quality of education in the district when compared to neighboring communities and the superintendent may see a large-scale technology initiative as a powerful symbol of educational innovation. The human resource frame focuses on the individual employees and their “needs, feelings, prejudices, skills, and limitations” (p. 14). Through the lens of the human resources frame, the superintendent would respond to accountability pressure and stakeholder influence by enlisting the skills of key players to help lead the initiative. Personnel such as the director of technology, building principals, and the director of curriculum could possibly have leadership roles regarding the technology initiative. Lastly, the political frame is defined by Bolman and Deal (2003) as an environment where “conflict is rampant...[as] interests compete for power and scarce resources” (p. 15). The political frame would suggest that the superintendent would need allies on the school committee and possibly other elected town officials (finance committee) in order to proceed with a significant capital expenditure such as a large-scale technology initiative.
Brazer, Rich, and Ross (2010) concluded “that superintendent choices regarding how to involve multiple stakeholders in decision making led to different strategic outcomes that may have implementation consequences” (p. 212). The Brazer et al., 2010 study is relevant to this research since it suggests there is a connection between the decisions that superintendents make and implementation outcomes. But as Simon (1993) points out, “decision making is not the whole story of management, because decisions do have to be implemented” (p. 406). Successful implementation may be the desired end result, but decisions do have to be made before implementation can take place. To help with those decisions, there are cost predictive tools that can be of assistance to superintendents.
Cost predictive tools. To improve on purchasing decisions, district leaders have increasingly relied on tools such as **Total Cost of Ownership (TCO)**, **Return on Investment (ROI)**, and **Value of Investment (VOI)**. Iansiti (2012) has referred to TCO as “perhaps the most important advancement in procurement evaluation.” If a high school buys an iPad for every student for $499 each, that is not the true cost to the district. TCO says you must include all of the life-cycle costs for the iPad such as: maintenance, training, accessories, updates to the wireless infrastructure, additional support personnel, training for staff and students, and software applications. This type of analysis will give school leaders and school boards a better idea of the true costs of a large-scale technology initiative so they can make a more informed decision (Iansiti, 2012; Kaestner, 2007; Simkins, 2007; Tapang, 2002).

Return on investment is a more appropriate purchasing tool for businesses than it is for schools. ROI is used by businesses to maximize profits by comparing total costs and benefits of potential purchases or projects. Schools usually are purchasing technology to advance non-monetary goals such as improving teaching and learning, which is why the value of investment model is more appropriate (Kaestner, 2007).

VOI looks at the same costs as TCO, but it also assigns a score to projected educational benefits. By using VOI, districts can compare different technology solutions to see which one offers the greatest value. The value of a technology solution is determined by considering the following four factors: (1) the total life-cycle costs of the technology initiative (maintenance, training, accessories, updates to the wireless infrastructure, additional support personnel, training for staff and students, and software applications); (2) anticipated savings in teacher time, supplies, improved student
attendance and increasing enrollment by attracting students currently attending other schools; (3) the projected educational benefits as they relate to district goals and other mandates; and (4) the likelihood that the technology initiative will be successful (Eisele-Dyrli, 2011; Kaestner, 2007; McLester, 2012). Kaestner (2007) explains the difference between TCO and VOI as, “Total Cost of Ownership answers the question, ‘What is my technology infrastructure costing me?’ [and] Value of Investment answers the question, ‘Which way should we go?’” (p. 29). While there is minimal research in the area of procurement practices and user acceptance of technology in schools, a study of government IT managers found that user satisfaction with software was greater when the organization “considered criteria beyond initial purchase price of software, such as total cost of ownership and fit for purpose” (Iansiti, 2012, p. 211). TCO, ROI, and VOI are helpful tools when making purchasing decisions and in order for them to work there are specific factors that must be considered when using these tools.

**Other factors.** Some of the other factors that influence the technology initiative decisions include the following: the sustainability of the initiative; the anticipated reliability and durability of the technology; compatibility with existing technology and technology infrastructure; and the perceived impact on transforming instruction in the classroom (Eisele-Dyrli, 2011, McLester, 2012, Watters, 2012). After a superintendent considers all of these factors, it was my belief that cost would be the most significant determinant for decisions made with regard to both the technology infrastructure that is purchased and the funding of the technology initiative. Superintendents do not have unlimited budgets and this may mean that they are not able to purchase the most preferred technology. The necessity to focus on cost may have undesirable outcomes on
the acceptance of the technology initiative. Crisp and Williams (2009) conducted a study that compared the outcomes of two different mobile devices that were used by college students for educational purposes. They concluded that “all devices are not created equal” and that the “unique features and social influences of a particular device affect important outcomes” (Crisp & Williams, 2009, p. 9). While a thoughtful team approach to making technology purchases is part of a successful technology initiative, the literature also identifies the importance of having a reliable communications network for the technology to operate.

**Robust and Reliable Infrastructure**

A quick way to turn teachers off to technology may be for it to fail when they have thirty students sitting in front of them. A key component of any technology infrastructure in schools is the network. The network must be able to handle all of the wired and wireless devices of every student, teacher, and administrator in the building in order for it to be effective (Conway & Amberson, 2011; O’Donovan, 2009). Sufficient Internet bandwidth to handle all of the devices is a necessity. When the network slows down or crashes because of inadequate bandwidth, it “leads to student and teacher frustration and reduced usage levels” (Greaves et al., 2010, p. 12).

A study of nearly 1,000 U.S. schools was conducted in 2010 by an education technology advocacy group, known as Project RED (Revolutionizing Education). School administrators that participated in the study believed that the network should be 99.9% reliable, which is defined as thirty seconds or less of downtime per day, in order for their educators to feel comfortable integrating technology on a daily basis (Greaves, et al., 2010). Robust and reliable networks can be expensive, but if the technology is not being
used because of an unreliable network the financial costs as measured in unused technology are even greater. Unreliable networks will lead to technology not being used by teachers. A school may have laptops for everyone and the wireless network to support them, but if there is a lack of LCD projectors or software then this too can lead to less use of the laptop computers (Bebell & Kay, 2010). A 2010 study showed that only 49% of the 1:1 schools reported the desired 99.9% reliability. Another 30% reported 99% reliability, which is defined as the network being down 4 minutes per day (Greaves, et al., 2010).

Usability

The National Educational Technology Standards for Administrators (NETS•A) of the International Society for Technology in Education recommend educational administrators “establish and maintain a robust infrastructure for technology including integrated, interoperable technology systems to support management, operations, teaching, and learning” (International Society for Technology in Education, 2009, p. 2). This robust infrastructure must also be easy to use. The findings of Yuen and Ma (2008) demonstrated that teacher’s perceptions about how easy an e-learning system (software application) was to use was the “sole and dominant determinant in the model in predicting intention of use” (p. 237). To enhance the integration of technology in the classroom, the hardware and software must be easy to use for both teachers and students. Yuen and Ma (2008) also concluded that it was desirable for principals to promote the use of technology in order for teachers to understand the importance of integrating the technology in their classroom.
Even the best networks and computers can fail, so schools must have sufficient technical support personnel to address problems as they arise. If technical help is not available it will negatively impact the teaching and learning process and possibly cause teachers to lose faith in integrating technology into their lessons in the future (O’Donovan, 2009; Waters, 2009).

**Obsolescence**

Another concern with the infrastructure of technology is the issue of hardware and software obsolescence. For example, the Berkshire Wireless Learning Initiative purchased Apple iBook G4 laptop computers in 2005 and they were “showing the limitations of their age and amount of use” after only two years (Bebell & Kay, 2010, p. 53). School technology purchases may have a shorter usable life than more conventional purchases such as textbooks, although improvements in a number of areas (including reduced cost) may lessen this concern. Laptop computers, for example, have significantly longer battery life and weigh much less than their counterparts than just a few years ago. A reduction in the cost of mobile devices has made the issue of obsolescence somewhat less important. This was seen in 2012, for example, when Samsung introduced a $249 laptop that runs on Google’s Chrome platform.

Tablet computers, namely the iPad, were released in 2010 and hence lack long-term reliability data. Their similarity to smartphones, however, leads technology experts to surmise that they will be similarly reliable. The iPad and iPhone have turned out to be the most reliable brands in their categories, which is welcome news for all of the schools worldwide that have purchased nearly 10 million of the devices as of June, 2013 (Apple, Inc., 2013; Sullivan, 2011). Regardless of the hardware or brand purchased, school
districts should plan not only for obsolescence but also for repair of items such as device screens, keyboards, batteries, cables, and printers (Bebell & Kay, 2010; O’Donovan, 2009).

Project RED describes factors that lead to successful integration as being multiplicative, rather than additive. This means that if any one factor, such as the reliability of the network, “…goes to zero, the whole project may fail” (Greaves, et al., 2010, p. 12). The overall cost of student computing has been going down each year, but a robust and reliable network can still be costly. As an example, forty years ago the average cost of student computing at universities was ten dollars per student and today it is not more than ten cents per student (Greaves, 2012). Even though costs have come down, schools are still looking for ways to provide more technology for less money. One way to do this is to push the cost of the technology onto the students instead of the district. These next sections on funding a 1:1 technology initiative help explain some of the factors that superintendents should consider when making decisions on how to fund an initiative.

**Funding Designs**

Given the funding limits facing schools and the pressure on them to have the latest technology tools available for students and teachers, schools have looked at several ways to fund 1:1 technology initiatives. The most common funding designs are: *District-provided Device* (DPD), *Bring Your Own Device* (BYOD), a district-sponsored *Lease-to-Own* (LTO) model, or a *Blended* model (Hill, 2011; Johnson, 2012; Salerno & Vonhof, 2011).

**District-provided Device.** A DPD design is when a school district purchases all
of the devices and provides them to the students for their use while they are enrolled in school. Students are typically allowed to bring the device home each day and occasionally during the summers as well. The financial costs for districts tied to supporting, maintaining, and purchasing the devices are a major drawback with this design, but equity and homogeneity of the technology are significant pros to a DPD design (Norris & Soloway, 2011).

**Bring Your Own Device.** BYOD programs rely on the students using their own mobile device. This means the school just needs to provide a wireless network and all other costs, such as, applications, maintenance and repairs, and the cost of the device itself are born by the students. While appealing from a financial perspective for schools, the drawbacks to BYOD programs include: inequity of devices, lack of homogeneity of devices, and what to do about students who do not own a mobile device (Hill, 2011; Johnson, 2012, Norris & Soloway, 2011).

The Bring Your Own Device (BYOD) movement has been growing in popularity mainly due to the cost savings for school districts (Norris & Soloway, 2011; Salerno & Vonhof, 2011). Not everyone likes this option, but there is a consensus that it is inevitably going to take root in any district where a DPD plan is not feasible (Fingal, 2012; Norris & Soloway, 2011; Puente, 2012). When schools own the devices, they also own the technical problems that come with them. Laptop computers especially are subject to more malfunctions as they age and battery longevity and failure is also problematic. A main benefit to BYOD is that any malfunction, accidental breakage, or firmware/software updates are the responsibility of the student. If students already have smart phones, tablet computers, or laptops, and they are encouraged to bring them to
school, the school is on its way to becoming a 1:1 school. One significant hurdle is that schools will most likely have to upgrade their wireless network. Even systems just a few years old may not be able to handle the large number of BYOD devices in addition to the regular school computers (Norris & Soloway, 2011; Raths, 2012). One school district in Missouri spent $1.3 million to wirelessly network 19 separate facilities in order to handle a BYOD program (Raths, 2012).

The issue of equity is the main BYOD concern reported in the literature (Fingal, 2012; Norris & Soloway, 2011; Puente, 2012). The term digital divide refers to the gap, due to economic inequality, between those that have access to the latest technology and high-speed Internet access and those who do not (DiMaggio & Hargittai, 2001; Li & Ranieri, 2013). A criticism of BYOD is that it could widen the digital divide because there will be students with the newest, most advanced laptop or tablet and then there will be students with an outdated cell phone or no device at all (Norris & Soloway, 2011; Hill, 2011). Alternatively, students without devices might share another student’s device or the school might assume the responsibility of providing devices for those individuals.

Another challenge with BYOD programs is the issue of heterogeneity. With so many different devices that have different functionalities, how will a teacher be able to plan a lesson that integrates them all? An app may run on some devices, but not on others. It is likely the one functionality teachers could plan on is that all students should be able to connect to the Internet. Norris and Soloway (2011) argue that the marketplace will solve the problem of heterogeneity; companies will develop apps/software that can run on multiple devices and therefore make this issue a non-factor. Utilizing the cloud is one way the marketplace is already solving the problem of heterogeneity. For this study,
cloud is synonymous with the Internet. Cloud-based applications, such as Google Docs, work through any web browser and therefore are not dependent on the type of device or operating system. Currently, there are fewer cloud-based applications and they are less robust than traditional computer-based software, but this market is growing and the technology is continuously improving (Aaron & Roche, 2012; “Heads in the clouds”, 2011). BYOD is already in place in schools across the country, but the movement can only succeed if the equity concerns are tackled, the heterogeneity issues are addressed, and there is a robust and reliable wireless network in place. A funding model for a 1:1 initiative that addresses some of the BYOD concerns is the LTO design.

**Lease-To-Own.** LTO designs are often miscategorized as BYOD designs in the literature, but there are significant distinctions between the two that warrant LTO designs having a distinct category separate from BYOD. In a LTO design, the district decides on a specific mobile device that everyone will use and students can either purchase it outright, or pay for it in installments which are typically over a three or four year period. Depending on the cost of the device and the socio-economic status (SES) of families in the school district, this design could be a financial hardship for parents. To account for this inequity, some schools subsidize the cost of the device depending on the socio-economic status of families and still realize substantial cost savings over a DPD model, while still having the benefit of device homogeneity. Supporting and maintaining the devices is a disadvantage in the LTO design just as it is in the DPD design (Day 2010; Mouza, 2008).

**Blended.** Lastly, a blended design would be some combination of the previous three designs. For example, a district might implement a BYOD design, but then provide
a device to all students that do not have their own. DPD, BYOD, and LTO designs that are modified to address associated drawbacks may thereby be reclassified as a blended design (Salerno & Vonhof, 2011).

**Methodology**

The previous section discussed the relevant literature in order to gain an understanding of the various factors that superintendents should consider when investigating technology infrastructure purchases. The methodology for the group study was described in detail in Chapter 3 and those methods apply to this individual study as well. However, a brief review of those methods and others that are unique to this individual study will be discussed in this section.

**Design of Study**

As described in detail in Chapter 3, our team employed a multiple-case study approach to investigate what superintendents do to gain acceptance for large-scale technology initiatives. Selecting the cases began with an informal email survey that was sent to school administrators’ who were members of the state’s administrator association. This survey identified 30 districts that had large-scale technology initiatives in place. We were able to enlist five districts from this group based on the following additional criteria: (a) small-to-midsized suburban towns with less than 5,000 students enrolled in grades K-12; (b) rated as either Level 1 or Level 2 according to the state’s school accountability system (although one district dropped to Level 3 after selection); (c) the superintendent was a leader in the system at the inception of the initiative; and (d) the superintendent was willing to participate in the study. We imposed the district size criterion in an effort to increase the likelihood that the superintendent had more direct involvement in the 1:1
technology initiative.

Of the five individual spokes to the group study, mine sought to discover how the superintendent’s decisions on technology infrastructure impacted the acceptance of the 1:1 computing initiative. For this study, technology infrastructure was defined as all of the hardware, software, and technology staff that would be necessary to operate a 1:1 mobile device initiative. The technology staff included network managers, technology directors, and technology integration specialists. Other technology infrastructure included, but was not limited to: wired and wireless networks, mobile devices, printers, chargers, classroom projectors, software applications, cloud applications, and cloud storage solutions. The funding design of the technology initiative was defined as identifying who was responsible for paying for the mobile devices. In simplest terms, it was either the district or the parent/guardian who paid for the device.

**Theoretical Framework**

Frame theory, as described in Chapter 2 (Goffman, 1974; Benford & Snow, 2000), was chosen as the theoretical framework for the group study and this individual study. Frame theory has been used to describe social movements and government policy reforms. The work of the superintendent to implement a large-scale technology initiative has similarities to social movements and government policy reforms. The factors considered by superintendents when making decisions about technology infrastructure will be examined from the perspective of frame theory. Frame theory identifies three core framing tasks (diagnostic, prognostic, and motivational) through which the infrastructure decisions could be viewed. Frame theory also takes into account constraints surrounding the infrastructure decisions and the actions the superintendent
takes to address the constraints (known as strategic processes). Lastly, both the group study and this individual study are concerned with how the superintendent was able to achieve acceptance of the initiative; frame theory identifies the importance of creating points of resonance in moving an initiative forward. After examining the individual results through the lens of frame theory, I concluded that a different theoretical framework might have made a better contribution to understanding the processes by which superintendents make decisions about technology infrastructure. The appropriateness of frame theory will be reviewed in the discussion section of this chapter.

The next section describes the data collection methods as they relate to this individual study.

**Data Collection**

The team conducted one-hour *semi-structured interviews* (Yin, 2008, p. 107) for each of the five superintendents and other members of the district leadership team that were identified as being leaders in the technology initiative. The team also collected all relevant documents. The interviews and the documents served as our research data. The superintendent interviews served as our primary source of data. The team also interviewed members of the district leadership team who were involved with the technology initiative, or those who the superintendent suggested had relevant information for our study. Described in detail in Chapter 3, this is known as *snowball sampling* (Creswell, 2011). Four out of the five superintendents identified the director of technology (or network director) as a key person involved in the initiative that we should interview. David, the superintendent from the Jefferson School District did not, but that may have been because their director of technology abruptly resigned just before the
initial implementation. This did not impact the ability to get the data to answer the research questions, because David and his technology leadership team members were knowledgeable with regards to the technology infrastructure. Single interviews with the technology leadership team members in each district were sufficient to get their story and the interview transcripts allowed me to compare their assessment of the technology initiative against what was learned from the superintendents. District technology plans and district websites and blogs were also coded for data and were used to crosscheck interview responses.

The interview questions were piloted with three superintendents from districts with large-scale technology initiatives that did not participate in the study. Several questions were revised as a result of the piloting. Appendix E contains all of the interview questions that were used for our interview protocol. Table 6 lists the primary interview questions that were developed to provide data for the following three research questions: (a) What factors are considered by superintendents in making decisions about technology infrastructure? (b) What factors are considered by superintendents in making decisions about funding the large-scale technology initiative? and (c) How did the technology infrastructure or funding decisions have an impact on the perceived acceptance of the initiative?
## Table 6

**Interview Questions corresponding to Research Questions**

What factors are considered by superintendents in making decisions about technology infrastructure?

1. What were the main reasons that the specific mobile device was chosen? (not applicable if BYOD)
2. Describe the reliability of your wireless network and how, if at all, it has impacted the 1:1 initiative.

What factors are considered by superintendents in making decisions about funding the large-scale technology initiative?

1. What factors were considered when determining how to fund the technology initiative?
2. How did the capacity of the existing technology staff to support the initiative figure into the decision-making about the 1:1 initiative?

How did the technology infrastructure or funding decisions have an impact on the perceived acceptance of the initiative?

1. How did the mobile device that was chosen (or BYOD program) impact the use of the device among teachers & students?
2. How, if at all, did the funding design impact the acceptance of the 1:1 initiative?
3. In hindsight, should anything have been done differently with regards to the implementation of the 1:1 initiative?

### Data Analysis

The interviews were recorded and transcribed. Chapter 3 details the process the team used to analyze the data, which was the same process for analyzing this individual spoke. The recommendations of Miles and Huberman (1994) were followed which describe three steps for analyzing data for a multiple-case study design. These steps are: (a) early steps in analysis, (b) within-case analysis, and (c) cross-case analysis.

**Early steps in analysis.** In addition to recording the interviews, notes were also taken. The notes served as the basis for informal research journals and analytic memos (Saldana, 2009). Informal research journals to record impressions of the interview were used in order to aid with the data analysis that took place days or weeks after the interview. The analytic memos served to help make sense of the data. These memos may have been as short as a sentence or as long as a couple of pages, but they all had the
purpose of connecting “different pieces of data into a recognizable cluster, often to show that those data are instances of a general concept” (Miles & Huberman, 1994, p. 72). The journals and memos helped to determine the factors that framed interviewee’s perceptions on the acceptance of the initiative. The memos were also important in the process for modifying the initial list of codes (start list). The journals and memos were helpful in revealing the complete picture of the data. This picture of the data started to take shape with the creation of an interim summary. This was completed about a third of the way through the data analysis. My dissertation advisor reviewed the interim summary and his feedback helped improve the remaining analysis of the data.

Coding. The start list of codes was modified in the early stages of analysis. A code dictionary was created and it was referred to frequently throughout the coding process. Appendix L shows the code dictionary to analyze the data for this area of research. Coding for the overarching study was done collaboratively in pairs, but individuals coded for their own spokes of research. A software application (Dedoose) was used to assist in the coding and analysis of the data.

Within-case analysis. The second step in the data analysis was to conduct a within-case analysis. This was completed to gain an in-depth understanding of each individual case. Patterns of coding and frequency of coding would become apparent through this process. Each code excerpt was examined in relation to what the study was seeking to discover through the research questions.

Cross-case analysis. The final step in the data analysis was cross-case analysis. This process identified patterns and generalizations. Miles and Huberman (1994) promote multiple-case study designs and cross-case analysis to strengthen the ability to
make generalizations, but also for the ability “to see processes … outcomes … [and] how they are qualified by local conditions [so you may] … develop more sophisticated descriptions and more powerful explanations” (p. 172).

Table 7 shows the most frequently occurring codes among superintendents and other members of their technology leadership teams. The code occurrence data was used in within-case and cross-case analysis of the five school districts. The data also was important for using triangulation to show internal validity (data from the superintendents was corroborated by their technology leadership team members).

Table 7

*Most Frequently Occurring Codes*

<table>
<thead>
<tr>
<th>Code</th>
<th>Superintendent</th>
<th>Technology Leadership Team Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wi-Fi Reliability</td>
<td>9</td>
<td>26</td>
</tr>
<tr>
<td>Wi-Fi &amp; Acceptance</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td>Sustainability</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>School Funds Opportunity</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Device Reliability</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Device Capabilities</td>
<td>5</td>
<td>16</td>
</tr>
</tbody>
</table>

Limitations/Delimitations and Validity/Reliability of Research

Limitations, delimitations, validity and reliability are discussed in detail in Chapter 3. The delimitations included: only Level 1 and Level 2 schools, excluding large...
districts, and only considering successful large-scale technology implementations. The exclusion of Level 3 and Level 4 school districts was an attempt to avoid complications for our study that could arise since they are subjected to greater state oversight and possible restructuring. By limiting our study to small-to-midsized suburban towns we hoped to capture a more descriptive narrative of central administration leadership team actions, since due to their smaller staff, these team members are more likely to have a direct role in a large-scale technology initiative. We only included districts that had gained acceptance for their large-scale technology initiative in order to paint a richer description of these districts. Other than delimitations, the main limitation was that our study relied on self-reported data of events from two or more years ago and is therefore subject to errors in memory.

The collaboration among the research team improved the validity and reliability of the research. Even though the coding for this study was conducted individually, I was able to test the strength of ideas and seek counsel from researchers that were as familiar with the data as I was. The piloting of interview questions, research team case analysis meetings, and the consistent interview protocol all led to improved reliability for the study. Additionally, I used triangulation (Merriam, 2009) to show internal validity. I had multiple methods of data collection (interviews and documents), multiple data sources (people with different perspectives in five different districts, see Table 7), multiple investigators that participated in pairs for all interviews, and peer examination of the data and findings. Merriam (2009) also indicates that the ethics of the investigator play an important role in determining the validity and reliability of qualitative research, since an unethical researcher could cherry-pick certain data to create inaccurate findings. This
was another benefit of having worked with four other researchers, since we were able to review each other’s analysis of the data. Additionally, the journals and analytic memos served as an audit trail to “describe in detail how data were collected, how categories were derived and how decisions were made” (Merriam, 2009, p. 223).

**Research Bias and Assumptions**

Being an educator that has helped lead the implementation of a large-scale technology initiative could result in research bias. While conducting this research, I was an administrator at a school that was in the second year of a 1:1 iPad program for grades 9-12. I tried to minimize this bias through the feedback of my dissertation chair, my research partners, and other outside readers. Additional concerns surrounding research bias and assumptions are discussed in Chapter 3.

**Results**

This multiple-case study of five school districts with 1:1, BYOD, and Blended technology initiatives yielded a rich database that was used to investigate the decisions superintendents make surrounding technology infrastructure. The results of this study will be discussed below.

After analyzing the coded data from the interviews of five superintendents, 18 technology leadership team members, and the technology plans from the five districts, four distinct findings have emerged. In an effort to investigate the decisions superintendents make surrounding technology infrastructure I sought to answer three research questions. The research questions and the results tied to them are as follows:

- What factors are considered by superintendents in making decisions about technology infrastructure?
Superintendents valued the capabilities and reliability of a device and were willing to pay more (within budget) for a device that had these qualities.

What factors are considered by superintendents in making decisions about funding the large-scale technology initiative?

- Superintendents funded 1:1 initiatives by seizing one-time budget opportunities and through creative financial moves.
- Superintendents considered the financial sustainability of the large-scale technology initiative before committing to it.

How did the technology infrastructure or funding decisions have an impact on the perceived acceptance of the initiative?

- Robust and reliable Wi-Fi networks were recognized as being critical to gaining acceptance by teachers for 1:1 initiatives.

Each finding will be discussed in detail in the sections that follow.

**Capabilities and Reliability of the Device**

When purchasing new technology it is reasonable to ask questions such as: What can the device do? How much does it cost? How user-friendly is it? Will it work with software and hardware I already have? Can I print from it? Can I easily share media on the device with others? How long will the battery last? Does it break easily? Will it work when I need it to? Superintendents and their technology leadership teams ask similar questions when they are looking to purchase new technology and they come to their own conclusions about what device qualities they value the most.

Several questions were asked to discover, “What factors are considered by superintendents in making decisions about technology infrastructure?” The primary
question was on the main reasons that the specific mobile device was chosen (not applicable to Washington since they had a BYOD model), but there were also other questions concerning the performance of the Wi-Fi network and the capacity of their technology staff to support the initiative. The first finding is that superintendents valued the capabilities and reliability of a device and were willing to pay more (within budget) for a device that had these qualities. The capabilities of the device could include things such as: battery life, audio/video recording, full size keyboard, variety of apps or software, portability, and ease of use. Table 8 identifies the capabilities that were important in the device selected for each school district. A reliable device would be one that is still likely to operate correctly even when it is constantly being transported from class to class and from school to home over a several year period. All superintendents considered a device to be reliable if they got three to four years of serviceable life from each device. Details on device capabilities and reliability are discussed in the next two sections.

Reliability and cost. Each superintendent referenced the reliability of the device as being important to its selection (see Table 8). David, the Jefferson superintendent, stated, “…the reliability was a big factor…we have a very small technology team, so the thought of trying to save some money with a less reliable, less developed device was greatly outweighed by what I believed to be the reliability [of the iPad].” Bob, the superintendent from the Madison School District, whose district primarily used Apple laptops, decided to pilot a classroom set of Chromebooks. Bob described the pilot of the Chromebooks as follows: “within a couple months we had more problems trying to support the Chromebooks. [Teachers said] ‘it’s not quite like my MacBooks’. In the end
you can buy three Chromebooks for the price of a MacBook, but if teachers aren’t willing to use them [what’s the point]?”

Table 8

Factors Considered in Device Selection

<table>
<thead>
<tr>
<th></th>
<th>Full Keyboard</th>
<th>Reliability</th>
<th>Ease of Use</th>
<th>Battery Life</th>
<th>Multimedia Audio/Video Recording</th>
<th>Compatibility with existing technology</th>
<th>Price</th>
<th>Value</th>
<th>Device Chosen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>iPad</td>
</tr>
<tr>
<td>Jefferson</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>iPad</td>
</tr>
<tr>
<td>Madison</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>Laptop</td>
</tr>
<tr>
<td>Monroe</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Laptop</td>
</tr>
</tbody>
</table>

The four 1:1 districts were using either Apple laptops or Apple iPads. The lower price of the iPad was one factor that led to their selection over a laptop in the Jefferson and Adams School Districts. “We looked at laptops…they were very tempting but financially we couldn’t afford them so we never really got beyond that point to be honest,” said David. He went further to describe the importance of conducting a 1:1 initiative with high quality devices (“not Atari or something”) and a great infrastructure. David ended up supporting the purchase of the iPad due to the “price of it [and] the reliability of it.” Technology leadership team members from all four districts mentioned that the cost of the device was a factor in their decision, but it was only Madison and Monroe, the two districts that primarily use laptops, where team members specifically referred to the overall value they felt they were getting with the purchase of laptops. Howard, the director of technology from Adams, described what they did not like about netbooks (PC based mini laptops) that they had purchased as part of a small pilot program: “The screen was a little bit too small. The whole device layout was pretty
clunky, speed wise they weren’t the best. Battery life wasn’t the best.” Paul, the former high school principal in Adams, referred to the netbooks as “kind of flimsy”. The director of technology from Monroe, Meagan, had a similar experience with netbooks: “We tried netbooks. It was because of the solid foundation of the Macs, knowing we wanted them to last 4 years and be in good condition, they just have a better track record of being a stronger machine.” She also said they ended up choosing a laptop with a solid-state drive because they thought since it had less moving parts it would be more durable.

**Capabilities.** In addition to the reliability and cost of the device, superintendents chose devices that they believed had the features and capabilities that their students and teachers needed in the classroom (see Table 8 above). Norman, the Adams superintendent, was impressed with how the iPad was used to share student reading progress information with parents:

> [at a parent conference, the parents indicated that their child is not reading at home] the teacher says, “I've been reading with your child and recording them. Let me play them reading in class.” Boom, on an iPad, it is so damn simple. They play the recording back to the parents and they're bawling. [The teacher continued] “Your kid can do it in class. I end up reading with them usually once a week, give me your email, and I'll email you the sound file every other week so you can monitor their progress in their own voice.” That teacher didn't necessarily need to learn new reading instruction. They have a new tool that's made their job easier. That's where this has been extremely powerful.

Adams and Jefferson, the two districts that chose the iPad as their device, indicated the importance of having a device that had long battery life. According to Jim from Adams,
“We needed a device where they could walk into school first thing and have a device that worked the entire day.” No interviewee from Madison or Monroe, the two districts that primarily used laptop computers, expressed that battery life was a factor in why they chose their device. Additionally, the only districts that described the desire to have a device that could be used for multimedia purposes, such as audio and video recording, were the iPad districts of Adams and Jefferson. Jim also indicated they chose the iPad because, “We wanted a device that had multimedia ability…We didn’t want students to have to use digital cameras…video cameras, and then have to be using USB sticks.” Jim continued, “for content creation, we felt that a teacher can more easily build a consistent digital workflow with a student with an iPad, so that we’re all in a consistent platform.”

Jackson, the Monroe superintendent, described their decision to go with a laptop instead of a tablet:

We went and visited schools up in Maine and some of the schools around here, just to kind of compare and contrast [the devices they used] and the belief was that at the high school level in any case, in order to do the kinds of things that they wanted to do, it needed a computer, it needed a full computer, whether it had to do with the probes for science classes you wanted to be able to connect to it, or whether it had to do with the ease of the keyboard [it just seemed like the better choice for us].

As indicated previously, superintendents that knew they did not have the budget for a $1000 laptop spent their time investigating what was the best device for their students within the budget they had available. No superintendent purchased the least expensive device available (netbook, Chromebook, iPod). Instead, given the budget they had
available, they purchased the device they thought offered the best reliability and capabilities for their students and teachers.

The data from the four 1:1 districts was consistent with the literature that describes the increased use by district leaders of cost predictive tools such as Total Cost of Ownership (TCO). As described in the literature review, TCO is the consideration of such factors as device reliability, software application costs, training costs, and the cost of adding additional technology support staff. The next section describes findings related to how the large-scale technology initiative was funded.

**Budget Opportunities and Creative Financial Moves**

Why does it seem some districts can fund large-scale technology initiatives and others cannot? Certainly, the financial resources of some school districts are much greater than the resources of other districts. In our study, however, we found a variety of ways that districts were able to fund their initiatives.

**Creative financial moves.** The second finding is that superintendents fund large-scale technology initiatives by seizing one-time budget opportunities and through creative financial moves. This finding is the result of analyzing data for the research question: “What factors are considered by superintendents in making decisions about funding the large-scale technology initiative?” Table 9 indicates the funding design of each initiative and gives a brief description on how each district paid for their share of the costs. All renovation projects or new building projects mentioned in Table 9 received a percentage of the project cost reimbursed by the state. The percentage of reimbursement can be different for each school district based on such factors as: a community’s per capita income, property values, and the percentage of low-income students.
Table 9

Funding Designs for the Large-Scale Technology Initiative

<table>
<thead>
<tr>
<th>Funding Design</th>
<th>District</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYOD</td>
<td>Washington</td>
<td>Students can bring any computing device (smart phone, tablet, laptop) and use the district Wi-Fi network. The district has some tablets and laptops available for loan during the school day for those students without a device. The network was upgraded during building renovation projects in the district.</td>
</tr>
<tr>
<td>District-Provided Device</td>
<td>Adams</td>
<td>iPads are provided to students. Changes were made in the school budget to provide the funds for the district to lease the iPads from Apple.</td>
</tr>
<tr>
<td></td>
<td>Jefferson</td>
<td>iPads are provided to students. Funds from a new high school building project funded the network and about half of the iPads needed.</td>
</tr>
<tr>
<td></td>
<td>Monroe</td>
<td>MacBook Air laptops are provided to students. Changes were made in the school budget to provide the funds to lease the laptops from Apple. The network was upgraded through a new high school building project.</td>
</tr>
<tr>
<td>Blended: District-Sponsored Lease-to-Own &amp; BYOD</td>
<td>Madison</td>
<td>MacBooks or iPads are leased by parents through a non-profit created by the school district. The district provides funds to aid low SES families. Loaner devices are available at school for those that do not participate in the lease program. The network was upgraded through a new high school building project.</td>
</tr>
</tbody>
</table>

An example of a creative financial move is when superintendents are able to use political maneuvers to get a fixed sum in the budget that is dedicated for technology purchases. The superintendent typically worked with members of the Town Finance Committee (FINCOM) to secure these funds. Frame theory labels these moves as strategic planning processes. Norman, the Adams superintendent, explained how he was able to work with the FINCOM to secure steady funding for network infrastructure by getting all of the town departments to use the school network:

If I brought anything to the table [with regards to the 1:1 initiative], it was commitments and a funding source from the town. We created a line in the town budget for technology infrastructure that basically is just like the electric bill, no
one bats an eye and asks “What's that $300,000 for every year?” We run a five-year lease like we used to do with textbooks all the time. Every five years we have about $1.5 million we can put into anything you don’t see – switches, routers, wireless. The argument I had to win with everyone else in town…was that if we share a network, we get much better technology.

By getting the cost of technology infrastructure to be a town-wide responsibility, rather than just a school expense, Norman was able to free up school budget funds to help with the purchase of the 1:1 iPads for students.

**Constraints.** Frame theory recognizes that framing processes are frequently contested or constrained. One category of constraint is political. We defined a political constraint as the lack of support (perceived or actual) from any stakeholder. Stakeholders could include school committee, FINCOM, parents, teachers, and the community. One type of political constraint that was seen in districts surrounded how the initiative would be funded. Grace, the high school assistant principal from the Jefferson School District, claimed, “If we had to go to, like, parent funding, that would have never flew in this town at this time with all the money people were putting forward to a new building.” Jim, a technology integration specialist from Adams, explained the political constraint his district faced:

> We’re a district that doesn’t have fees. So we don’t have fees for sports, we don’t have fees for buses, we don’t have fees for some of the traditional things that you might get $35 from for this, or $50 from this -- we have none. We knew right away that we were not going to fund our technology initiative with a technology fee. So, the funding became the big challenge, initially. We decided on a device,
we knew what the cost would be, and so we had to see how we would meet that cost. For the first deployment here, we decided to reallocate some of the ways that we were spending to meet the cost that we needed.

In addition to the creative financial move of transferring the cost of maintaining the network infrastructure to the town budget, Adams created the funds to purchase iPads by reallocating money budgeted for textbooks, decided not to fund a new foreign language lab, cut one permanent sub position, cut one teacher aide position, and reduced printing costs.

**Budget opportunities.** The Monroe School District typically had to go before the town FINCOM annually and request money for technology as a capital expenditure. The FINCOM decided to increase the school operating budget so they would not have to consider annual technology fund requests from the school department anymore. The superintendent, Jackson, described it this way:

So there was this influx of funds that we could put towards a lease [of laptop computers], which in a different year might have gone towards actually paying for [network] infrastructure, which is mostly what the capital money was for, but we were in good shape in that regard. We didn't need to do that. So the same year that we didn't need to buy a lot of infrastructure, we were able to apply it to this lease and it was put it in our operating budget.

The main reason the Monroe School District’s network infrastructure was already in good shape was because it had just been upgraded as part of a new high school building project. Three other districts (Washington, Madison, and Jefferson) benefitted from one-time budgeting opportunities due to the construction or renovation of a new
school building. These districts were able to build or upgrade their wireless networks because of construction or renovation projects. Because of a new high school building project, the Jefferson School District was able to fund the network infrastructure as well as purchase about half of the iPads for a 1:1 iPad initiative for grades 9-12.

Superintendents may find themselves rushed to make a decision and this can be especially significant when it involves large capital expenditures. David, the Jefferson superintendent, faced such a situation surrounding their technology initiative. David became superintendent of the district after the construction had already begun on a new high school. Because of other important district matters, it was a month before he was able to study in detail the plans for the new building. As David described it:

[The building] was coming online in just another seven months and I realized on a walkthrough that they have all of these computer labs set up all over the place with iMacs. It just seemed archaic to me, that’s the same bloody thing that was done when I went to school.

In the short amount of time before the building was going to be completed, the decision was made to abandon the traditional computer labs and to instead implement a 1:1 iPad program. David recounted, “The opportunity in terms of funding came about due to the fact that we had a brand new high school. I wanted to grasp that funding and that opportunity for change.” Even though only half of the iPads that were needed for a 1:1 initiative in grades 9-12 were purchased with available building project funds, the superintendent was able to purchase the remaining half of the iPads by entering into a 3-year lease with Apple. This lease provided new laptop computers for teachers K-12 as well as some iPad carts to be shared in grades K-8. Politically, David felt it was
successful because he did not have to ask the town or parents to fund the initiative and grades K-8 also were able to receive new technology. Getting the initiative funded is an accomplishment, but superintendents are also concerned about sustaining the large-scale technology initiative.

Superintendents Consider Sustainability

Paying for laptops and tablets is not a one-time expense. Every device has an average serviceable life before it breaks or becomes obsolete. School districts need to look beyond funding the initial purchase and ask themselves, “Is this an initiative we can sustain?”

A third finding is that superintendents consider the financial sustainability of the large-scale technology initiative before committing to it. This finding (as well as the second finding) addresses the second research question: “What factors are considered by superintendents in making decisions about funding the large-scale technology initiative.”

The Washington School District decided to go with a BYOD initiative because of financial reasons. Brody, the superintendent indicated, “We made the conscious choice that there was no way we could do a 1:1 from a financial standpoint, it wasn't a sustainable solution. We then started preparing for what BYOD would look like.” Ava, a technology integration specialist, supported the superintendent’s statement by explaining, “We don't foresee at any point in the future, really, having a 1:1 initiative. We would love to see 1:1 but it's quite costly.” Norman, the Adams superintendent, supported the expansion of the 1:1 iPad initiative to all grade levels and he budgeted accordingly. He noted, “if we predict a 3 year life on the device, we'll probably need
about 1,000 devices every year… Again, that's my commitment. I need to know in my head, that for sustainability, I need to provide roughly 1,000 devices every year.”

The Adams School District and the Madison School District have framed technology as being equivalent to a utility expense. As Jim, a technology integration specialist from Adams explained it:

And then there was sustainability -- what do we do three years out, when these iPads are no good anymore, how do we sustain it? So, in our budgets we believe that technology is a utility…it’s just another thing that we spend money on like electricity and heating and everything else. We never ask for extra; we just know that there's always a certain amount of money in that line item for the things that we need.

Brett from Madison recalled what they did to help keep the initiative sustainable:

Our thinking on sustainability was that because we were buying the right technology -- we could actually turn in our technology after two years and they were worth enough to pay off the loan and still have a little bit of money left so then we could roll into newer technology faster if we'd wanted to. So, it gave us a lot of flexibility, but because it was like a utility, the school committee never questioned it.

The Madison School District developed an innovative approach for making their large-scale technology initiative sustainable that involved more than the traditional leasing of equipment.

Madison did not have the budget to provide devices for all of their students so the superintendent and members of his leadership team created a non-profit agency to make
the large-scale technology initiative sustainable. This agency purchased the technology and then leased the laptop or tablet to individual families. Families paid for the device over a four-year period. Students that received free or reduced lunch paid a reduced rate for the device. Madison has created a sustainable funding model (Blended design) for their technology initiative through a combination of district-owned devices, a district-sponsored lease-to-own program, and by allowing students to bring other devices they already own (BYOD).

**Reliable Networks Impact Acceptance**

Why are some initiatives effective and others fail? This study looked at five districts that we determined had gained acceptance for their large-scale technology initiatives.

Our study examined what superintendents do to gain acceptance of large-scale technology initiatives and a third research question sought to further that goal. I wanted to examine if the technology infrastructure or funding decisions had an impact on the perceived acceptance of the initiative. This led to a fourth finding: Robust and reliable Wi-Fi networks were recognized as being critical to gaining acceptance by teachers for 1:1 initiatives.

Superintendents and technology leadership team members tended to downplay the importance of the specific device chosen or the funding design as significant factors in gaining acceptance for the initiative, but there was a strong consensus for the importance of having a robust and reliable Wi-Fi network (see Table 7 above). A robust network is defined as one that has sufficient bandwidth and density (being able to handle all of the devices that might access the network from a specific part of the building) to provide fast
access to the Internet, regardless of the time of day or how many devices might be trying to access it. A reliable network is one that is, rarely, if ever, not functioning properly (operational 99.9% of the time). All districts indicated they put the necessary planning and funds into their wireless networks in order to support their large-scale technology initiative, but this did not guarantee that they would not have problems. Ethan, a former middle school principal from Washington, described his experience:

The first year or so we were addressing issues where it wasn't [very reliable]. In my own building, there seemed to be pockets where it didn’t work. The joke was that technology people wouldn't believe us. In my role, I go around carrying an iPad and I'm able to access things well. But there were definitely frustrations in the beginning. Sometimes with technology, people's views are “oh it's got to be the user, it worked fine when I was there”. Like when you take your car in, “It was making the noise earlier!”

Teachers can become frustrated when the wireless network is not working as they expect it to. Georgia, a technology integration specialist from Washington, validated this by saying, “When it doesn't work, it's a great excuse for a teacher. ‘It didn't work, I'm not doing it again, it messed up my lesson...’ The challenge for us is to get them to report that, so we can solve the problem.” Ethan stated, “Nothing can stall things more than a teacher who is willing to do things and suddenly [the Wi-Fi’s] not working [and the] kids can't access what they need to...”
Districts that do have robust and reliable networks believe that it helps gain acceptance for the initiative. Jim from Adams explained:

The wireless network is outstanding. We have one of the best. It was built to say whatever device we buy, whatever we put in kids’ hands, we’ll be ready for it. So the fact that teachers don’t have to worry about it going down or having access to certain parts of the building, although it’s not always perfect, just like anything networked, it has its moments, [but] the reliability makes people more willing to try to do things with technology because they know they're not going to be frustrated by it. I think that was really important. I talked to other districts whose people are frustrated, they cannot always get on the Wi-Fi, so maybe they're not as willing to try to build a lesson around it, you know.

According to Teagan, the director of academics from Madison, their network is down “no more than like a couple of times a year.” While in the planning stages of their high school building project, David, the superintendent from Jefferson, had heard from other superintendents about the importance of having a robust and reliable network. Swayed by their advice, he expressed to his project manager, “First and foremost, we are going to have the Autobahn in terms of [network] infrastructure and I'm not bending on that. If that means we don’t have 1:1, so be it. That was a non-negotiable.” As one final example, Tim, the former high school principal from Monroe said their network is “so powerful that it could accommodate like 40,000 users. Way more than we'll ever have. No issues with slowing down even with 900 computers in use every day.” While building a network capable of handling 40,000 users may be overkill, districts built reliable networks in order to increase the likelihood of gaining acceptance for the
initiative amongst teachers and students. John, the network manager from Washington, reaffirmed this by saying, “The way you have to look at it is the classes here are about 50 minutes long - so if you have a five minute wireless hiccup, 10% of your class is down.” Superintendents and technology leadership team members did planning and made the investments in the wireless network to try to minimize situations such as this.

**Discussion**

**Summary of Findings**

This multiple-case study provided a rich description of a variety of large-scale technology initiatives in five school districts. The four findings that were the results of this study are: (a) superintendents valued the capabilities and reliability of a device and were willing to pay more (within budget) for a device that had these qualities, (b) superintendents funded 1:1 initiatives by seizing one-time budget opportunities and through creative financial moves, (c) superintendents considered the financial sustainability of the large-scale technology initiative before committing to it, and (d) robust and reliable Wi-Fi networks were recognized as being critical to gaining acceptance by teachers for 1:1 initiatives. These findings generally supported the limited research that currently exists in the literature. The contributions to theoretical and practical knowledge that have resulted from this research will be discussed next.

**Contributions To Theoretical Knowledge**

The findings have shown a connection between frame theory and the decisions superintendents make surrounding technology infrastructure. This connection, however, did not follow the blueprint exactly as described by Benford and Snow (2000). The
actions of superintendents did not always reflect the three core framing tasks of diagnostic, prognostic, and motivational. All superintendents developed plans and goals for their large-scale technology initiative (prognostic framing), as well as communicated the rationale for the initiative to build support and create resonance (motivational framing), but the connection to diagnostic framing was not present.

Superintendents use strategic planning processes to secure funding for the large-scale technology initiatives. These strategic processes are necessary to overcome financial and political constraints that impact large-scale technology initiatives. Justifying a district-provided device (DPD) initiative to guarantee that all students have a device of equal capabilities, regardless of their socioeconomic status, would be consistent with diagnostic framing (identifying a problem and assigning blame based on an injustice). A summary of the 1:1 literature suggest that superintendents could be motivated to support a DPD 1:1 model to achieve greater equity and eliminate the “digital divide”, but only the superintendent from the Madison School District mentioned this. Instead, superintendents saw their large-scale technology initiative as a progressive move that was a rational choice given their views on the educational needs of their students, the district’s available funds, and their desire to make sure their graduates would be “college and career” ready.

Even though Bolman and Deal’s (2003) organizational theory was not employed as our theoretical framework for this study, there are aspects of our study that are consistent with their work. Bolman and Deal’s (2003) organizational theory views organizations through the four frames of structural, human resource, political, and symbolic. Our research showed the superintendent’s use of technology teams to help
with the decision-making process (structural frame); the enlisting of key players to help move the initiative forward (human resource frame); and the seeking of allies on the school committee and town finance committee (political frame). We did not collect data relative to the symbolic frame. While analyzing the data, it became apparent that a third theoretical framework would also have been an appropriate framework to help explain many superintendent actions related to technology infrastructure.

While there were strong connections to frame theory, bounded rationality theory may be an even more appropriate framework for this study. Bounded rationality theory states that decision-makers work under constraints; they have limited information, limited cognitive abilities, and limited time to make a decision (Jones, 1999). The rushed process to change from traditional computer labs to a 1:1 iPad initiative in Jefferson’s new high school building project is reflective of bounded rationality theory. Since David, the Jefferson superintendent, was only on the job for about a month when he made this important decision, he was certainly constrained by limited information and a limited amount of time. These important decisions are not necessarily poor decisions, but as David described their rushed process, “We’re definitely not the model for this.” In Jefferson’s case (as is the case in Washington and Monroe), it is too soon to make any judgment on the success or failure of the 1:1 initiative since they are only in their second year, but, despite the rushed process, David is very pleased with how the initiative is going so far:

It is going much better than I would have guessed. Knowing how we got to it, no buildup, no nothing, I’d say it’s going a hundred times better than I expected. Every class I just went into in that hour-long quick walk through I just did, every
class with the exception of two math classes were truly utilizing the iPads in
different ways. I’m seeing it used as a personalized tool. I couldn’t be happier
with how it’s working.

While Jefferson’s implementation of their 1:1 iPad program was consistent with bounded
rationality theory, the other four districts in the study did not indicate any concerns about
having a rushed implementation process.

Bounded rationality “asserts that decision makers are intendedly rational…but
because of human cognitive and emotional architecture, they sometimes fail, occasionally
in important decisions” (Jones, 1999, p. 297). Bounded rationality theory would lead us
to surmise that poor decision-making by a superintendent surrounding a large-scale
technology initiative could potentially lead to an initiative that does not achieve the goals
that the superintendent had intended. Researching large-scale technology initiatives that
have been abandoned, or can be shown through data to have not met the expectations of
the superintendent, would be an interesting area of further study to see if the principles of
bounded rationality theory were present.

**Contributions to Practical Knowledge**

The study results revealed that superintendents place importance on the quality of
the device they are purchasing. They did not express an interest in purchasing the least
expensive mobile device available. Superintendents see the value in devices that are
reliable and have the capabilities for which their teachers and students are looking. As
described in Chapter 4 (overall findings), superintendents also recognized the time
limitations of their technology support staff to support a large-scale technology initiative.
This is one reason why they were either looking for reliable self-managed devices, or for
students to bring their own device, which the district would not be responsible for supporting. The importance placed on purchasing a reliable device that has the capabilities they are looking for is consistent with the literature on the cost predictive tools known as Total Cost of Ownership (TCO) and Value of Investment (VOI) (Iansiti, 2012). When districts consider TCO, factors such as device reliability, software application costs, training costs, and the cost of adding additional technology support staff influence decisions regarding what technology infrastructure to purchase. VOI considers the additional factor of educational benefits that typically cannot be measured in terms of dollars. An educational benefit could be an increase in student engagement or improved achievement on state standardized tests.

The literature is fairly silent on the various ways that superintendents have funded large-scale technology initiatives. Most of the literature may give general descriptions of the various models for funding 1:1 initiatives (DPD, LTO, BYOD, or Blended), but the literature does not provide insight into the political maneuvering and creative financial moves that superintendents’ employ to gain acceptance of the initiative. This study offers superintendents who are contemplating large-scale technology initiatives, descriptions of some of the strategic processes that have been implemented in attempts to overcome the financial and political constraints that often are present in these initiatives.

Another interesting funding aspect that was revealed in this study was the role that money from state subsidized school building or renovation projects had in helping to initially fund aspects of the large-scale technology initiatives. The Madison, Monroe, and Washington school districts had portions of their Wi-Fi network infrastructure installed or upgraded as a result of building or renovation projects. The Jefferson School
District high school building project paid for the high school Wi-Fi network and approximately half of the iPads needed for their 1:1 initiative. Would the large-scale technology initiatives have been implemented without the financial assistance from the state subsidized building or renovation projects? This study does not answer this question, but investigating the influence of government subsidies on the proliferation of large-scale technology initiatives in schools is an area in need of further study. The Adams School District was the only one of the five initiatives that was not influenced by state funding for a building or renovation project.

The superintendents in this study all considered the sustainability of the initiative given the constraints they faced in their school districts. Planners can take away from this study the knowledge that there is no one single correct way to fund a large-scale technology initiative; they must identify the constraints that exist in their school district and develop a sustainable funding model most suited for the constraints that are present in their community. Interestingly, the four 1:1 districts we researched all entered into technology lease agreements with Apple. Leasing allowed the districts to receive a lot more technology up front and pay for the technology over a three or four-year period. Depending on the lease structure, at the end of the lease districts could either keep the technology or trade the equipment in to receive a reduced lease payment on new equipment. An Internet search showed that both Dell and HP computer companies offered lease programs to schools, but this study did not result in data that showed how their lease programs compared to Apple’s, or how many school districts purchased devices through their lease programs. An area for further study would be to investigate the success of the lease programs offered by other manufacturers. Is Apple’s success in
selling their products to the districts we studied the result of a better device, or is it the result of a better lease program, or both?

This study supported the previously published reports that emphasized the importance of having a robust and reliable network. The Project RED study from 2010 concluded that administrators believed the network could not be down for more than 30 seconds a day if teachers were going to feel confident integrating technology into their lessons on a daily basis (Greaves, et al., 2010). The small sample of superintendents and technology leadership team members that participated in this study were very clear that a robust and reliable network was a necessity for these initiatives to work. I believe one reason there is consensus on this issue is that too many have experienced the frustration that occurs when a wireless network is inoperative for any length of time and it is easy to imagine the difficulties that this would present to a teacher with a room full of students in front of them.

Recommendations

The four findings lead to several recommendations. These recommendations consider infrastructure, funding, and achieving acceptance for the initiative.

**Invest in the wireless network.** The first recommendation is for district leaders to make the necessary investments in their wireless networks to ensure that they are robust and reliable. The participants in this study echoed the literature that stressed the importance of building a reliable network in order to gain acceptance for the initiative from their teachers. Teachers are less likely to use technology if the wireless network or other infrastructure does not work when it is needed. The Wi-Fi network must be built for both coverage and capacity (sometimes referred to as density). Coverage refers to the
ability to get a wireless signal in all parts of the school building. This is clearly important, but it is worthless if the network is overwhelmed by the number of devices that want to access the network, or the size of the content that is being streamed from a particular location (capacity). Leaders should consider the following potential factors: (a) the network capacity must be greater in areas such as cafeterias, gymnasiums, libraries, and auditoriums, (b) Internet content (movies, videos, music, and games) that can be streamed on devices often require large amounts of bandwidth, and (c) students, teachers and guests will likely have more than one device that they want to connect to the Wi-Fi network. Schools can build networks that meet all of these needs, but there is a financial cost to do so which districts must plan for.

**Choose the right device for the job.** Most participants in this study downplayed the significance of cost as a deciding factor for the device that was selected (while still appreciating their budget constraints) and instead emphasized their desire to select a device with the capabilities they were looking for. Developing a device selection process that includes the input of students, teachers, and possibly even interested community members is likely to lead to greater acceptance of the technology initiative by all stakeholders. It is very possible that the ideal device could vary from one school to another based on the mission and vision of the particular school. Superintendents should also consider that the ideal device might vary by grade level. For example, teachers at the elementary level may place greater value on the ease of use of a tablet for their students over the convenience of a traditional keyboard that high school teachers might prefer. Superintendents that purchase devices that best suit the needs of teachers and students are likely to see greater acceptance of the initiative.
Consider lease-to-own initiatives. These study findings suggest the usefulness of lease-to-own (LTO) models in those school districts that do not believe they have the funds to sustain a 1:1 initiative. On the advice of their lawyer, the Madison School District created a non-profit agency to operate the district-sponsored LTO mobile device program; it is not clear if this was necessary to do. I would recommend that any school district that is considering such a program consult their own legal counsel, especially since laws vary among the states. The combination of parents paying for their own child’s device and the school district having some devices available in each classroom for those that do not participate in the lease program could lead to greater participation rates than a BYOD program alone. District-sponsored LTO programs also avoid the criticism of BYOD programs that they lack device homogeneity. Teachers can generally plan their lessons more easily when they know that all students will have the same device.

Plan with a focus on sustainability and equity. Superintendents should have a plan to sustain the initiative when the new equipment needs to be replaced. Lease programs seem to offer a pathway that permits sustainability for district-provided device 1:1 initiatives. The lease programs offered by computer manufacturers allow for school districts to receive all of the leased technology in year one, but spread out the payments over several years. Norman, the Adams superintendent, was able to frame the technology payments as being the equivalent of a utility payment — an expense that should not be subject to budget cuts. The superintendents in this study all believed that their initiatives were sustainable, but given the inability to forecast district finances years ahead, the initiatives that passed the cost of the technology onto the students had the greatest chance of sustainability. Large-scale technology initiatives that can accomplish this, while
making provisions for those families that lack the financial means, may have an easier
time creating buy-in from all stakeholders. Providing a free device, or at a reduced rate,
to students from lower income families, is one way to ensure that all students are
included in the large-scale technology initiative. If schools did not have the financial
means to allow school devices to go home with students, schools could still purchase
several extra devices for each classroom so that students that did not have their own,
forgot it at home, or it was broken, would still have access to technology. In order for
teachers to plan lessons that integrate mobile devices, they need to be assured that each
student will have access to a device each class period.

Conclusion

This study sought to answer the following three research questions: (a) What
factors are considered by superintendents in making decisions about technology
infrastructure? (b) What factors are considered by superintendents in making decisions
about funding the large-scale technology initiative? and (c) How did the technology
infrastructure or funding decisions have an impact on the perceived acceptance of the
initiative? I hope this multiple-case study was able to reveal instructive answers to these
questions in order to aid the technology infrastructure decisions of superintendents and
other district leaders. If present education trends continue, it is not “if”, but “when”, all
districts will be implementing large-scale technology initiatives of their own and it is
sensible to learn from the experiences of other superintendents.
Chapter Six

Discussion

Introduction

This chapter will summarize the key findings of this study and discuss the potential contributions of this study for practice and theory. The discussion will outline limitations of the study and the implications for future research. Finally, the research team will make recommendations from the results for superintendents pursuing large-scale technology initiatives in their districts.

Summary of Key Findings

The findings of this multiple-case study describe the many actions superintendents took to gain acceptance for technology initiatives in their districts. In addressing this research, the team assumed that superintendents are no longer asking whether it makes sense to move toward a 1:1 learning environment, but rather when and, most urgently, how. The study results provide assistance to district leaders as they work toward framing the implementation of a technology initiative. Additionally, this study begins to fill the current gap in the literature on superintendents as technology leaders by detailing how the five districts in the study gained acceptance for the technology initiatives in their districts.

Three central findings resulted from this study. The first finding was that superintendents achieved resonance through leadership actions that were consistent with

11 This chapter was jointly written by the authors listed and reflects the team approach of this project: Peter D. Cohen with Erik P. Arnold, Gina E. Flanagan, Anna P. Nolin, Henry J. Turner
prognostic and motivational framing. Achieving resonance is a sign of the effectiveness of the framing actions of the superintendents and all superintendents were able to gain acceptance for their initiatives.

The second finding was that superintendents considered constraints the initiative might face. These constraints were (a) financial, (b) political, (c) competing interests, and (d) technology support staffing. Understanding these constraints allowed superintendents to develop a structured plan for the technology initiative that took these constraints into account.

The third finding was that superintendents developed strategic processes to gain acceptance for the initiative. These processes were undertaken to either prepare for implementation or to create buy-in. The strategic processes that superintendents took to prepare for implementation were: conduct research, select equipment, identify key players, pilot devices, conduct professional development, and assess the capacity of the technology staff. The strategic processes that superintendents took to create buy-in were: communicate expectations for use and public relations efforts. Taken together, effective action by the superintendent in these areas helped to gain acceptance for the initiative.

**Summary of Thematic Studies**

The research team also conducted five thematic studies that address how superintendents utilized distributed leadership (Turner, 2014), instructional vision (Flanagan, 2014), professional learning communities (Nolin, 2014), technology decision-making (Arnold, 2014), and the superintendent’s use and attitudes regarding technology (Cohen, 2014). This section summarizes the findings of each of these studies.
**Distributed leadership.** Turner (2014) studied distributed leadership and its role in the acceptance of technology initiatives. While there were different methods of interaction in all districts, leadership was distributed in each district and required more than one person to gain acceptance of the initiative. With the exception of the superintendent of Washington, Brody, the superintendents relied on one person more regularly than the other members of the technology team to help gain acceptance of the initiative. This leader is referred to as the primary leader. While the superintendents identified one individual as the primary leader, there were additional individuals who played direct leadership roles in gaining acceptance of the initiative. Often the secondary leaders worked alongside the primary leader to gain acceptance of the initiative. Study results found that superintendents worked with a primary leader as well as secondary leaders to gain acceptance.

Superintendents worked with these leaders to discuss logistics and ensure effective communication with the stakeholders, be they parents, school committee members, or faculty. Superintendents typically interacted with primary and secondary leaders through institutional practices, such as meetings where they worked through explicit tasks.

**Instructional vision.** Flanagan (2014) studied the development of an instructional vision and how that process can help superintendents gain acceptance for a technology initiative. Our results indicated that the instructional vision of superintendents who have participated in a large-scale technology initiative is often connected to constructivist/21st century learning components such as: communication,
collaboration, creativity, student engagement, real world applications, and technology use.

In most of the districts who participated in this study, the superintendent’s instructional vision was not consistently re-iterated or emphasized in the district’s mission statement, technology plan or by district administrators. The development of the instructional vision in a large-scale technology district, did not involve all the district administrators who were identified as key players of the technology initiative (primarily technology support staff). In terms of how the superintendent connected his instructional vision with the technology initiative to all stakeholders, the superintendents utilized motivational and prognostic framing which helped to create acceptance for the technology initiative.

The articulation of the instructional vision in connection with the technology initiative by district administrators was inconsistent in each district. In many districts, the instructional vision was often defined as the technology initiative. The implementation and communication of the instructional vision in these districts, specifically as it pertained to the technology initiative, was often described as much more collaborative, involving all stakeholders. In terms of how district administrators made sense of the superintendent’s instructional vision for technology, district administrators felt that the superintendent’s leadership in defining and supporting the instructional vision for the initiative was very helpful in gaining acceptance. However, in this study, although most district administrators were inconsistent in their communication and understanding of the superintendent’s articulated instructional vision, they seemed to understand and accept technology’s place in the classroom.
**Professional learning communities.** Nolin (2014) studied professional learning communities and their role in the acceptance of large-scale technology initiatives. The findings confirm that PLCs, their constructs and collaborative structures in districts do serve to assist in the implementation of large-scale technology implementations in school systems, but largely at the central office strategic planning level. Superintendents created their own technology learning ecologies that functioned as PLCs for technology implementation teams, but did not necessarily “scale up” PLCs for district-wide technology learning.

Superintendents clearly expect collaboration and shared time to occur across the school systems with regards to implementing the technology initiatives, but varied in the degree to which they connected PLC constructs to support the technology initiative.

The term PLCs was not used as a part of the superintendent’s deliberate strategy to support technology implementation or gain acceptance. However, all five superintendents described expectations for *shared time, collaborative teams, an action orientation* and expectations for *continuous improvement* in their descriptions of educator work involving the technology implementation in their districts.

**Infrastructure.** Arnold (2014) studied the factors considered by superintendents in making decisions about technology infrastructure. The study results found that superintendents valued the capabilities and reliability of a device and were willing to pay more (within budget) for a device that had these qualities. A device (laptop or tablet) was considered reliable if it worked well for three to four years. Superintendents knew these devices would be transported to and from school daily and they wanted some assurance that the device could withstand this type of handling. Ease of use, long battery life,
multi-media recording, and compatibility with existing district technology were the
device capabilities most frequently mentioned by superintendents and technology
leadership team members. The other factor that was considered by superintendents was
the price of the device. This did not mean, however, that they chose the least expensive
device; in fact, no superintendent did this. Instead, superintendents discussed the value
they thought they were getting by purchasing a device that may have cost more, but
offered the capabilities and reliability that they were looking for.

The next two findings concern the factors that superintendents consider when they
are making decisions about how to fund a technology initiative. One finding is that
superintendents funded 1:1 initiatives by seizing one-time budget opportunities and
through creative financial moves. Technology funds that were available due to a state-
subsidized school building or renovation project helped fund four of the five technology
initiatives. The one exception to this was the Adams School District. They were able to
fund their 1:1 iPad initiative through a combination of creative financial moves that
included: transferring annual network infrastructure costs from the school budget to the
town budget, staff reductions, and cost savings in other areas of the high school
budget. The third finding is that superintendents considered the financial sustainability of
the technology initiative before committing to it. Each superintendent chose a large-scale
technology initiative that they felt was financially sustainable. For example, Washington
chose a BYOD program, Madison went with a Blended model, and Monroe chose a 1:1
laptop program. Each of these initiatives had very different costs associated with them,
but each superintendent indicated they were sustainable given their respective school
district budgets.
In seeking to find if the infrastructure decisions had an impact on acceptance of the initiative, we found that in order to gain acceptance by teachers for 1:1 initiatives, robust and reliable Wi-Fi networks were identified as being critical. Technology leadership team members in each district indicated that if teachers considered the network unreliable, they would be less likely to integrate the technology into their lessons.

**Superintendent’s use and attitudes regarding technology.** Cohen (2014) described how superintendents and other district leaders use technology in their practice as well as exploring the leaders’ attitudes about technology. All of the superintendents in this study and all other district leaders involved in the technology initiatives used technology in their everyday practice. The leaders in this study describe using technology for two main purposes in their professional practice: communication and collaboration. While the data indicates that nearly all superintendents and district leaders are using technology for communication, the data are inconclusive about any connection between the superintendent’s use of technology and gaining acceptance for a technology initiative.

While the *use* of technology by superintendents and other district leaders is variable, the overall attitudes about technology amongst the five superintendents indicated commonalities. First, the superintendents and other district leaders indicated that technology was an important tool for instruction. Second, leaders in each district discussed the helpfulness of technology in preparing students for college and careers. Third, there was also an indication that superintendents wanted their districts to be on the cutting edge as innovative school districts, not behind the curve, but proactively inserting the tools students will need in the future.
Every superintendent we interviewed was pleased that his district had moved toward deeper involvement with technology in the classroom. This attitude appears to have more of an impact on the acceptance of the technology initiative than the superintendent’s use of technology. In other words, while there is no direct correlation between the uses of technology by superintendents, the superintendent’s attitude about technology is a strong factor in gaining acceptance for the technology initiative. Ultimately it is the superintendent who needs to make the case for the funding and sustainability of the initiative.

**Discussion of Findings**

This section will highlight the contributions this study makes to theory and practice as well as the relevance of this study to the literature.

**Theoretical Contributions**

Frame theory identifies three core steps to framing that include diagnostic framing which identifies a problem; prognostic framing, which identifies a solution to the problem; and motivational framing, which creates a call to action through communication to solve the problem (Benford & Snow, 2000). The study results add to the complex dynamic of framing social movements. The framing process is not linear when applied to gaining acceptance for technology initiatives in schools. The study results indicate that it is not even necessary to gain acceptance for a technology initiative by first identifying a problem. In the district of Adams, for example, Paul, who was the high school principal as well as the primary leader of the technology initiative, made the case to Norman, the superintendent, that every student in the high school needed a mobile device. Paul did
not first identify a problem rather he made the case for the goal of integrating more technology into his school.

Elements of frame theory were present in each of the five districts researched for this study. More specifically, motivational and prognostic framing and the utilization of strategic actions to build resonance (Benford & Snow, 2000) were in place as superintendents worked to gain acceptance for the technology initiatives. The study results highlight the importance of effective communication when seeking to gain acceptance. Superintendents in this study needed to convince all key stakeholders – teachers, parents, and community – in order to create resonance by making the case for the importance of the technology initiative.

This study makes an important contribution to frame theory by highlighting the mix of leadership actions and effective communication that can help a superintendent gain acceptance for a technology initiative. Additionally, the data of this study indicate that motivational framing can help leaders successfully create resonance for an initiative and overcome constraints.

**Lack of Diagnostic Frame.** Only Bob, the Superintendent from the Madison School District looked at that district’s technology initiative through the lens of diagnostic framing. He saw the majority of his rural student population without computers at home and without Internet access. Of note is that numerous studies have actually shown robust home computer and Internet access amongst low-income students in this rural area of the state. Bob’s personal view for the students in his district was that access was a problem. According to Bob, getting the students in Madison a computer was not enough: “the reality of how you’re going to get high speed internet to, you know,
roughly less than ten thousand people over two hundred and five square miles is pretty difficult.” The Madison superintendent identified a problem and put a plan in place to solve that problem. The superintendents in Adams, Jefferson, and Monroe did not identify a problem that they saw technology as the solution, rather, as the Jefferson superintendent indicated, “It was less about solving a current problem, it was more about the future and giving us a fighting chance to be ahead of the curve for once.” This leads us to consider if it is even necessary for there to be an educational problem for which a technology initiative is seen as the solution. Could it be that increasing student access to technology through a 1:1 initiative is seen as an educational innovation that does not require diagnostic framing? In hindsight, however, the superintendents in Washington, Adams, Jefferson, and Monroe identified the lack of 1:1 technology in the hands of students as a problem. The problem was access to technology either because students did not have technology at home, as in Madison, or because demand for using technology in school outpaced supply of computer labs and carts of laptops. While nearly all of the districts skipped over the step of assigning blame as identified as part of diagnostic framing, they did seek to remedy the issue of access to technology.

**Resonance.** Frame theory tells us that the goal of resonance is reached when the framing actions of a leader sway the beliefs of others thus creating movement for an initiative. In this study, resonance meant that the superintendent evoked a connection or shared feeling that the technology initiative was important for the district. Our findings indicate that the superintendents in this study sought resonance through their leadership actions. However, in some cases, it took the primary leader of the initiative to first achieve resonance with the superintendent before the initiative could move forward.
Resonance is essential to gain acceptance. Figure 5 indicates that the effective countering of constraints by strategic processes leads to resonance. The leadership actions of superintendents and other district leaders were a function of their efforts to solve a problem – prognostic framing, and initiate a call to action – motivational framing. These actions work to overcome any constraints that an initiative may face and eventually lead to resonance. The study results indicate that resonance then builds acceptance.

Figure 5. Strategic processes are a function of prognostic and motivational framing and they work to counter constraints. If successful, this leads to resonance. Adapted from, “Framing Processes and Social Movements: An Overview and Assessment,” by R. D. Benford and D. A. Snow, 2000, Annual Review of Sociology, 611-639.

Our study reinforces this idea and indicates that it may be that resonance is achieved in small ways and ripples out to others. Having the superintendent frame the initiative seems to be an essential step in achieving resonance. Benford & Snow (2000) teach us that the more resonance moments that occur in a movement, the more likely it is for a
movement to gain momentum. Resonance leads to a higher rate of buy-in amongst key stakeholders. In our study the district leaders were able to take the necessary steps in their specific situations to connect the technology initiative to student learning and create positive support for technology in the hands of students.

At the commencement of this study, we were unaware of any published research on the role of the superintendent as technology leader, although the literature indicated that school districts purchase technology devices for the purpose of student learning. There are ongoing studies examining the impact of 1:1 learning environments on student achievement. However, none of these studies specifically looked at the leadership actions taken to gain acceptance for these technology initiatives. With the lack of existing studies on superintendents as technology leaders, it is challenging to determine strong connections to the literature. However, this study does add to the existing literature on instructional leadership and the few studies on technology leadership that have been conducted.

Honig (2006) describes the role of district leaders as boundary spanners. Her research indicates that district level leaders serve as boundary spanners in schools as they search out strategies for reform in other arenas and bring them back to the district. Honig also argues that it is the superintendent who can support boundary spanners in their districts in order to increase their potential as levers of change. This is a shift from the traditional leadership model of top-down leadership to a relationship where the superintendent supports the schools in making key decisions about how to improve student learning. This idea was confirmed by our study, as we found the superintendent
supported the primary leader of the technology plan, which led to acceptance for the technology initiative.

At the commencement of this study there were no known research studies with a focus on the role of the central office in implementing technology initiatives. The only existing research focused on the role of the superintendent and central office in implementing instructional initiatives. When considering the existing literature on implementing instructional initiatives in schools, our findings indicate that similarities do exist between how superintendents successfully implement instructional initiatives and technology initiatives. With or without a technology component, similar patterns exist of collecting evidence, making sense of the evidence for stakeholders, and building capacity throughout the district to accept the large-scale technology initiative.

Each of the districts in this study went through a process of gathering evidence from other arenas and other districts to be able to make the best decisions for their individual circumstances. The difference in the case of technology initiatives is that there is not the assessment data that districts may rely on for instructional initiatives.

Coburn, Tourre & Yamashita (2009) defined sensemaking in the central office as leaders understanding evidence and enacting its use within a school district. This step allows district leaders to make their interpretations of the data and think about how it impacts their district. Brody, the superintendent in Washington was the primary leader of the technology initiative. The findings of this study indicate that the superintendents in Adams, Jefferson, Madison, and Monroe were persuaded by the primary leader of the technology initiative and in turn able to make the case for key stakeholders in order to gain acceptance. Once the primary leader was able to gain acceptance from the
superintendent in these districts, the superintendents then became integral to framing the initiative for all key stakeholders. Superintendents also needed to ensure that professional development opportunities were available to staff. Furthermore, superintendents had to address public relations issues to gain the support of the community and the school committee. This reinforces the research on capacity building as indicated in our review of the literature.

As noted, Spillane and Thompson (1997) found that capacity building requires investing in two critical forms of capital: human capital and social capital. Human capital is based upon the knowledge base of the people within the organizations and that the leadership has the knowledge, not only of the initiative, but also to teach people about the initiative. Social capital comes in the form of the trust and collaboration among educators within the district and the ability of the district to gain support from consultants outside of the district. If districts have the robust investment in human and social capital, the stakeholders are more apt to accept the initiative (Mulford, 2007; Spillane & Thompson, 1997). Frame theory and in particular, motivational framing as described in this study supports this investment in human and social capital. Without this investment, the superintendents in this study would not have been able to achieve resonance for the technology initiative. This study confirms that capacity building needs to be in place for technology initiatives in the same way it is necessary for instructional initiatives not involving technology. Superintendents in this study either took on the role of teaching stakeholders about the importance of the technology initiative or designated another district leader to perform this task.


**Recommendations for Practitioners**

The study results describe leadership actions that lead to gaining acceptance for large-scale technology initiatives. Districts that have not already implemented a large-scale technology initiative will benefit from this study by customizing our findings to their idiosyncratic situation and needs. These actions include the strategic processes that leaders took as outlined in the findings described in Chapter 4. Urban districts, districts that have more significant achievement gaps, or districts that face additional obstacles than described in the five districts of this study will need to adapt the recommendations to their own situation. For example, technology may be framed as the solution to differentiate instruction and close achievement gaps. Key to gaining acceptance is to identify key stakeholders and effectively communicate the importance of the technology initiative. These actions are intended to create resonance and support for the technology initiative, in turn leading to acceptance.

**Prepare stakeholders for the initiative.** All districts planned carefully for the implementation of their technology initiative. Districts that are currently in the planning process for a technology initiative can conduct a self-assessment or technology audit of their current level of technology by making comparisons to the districts in this study and others that have gained acceptance. Securing funding, identifying key players, and selecting which implementation model to pursue are all necessary steps in the process. Superintendents will need to both lead the public relations efforts and frame the initiative in order to get buy-in, or entrust this to a key leader in the district.

**Communicate to key stakeholders.** A highlight of our study was the necessity for effective superintendent communication, if support for the initiative was to grow
among all stakeholders. Superintendents or their designee need to be thoughtful and proactive in developing a public relations plan to be able to gain widespread support for the initiative. This study highlights different approaches to gaining acceptance taken in the five districts. But independent of the individual circumstances, we found that by framing the initiative, planning to deal with anticipated constraints, and strategically taking action a superintendent is well equipped to gain acceptance for a large-scale technology initiative.

**Hire and empower technology leaders.** Superintendents may or may not be the primary technology leader in the district. However, this study indicates the importance for superintendents to either identify the technology leaders in the district to lead this initiative or hire the right leaders for district-level and building-level positions. While acceptance of a large-scale project does depend on highly developed technical knowledge, we found that the superintendent need not possess technical expertise, so long as others in his administration or faculty do.

**Anticipate obstacles.** With federal and state departments of education implementing technology recommendations and mandates for districts, including online student assessments, an increase of funding for school districts is recommended. All of the superintendents in this study described some of the obstacles faced while trying to implement the technology initiatives in their districts. In addition to following the strategic actions that led to the superintendents in this study successfully gaining acceptance, it is recommended that uninitiated superintendents use this study to identify obstacles (constraints) they may encounter. The constraints that the superintendents in this study had to deal with are listed in the findings section. These constraints include
financial constraints, political constraints, competing interests, and staffing constraints. While our list is undoubtedly not exhaustive, it will offer leadership an opportunity to plan ahead to be able to address staffing issues, financial hurdles, or a political climate that may stand in the way of acceptance. Additionally, as superintendents across the country deal with mandates from a federal, state, and local level, our results indicate that the competing initiatives negatively impact the rollout of a technology implementation. It is therefore recommended that the number of initiatives be prioritized and, when possible, reduced in order to put as much focus on the implementation of the technology initiative as possible.

Limitations

Embedded in the considerations for future study are some of the limitations of this study. Among the limitations of this study is the limited scope and number of districts included. By expanding both the number of districts and including a wider spectrum of districts, there could be more generalizability of the results. Another limitation is the lack of urban districts and larger districts than the five districts in this study. Interviews were conducted of superintendents and the district and building-level leaders identified by the superintendent in each district. Participants who were identified by the superintendents to take part in our study may have been skewed to support the superintendent. Participants who weren't identified by the superintendent to participate in this study may have been hesitant to speak freely.

This study did not interview teachers, students, or parents or examine the impact of 1:1 learning environments on student achievement. In addition, this study did not quantify the use of technology in classrooms and by students in the five districts that
participated in this study. Nor did this study include districts where a large-scale technology initiative was attempted, but did not gain acceptance.

**Considerations for Future Study**

Taken collectively, the findings of this study as well as its limitations suggest several areas for possible future research. For example, a follow-up study could focus on the use of a diagnostic frame. Our study had just one district, Madison, where the diagnostic frame was explicitly utilized. Interestingly, this district had the lowest per capita income of the five districts in our study (bottom third in the state). To explore this possible connection between income level and the superintendent’s use of diagnostic framing, a further study should include a larger sample of school districts from communities with lower income levels (whether they are urban, suburban, or rural). A study that focuses on districts where the diagnostic frame was utilized to gain acceptance may result in different outcomes. We argue that how superintendents frame a large-scale technology initiative matters in terms of gaining acceptance. However, with only one district of five that utilized diagnostic framing, a study with a larger sample would enhance our research and the existing literature.

As noted, one limitation of this study is the number of districts studied. Due to time constraints, this study focused on five districts. These districts consisted of four suburban districts and one rural district. Further research should study the similarities and differences of large-scale technology initiatives in rural, urban and suburban school districts. The five districts in this study demonstrate that there are different approaches to framing initiatives while moving towards a 1:1 learning environment. While these
conditions may limit the legitimate generalization (Bem 2003) of the data, it is our belief that the data of this study can in fact be useful to districts of any size and in any location.

This study described the leadership actions in five districts that have gained acceptance for their technology initiative. This study did not, however, include any counter examples—districts where the technology initiatives were not supported. Therefore, a limitation of our study is that we are unable to estimate the role frame theory might play in a district that did not gain acceptance or where district leaders were unable to create resonance for the technology initiative. For example, in a study of districts where a technology initiative did not gain acceptance, we could examine the specific constraints district leadership faced.

Our study had a limited sample size of Bring Your Own Device (BYOD) districts. Future studies of BYOD districts could examine resources invested in technology and if technology use in classrooms is a lesser priority than in a school with district-funded devices.

While this study was focused on the leadership actions taken to gain acceptance for large-scale technology initiatives, future research could examine the impact of 1:1 learning environments in these five districts.

According to the research conducted for this study, there are a variety of approaches that can be taken when implementing a large-scale technology initiative. The study results highlight the many constraints superintendents face as they try to implement a technology initiative. These constraints included funding and competing initiatives. A related area of research would be an analysis of federal and state initiatives that interfere with time that could otherwise be utilized for professional development related to
technology initiatives. Thus another related research topic could be the lack of funding that is missing from state and federally mandated initiatives in education. Without sustained funding, large-scale technology initiatives are at risk of failing after the initial budget is exhausted. This study highlights the creative ways in which districts are funding technology initiatives. If assessments of the Common Core are to be electronic and the national and state departments of education continue to push more technology in schools, a funding structure will need to be developed so that there is equity amongst all districts.

Another area for future study is to interview teachers in the districts that gained acceptance for technology initiatives. Our study did not measure the degree of resonance that was achieved in each district. This study was focused on leadership actions that led to acceptance for the technology initiative. This study defined acceptance as mobile devices in the hands of students. The study did not describe or investigate the rate of integration of technology into the curriculum. One possible future study would be to look at one or more of the districts studied here and include interviews of teachers, students, and parents with a focus on resonance rather than leadership actions. Such a study would be able further the research on instructional initiatives.

**Conclusion**

This study was conducted to help district leaders frame the implementation of a large-scale technology initiative for the purpose of gaining acceptance, and to contribute to the limited body of research detailing how leaders of organizations gain acceptance of a large-scale program, such as a 1:1 device initiative. The research team also conducted five thematic studies that address how superintendents utilize distributed leadership
(Turner, 2014), instructional vision (Flanagan, 2014), professional learning communities (Nolin, 2014), technology decision-making (Arnold, 2014), and the superintendent’s use and attitudes regarding technology (Cohen, 2014). While all five research areas presented some very unique findings relative to the area of study that are found in each individual chapter, they also uncovered two common themes across these five spokes.

**Superintendents’ interaction with others.** Whether implementing an instructional vision, developing professional learning communities or making decisions regarding the technology infrastructure, all superintendents in this study relied on interactions with district administrators and communication with all stakeholders to help gain acceptance of their large-scale technology initiative. As the study on distributed leadership concluded, superintendents relied on primary leaders/key framers of their district administrative team to develop and implement their technology initiative in all areas of the five individual studies.

**The development of strategic processes.** As outlined in this study, superintendents utilized a variety of strategic processes in connection with prognostic and motivational framing to generate acceptance of their technology initiative. Across all spokes of this study, superintendents identified district-wide issues related to the individual focus areas and charted out strategic plans to help address these issues. In preparing for the initiative, the instructional vision, professional learning opportunities, leadership teams, technology infrastructure and communication avenues were all considered as elements necessary to build buy-in for the initiative. These focus areas were continued throughout the implementation phase of the initiative.
Additionally, the strategic process of developing professional learning opportunities related to the initiative was also interwoven within the five spokes. Professional development focused on advancing the instructional vision of the district, and involved the assistance of primary leaders/key framers, took into account the technology tools and infrastructure of the district and was communicated by the superintendent through various avenues including social media, blogs, newsletter and the district website.

The study focuses on the leadership actions that superintendents employ when working to gain acceptance of a technology initiative. The study results show that the superintendent’s framing of the technology initiative and strategic actions that are utilized throughout the initiative are vital to developing resonance, and ultimately acceptance by stakeholders.

This descriptive study of five school districts that have each gained acceptance for a large-scale technology initiative serves to inform leadership actions for district leadership considering a 1:1 learning initiative. A 2010 white paper from the Massachusetts Department of Elementary and Secondary Education states, “The superintendent has the responsibility to initiate and guide the transformation of the teaching staff from instructor/lecturer to mentors and guides who effortlessly utilize technology whenever it is appropriate and beneficial.” There is a movement across all levels of education to put mobile devices in the hands of students. This study earnestly begins what we predict will be a growing body of research to better serve, inform, and evolve future implementations of large-scale technology initiatives.
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12 Authors: Erik Arnold, Peter Cohen, Henry Turner, Anna Nolin, Gina Flanagan


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doi:10.1080/14759390000200099


doi:10.1080/13598660802232779.


doi:10.3102/00028312040004807


Appendices

Appendix A: Letter Inviting Accessible Population to Interview via Phone

Dear (name of person):

We are writing as current doctoral candidates in the Boston College PSAP program to invite you to participate in our dissertation research. The purpose of this study is to increase the knowledge about how superintendents make decisions and go about the process of gaining acceptance for large-scale technology initiatives in their school systems. We seek to uncover descriptions of superintendent leadership that bring about successful technology implementations. We invite you to signal your willingness to participate in our study by completing a 15-minute phone interview. The interview asks you some initial questions about your experiences.

If selected as a potential candidate for this study, you will be contacted to schedule a 1 hour interview with one of the five research team members at a location convenient for you, sometime during August-October. You will also be asked to sign the attached Consent to Participate form, and possibly to review the interview transcript sometime during September-October.

Participation in the research is voluntary, and you may withdraw at any time. Your responses will be confidential. The phone interview must be completed by August 15, 2013. To agree to participate, please email Anna Nolin at annanolin@aol.com. She will then send you the letter of consent required before the phone conversation can begin. If you have any questions about the study or the participant selection, please contact the principal investigator, Anna Nolin, annanolin@aol.com.

With respect,

Boston College EdD Candidates Class of 2014
Appendix B: Questions for Superintendents in Initial Phone Screening

Interviews for Site Selection Purposes

1. What type of 1:1 initiative is in place? (design, grade levels) Were you the superintendent at the time of the 1:1 initiative’s inception? How long has the 1:1 initiative been in place?

2. Is there a goal for technology use in a district plan that is related to an instructional vision?

3. Do you use social media to communicate with your school constituencies?

4. Was the use of a leadership team a critical part of the technology implementation process?

5. Does the district rely on a collaborative culture or professional learning communities (PLCs) to assist with program implementation efforts or with professional development?

6. Would you be interested in being interviewed for a study of superintendent leadership that inspires 1:1 implementations?
Appendix C: Consent to Participate in Phone Interviews (Superintendents)

You are being asked to participate in a research study titled Framing Innovation: What do Superintendents do to Gain Acceptance of Large-Scale Technology Initiatives?

You were selected to participate in this project because you are a superintendent who is implementing or has recently implemented an accepted large-scale technology implementation.

The purpose of this study is to discover, describe and explain the actions superintendents take to gain community and staff acceptance of such a technology implementation in their schools systems.

This portion of the study will be conducted through a brief six-question phone interview. This interview should take you approximately fifteen minutes to complete. There are no direct benefits to you, but you may feel gratified knowing that you helped further the scholarly work in this research area. You will not be compensated for the time you take to complete this survey. There are no costs to you associated with your participation. This Principal Investigator will exert all reasonable efforts to keep your responses and your identity confidential. In any sort of report we may publish; we will not include any information that will make it possible to identify you as a participant. Research records will be kept in a locked file in the home office and secured computer of the principal investigator of the team. All electronic information will be coded and secured using a password-protected file. Please note that regulatory agencies, the Boston College Institutional Review Board, and Boston College internal auditors may review research records.
Your participation is voluntary. If you choose not to participate it will not affect your relations with Boston College. You are free to withdraw or skip questions for any reason. There are no penalties for withdrawing or skipping questions.

If you have questions or concerns concerning this research you may contact the Principal Investigator, Anna Nolin at annanolin@aol.com.

If you have questions about your rights as a research participant, you may contact the Office for Research Protections, Boston College, at 617-552-3345 or irb@bc.edu.

This study was reviewed by the Boston College Institutional Review Board and its approval was granted on xxxxxx.

If you agree to the statements above and agree to participate in this study, please press the “Consent Given” button below.
Appendix D: Consent to Participate in Interview

Boston College Lynch School of Education

Informed Consent for Participation as a Subject in:

Framing Innovation: What do Superintendents do to Gain Acceptance of Large-Scale Technology Initiatives?

Investigators: Erik Arnold, Peter Cohen, Gina Flanagan, Anna Nolin, Henry Turner

PSAP EdD Candidates Class of 2014

Type of Consent: Adult Consent

Introduction

You are being asked to be in a research study to increase the knowledge about how superintendents make decisions related to large-scale technology initiatives.

You were selected as a possible participant because you are a superintendent who has recently taken a school district through a large-scale technology implementation which was accepted by your school district community. We ask that you read this form and ask any questions that you may have before agreeing to be in the study.

Purpose of study

The purpose of this study is to understand how superintendents implement large-scale technology initiatives and go about the process of gaining acceptance for these projects in their school systems. We seek to uncover descriptions of superintendent leadership that brings about such successful technology implementations.

The total number of participant districts in the study is expected to be five.

Members of the research team do not have any financial interest in the study.
Description of the Study Procedures

If you agree to be in this study, we would ask you to do the following things: participate in a 1-1 ½ hour in-person interview. In addition, you will be given the opportunity, if you choose to do so, to review the interview transcript for accuracy; it is estimated that this will take approximately 1 hour.

Risks/Discomforts, Benefits of Being in the Study

There are no reasonable foreseeable risks to participation. There are no direct benefits to you from participating in the study. However, the findings may be useful to school leaders, school boards and superintendents, school districts and schools of education as they prepare administrators for school district leadership positions, and preparation programs.

Payments/Costs/Voluntary Participation

Your participation in this study is completely voluntary. There is no penalty for not participating. There are no payments to you, nor costs to you to participate in the study.

Confidentiality

The records of this study will be kept confidential. In any sort of report we may publish, we will make every effort not to include any information that will make it possible to identify a participant. Research records will be kept in a locked file in the home office and secured computer of the principal investigator of this study team. All electronic information will be coded and secured using a password protected file. Audio tape recordings will be held by the individual interviewer until a transcription has been completed and confirmed for accuracy. Those interview recordings will then be destroyed.
Access to the records will be limited to the researchers; however, please note that the Institutional Review Board and internal Boston College auditors may review the research records.

**Voluntary Participation/Withdrawal**

Your participation is voluntary. If you choose not to participate, it will not affect your current or future relations with the University. You are free to withdraw at any time for whatever reason. There is no penalty or loss of benefits for not taking part or for stopping your participation. You will be provided with any significant new findings that develop during the course of the research that may make you decide that you want to stop participating. In addition, if you are selected for the interview, you may refuse to answer individual questions but continue with participation in the study.

**Dismissal From the Study**

The investigator(s) may withdraw you from the study at any time for the following reasons: (1) withdrawal is in your best interests, (2) you have failed to comply with the study requirements, or (3) the study is terminated.

**Contacts and questions**

The researchers conducting this study are current doctoral students in the PSAP program at Boston College: Erik Arnold, Peter Cohen, Gina Flanagan, Anna Nolin and Henry Turner

For questions or more information concerning this research you may contact the principal investigator, Anna Nolin annanolin@aol.com.
If you have any questions about your rights as a research subject, you may contact:
Director, Office for Research Protections, Boston College at (617) 552-4778, or
irb@bc.edu

**Copy of Consent Form**

You will be given a copy of this form to keep for your records and future reference.

**Statement of Consent**

I have read the contents of this consent form and have been encouraged to ask questions.

I have received answers to my questions. I give my consent to participate in this study. I have received (or will receive) a copy of this form.

**Signatures/Dates**

Study Participant (Print Name)______________________________________________

Participant Signature______________________________________________________
Appendix E: Interview Protocol & Guide

Notes to Interviewer

This interview guide is intended to provide consistency among interviewers using an exploratory format. Our goal is to explore the domains revealed in the literature to review under the categories of prognostic framing and collective action framing, and also under our individual spoke areas of interest: instructional focus, distributed leadership, strategic decision-making regarding technology, identify new domains. Further, the goal is to break those domains down into component factors and subfactors, within the context of each individual participants’ situation. The tone of the interview should be conversational, informal and feel as though the participant has been asked to tell you a story; please employ an interviewer-as-listener approach. Stay alert and engaged in the discussion and respond with agility to turns in the conversation, the needs for further exploration, the participant’s body language and facial expressions. Please take field notes while you are conducting the interview. Field notes should include any relevant body language, non-verbal cues, meanings of phrases, silences, pauses, etc. that may have impact on the line of questioning. These notes should be included in the NotesPlus App used for voice recording so the notes and the audio files travel in a unified fashion.

Tips for using the guide:

• Be responsive to the cues of the participant and be flexible about asking questions in a different order.

• Skip questions if the topic has already been covered.

• Ask probing follow-up questions to elicit richer, more thoughtful answers, and ask about topics the interviewee has not yet voluntarily identified.
• Respond to signals of reluctance if the participant seems to want to skip questions or end the interview.

• Do not solicit private information that is not related to the research question, and will dissuade revelation of irrelevant personal information if it happens spontaneously.

• If participants continue to talk after the recording device is turned off, ask permission to continue to record or to take notes to include the additional pertinent information.

• Limit your own discussion, affirmation of responses, and interaction with the subject save to establish and keep rapport.

• Keep a laser-like focus on the subject, the questions related to the central phenomenon and related sub questions.

• Participants must not be manipulated to respond to questions in a particular fashion.
Superintendent Interview Protocol

Thank you for agreeing to participate in our study.

My name is ______________ and I am one of five Boston College doctoral students conducting a study of district leaders and how they gain acceptance for a large-scale technology initiative.

First, let me explain the project.

The purpose of this study is to study how district leaders and teams gain acceptance for large-scale technology initiatives in their school district communities. We will also explore leadership distribution, strategic planning, communication modes, and the instructional and learning organization features of these districts to determine the relationship between leader actions and these constructs.

At the conclusion of this study we will prepare a report. We are happy to send you a copy of that report if you are interested. Shall we send the report to your email at ____________________________? YES NO

Now, a little about the interview.

As a team we are interviewing approximately five participants.

We have several questions that we are asking all participants; I will try to pace the interview so that we can conclude within one hour. Please understand that your responses are completely confidential. If we use a quote in our report, we will make sure it is not attributable to any particular interviewee.

All questions are optional – if there is any question you want to skip or if you want to stop the interview at any time, just let me know. I plan to take notes while we are talking; is it OK if I also record the interview for transcription?
Do you have any questions before we begin?

We are going to begin by asking you some questions regarding your views on instruction. For the purpose of this study, instructional vision will be defined as the instructional and organizational practices, theories, philosophies and beliefs that lay the foundation to achieving educational goals. We will also be asking you questions on how these views relate to your views on technology.

1. What is your vision for teaching and learning in your district?
   a. How was this instructional vision developed (what was the process, who was involved)?
   b. What is your role in supporting the instructional vision?

2. What evidence is there of the instructional vision taking shape throughout your district (resources, programs, PD, etc.)?

3. What role do you think technology ought to play in teaching and learning?
   a. How is that communicated to all stakeholders (leadership team, teachers, students, parents)? Please explain.

4. Where did the idea of developing a 1:1 program come from? (policy window/strategic alignment)

5. What problem did you hope to solve by implementing the 1:1 or BYOD program in your district.

6. Please describe the technology initiative in its current state.
   a. What initiatives were also being implemented at the time of the technology implementation (to determine co-implementation)?
7. Who did you need to convince to get buy-in and how did you go about this?

8. Who helped you lead the district through this technology initiative?
   a. Why did you choose to work with these people?
   b. How did you know who you wanted to work with?
   c. What was it like to work with these people?

9. What did working with these different people look like?
   a. How did you choose to work with them individually or in a group?

10. In what ways did these people work with each other to implement the plan?
    a. Did you have a role in helping people work together?
    b. How did you know what they were working on?

11. What factors did you consider when determining how to fund the technology initiative? [possible responses: sustainability, SES of families in the district, political pressure, school budget]

12. How, if at all, did the funding design impact the acceptance of the 1:1 initiative?

13. What were the main reasons that led you to choose this specific mobile device? (not applicable if BYOD) [Possible responses: cost, reliability/durability, brand reputation, included support from the vendor, free or packaged software applications, warranty, battery life, photo/video capabilities, ease of use, portability]
   a. How did the mobile device that was chosen (or BYOD program) impact the use of the device among teachers & students?

14. Describe the reliability of your wireless network and how it has impacted the 1:1 initiative.
15. How did the capacity of your existing technology staff to support the initiative figure into your decision-making? [possible responses: limited staff, adequate staff, could/could not hire more]

16. Describe structures that exist in the district around educator collaboration--formal and informal related to teaching and learning.
   a. What are your expectations around collaboration--collaborative culture--structured collaboration around teaching and learning and how is that embedded in the culture?
   b. How is educator collaboration related to technology implementation?
   c. Related to implementation of any educational innovation in general, are there expectations for educator collaboration?

17. Does the collaboration of teachers play a role in the implementation of the technology initiative? Is there formal time set aside for teachers to collaborate?

18. What technologies are most important to your job? What do you actually spend the most time using? What about at home?
   a. Follow up with specifics about blogs and social media

19. What are the benefits of these technologies that you mentioned? What complaints do you have?

20. How does your district support technology use? What’s your role?
   a. What training, activities, actions or documents helped to ease the implementation of this initiative in your system?

21. How do you feel about the direction your district is taking in regard to technology? Are these views you have shared with others?
22. In hindsight, would you have done anything differently with the implementation of the 1:1 initiative?

23. In what areas were you hoping this initiative would help your district?
Non-Superintendent Interview Protocol

Thank you for agreeing to participate in our study.

My name is ______________ and I am one of five Boston College doctoral students conducting a study of district leaders and how they gain acceptance for a large-scale technology initiative.

First, let me explain the project.

The purpose of this study is to study how district leaders and teams gain acceptance for large-scale technology initiatives in their school district communities. We will also explore leadership distribution, strategic planning, communication modes, and the instructional and learning organization features of these districts to determine relationship between leader actions and these constructs.

At the conclusion of this study we will prepare a report. We are happy to send you a copy of that report if you are interested. Shall we send the report to your email at _________________________________? YES NO

Now, a little about the interview.

As a team we are interviewing approximately five districts.

We have several questions that we are asking all participants; I will try to pace the interview so that we can conclude within one hour. Please understand that your responses are completely confidential. If we use a quote in our report, we will make sure it is not attributable to any particular interviewee.
All questions are optional – if there is any question you want to skip or if you want to stop the interview at any time, just let me know. I plan to take notes while we are talking; is it OK if I also record the interview for transcription?

Do you have any questions before we begin?

We are going to begin by asking you some questions regarding your views on instruction.

For the purpose of this study, instructional vision will be defined as the instructional and organizational practices, theories, philosophies and beliefs that lay the foundation to achieving educational goals. We will also be asking you questions on how these views relate to your views on technology.

1. What is the vision for teaching and learning in the district?
   a. How was this instructional vision developed (what was the process, who was involved)?
   b. What is your role in supporting the instructional vision?

2. What evidence is there of the instructional vision taking shape throughout the district (resources, programs, PD, etc.)?

3. What role do you think technology ought to play in teaching and learning?
   a. How is that communicated to all stakeholders (leadership team, teachers, students, parents)? Please explain.

4. Where did the idea of developing a 1:1 program come from? (policy window/strategic alignment)

5. Please describe the technology initiative in its current state.
a. What initiatives were also being implemented at the time of the technology implementation (to determine co-implementation)?

6. Who needed to be convinced to get buy-in and how was that accomplished, or not accomplished?

7. Describe your role in the implementation of the 1:1 initiative?
   a. What was it like to work with the superintendent on the 1:1 initiative?

8. Who else was instrumental in implementing the 1:1 initiative?
   a. Did you work with them individually or in a group?
   b. What was it like to work with these people?
   c. In what ways did these people work with each other to implement the plan?
   d. Did you have a role in helping people work together?
   e. How did you know what they were working on?

9. What factors were considered when determining how to fund the technology initiative? [possible responses: sustainability, SES of families in the district, political pressure, school budget]

10. How, if at all, did the funding design impact the acceptance of the 1:1 initiative?

11. What were the main reasons that the specific mobile device was chosen? (not applicable if BYOD) [Possible responses: cost, reliability/durability, brand reputation, included support from the vendor, free or packaged software applications, warranty, battery life, photo/video capabilities, ease of use, portability]
a. How did the mobile device that was chosen (or BYOD program) impact the use of the device among teachers & students?

12. Describe the reliability of the wireless network and how, if at all, it has impacted the 1:1 initiative.

13. How did the capacity of the existing technology staff to support the initiative figure into the decision-making about the 1:1 initiative? [possible responses: limited staff, adequate staff, could/could not hire more]

14. Describe structures that exist in the district around educator collaboration--formal and informal related to teaching and learning.
   a. What are the superintendent’s expectations around collaboration--collaborative culture--structured collaboration around teaching and learning and how is that embedded in the culture?
   b. How is educator collaboration related to technology implementation?
   c. Related to the implementation of any educational innovation in general, are there expectations for educator collaboration?

15. Did the collaboration of teachers play a role in the implementation of the technology initiative? Is there formal time set aside for teachers to collaborate?

16. What technologies are most important to your job? What do you actually spend the most time using? What about at home?
   a. Follow up with specifics about blogs and social media

17. What are the benefits of these technologies that you mentioned? What complaints do you have?

18. How does the district support technology use? What’s your role?
a. What training, activities, actions or documents helped to ease the implementation of this initiative in your system?

19. How do you feel about the direction the district is taking with regard to technology? Do you share these views with others in the district?

20. In hindsight, should anything have been done differently with regards to the implementation of the 1:1 initiative?
Appendix F: Format for Interim Summaries

Case Analysis Form: __________________________

(Adapted from Miles & Huberman, 1994, p. 78)

1. Main themes, impressions, summary statements about what is going on at the site/with the superintendent/leadership team:

2. Explanations, speculations, hypotheses: about what is going on at the site/with the superintendent/leadership team:

3. Alternative explanations, minority reports, disagreements site/with the superintendent/leadership team:

4. Next steps for data collection: follow up questions, specific actions, general directions field work should take:

5. Implications for revision, updating of coding scheme:
### Appendix G: State School Districts With PLC Aspects

**Randomized Web Search, May 2013**

<table>
<thead>
<tr>
<th>District Name</th>
<th>Web Post Involving PLC Aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na**** Public Schools</td>
<td>District Plans involve mandatory PLC goals for all staff and schools</td>
</tr>
<tr>
<td>Ne**** Public Schools</td>
<td>District Plan and all school improvement plans indicate PLC (named GLDs) goals</td>
</tr>
<tr>
<td>No***** Public Schools</td>
<td>PLC resource page</td>
</tr>
<tr>
<td>Li***** Public Schools</td>
<td>Information about PLCs setting coordinated learning goals</td>
</tr>
<tr>
<td>Mc**** Public Schools</td>
<td>Case study of their school system making improvement strides using PLC constructs</td>
</tr>
<tr>
<td>Ho****** Public Schools</td>
<td>Technology PLC is referenced prominently in strategic plan</td>
</tr>
<tr>
<td>Su***** Public Schools</td>
<td>School committee presentation indicating the 2011 implementation of PLCs in elementary schools around math achievement</td>
</tr>
<tr>
<td>No******** Public Schools</td>
<td>Published schedule of technology PLC meetings</td>
</tr>
<tr>
<td>So*** De******* Public Schools</td>
<td>Math PLC collaborative description K-8</td>
</tr>
<tr>
<td>Le******* Public Schools</td>
<td>District Improvement Goals Including PLCs writing new Common Core Curriculum and aligning using Atlas Rubicon.</td>
</tr>
<tr>
<td>Hu**** Public Schools</td>
<td>Adoption of PLC constructs into instructional improvement goals</td>
</tr>
<tr>
<td>Ch******* Public Schools</td>
<td>Videos of teachers discussing the power of collaboration in their PLCs for implementing UDL strategies in curriculum design.</td>
</tr>
<tr>
<td>Am***** Public Schools</td>
<td>Description of technology regional PLC group formed to learn about technology implementation</td>
</tr>
<tr>
<td>Wh******** Public Schools</td>
<td>Formal presentation to school committee detailing PLCs, what they are and why the district will use them and how</td>
</tr>
<tr>
<td>We******** Public Schools</td>
<td>Collaborative co-teaching study groups create common assessments and share results (school plan)</td>
</tr>
<tr>
<td>Ne******** Public Schools</td>
<td>Identified resource in school improvement plans</td>
</tr>
<tr>
<td>School District</td>
<td>Action</td>
</tr>
<tr>
<td>----------------</td>
<td>--------</td>
</tr>
<tr>
<td>Ho****** Public Schools</td>
<td>Identified resource in school improvement plans</td>
</tr>
<tr>
<td>Me****** Public Schools</td>
<td>Identified as core part of district operations in school improvement plans</td>
</tr>
<tr>
<td>Mi**** Public Schools</td>
<td>Videos of teachers engaged in PLC work; identifying as “heart” of instructional work</td>
</tr>
<tr>
<td>Au**** Public Schools</td>
<td>Entire website devoted to the retooling of schedules, budget, training to embrace PLCs</td>
</tr>
<tr>
<td>Mi**** Public Schools</td>
<td>Initiative overview 2011-12 to begin PLCs in district</td>
</tr>
<tr>
<td>We**** Public Schools</td>
<td>District PD page overviews 30 hours of sustained PD for PLCs</td>
</tr>
<tr>
<td>We****** Public Schools</td>
<td>In various school improvement plans and posted school committee notes</td>
</tr>
<tr>
<td>As***** Public Schools</td>
<td>Posted a part of negotiated teacher contract</td>
</tr>
<tr>
<td>Gr***** Public Schools</td>
<td>Letter from NSA indicating that the technology PLCs in the town were impressive and grant worthy</td>
</tr>
<tr>
<td>Gr****-Du******* Schools</td>
<td>Job Description of curriculum leaders—primary role: leadership of PLCs</td>
</tr>
<tr>
<td>Ma***** Public Schools</td>
<td>Superintendent's Newsletter hiring new principal and citing his PLC experience as a plus</td>
</tr>
<tr>
<td>Av** Public Schools</td>
<td>School improvement plans/articles celebrating improvement due to PLCs</td>
</tr>
<tr>
<td>We****** Public Schools</td>
<td>PLCs defined in key glossary of district terms</td>
</tr>
<tr>
<td>Fr*****-La****** Schools</td>
<td>5-year plan relies on PLCs to implement goals</td>
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## Appendix H: Scholarly Articles Referencing PLC Constructs in Describing Technology Leadership

<table>
<thead>
<tr>
<th>PLC construct</th>
<th>Technology Leadership Characteristics</th>
<th>Leadership Characteristics for Effective Reform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared Mission, vision, values</td>
<td>Robertson et al. (2007)</td>
<td>Leithwood et al. (2007) (types of alignment),</td>
</tr>
<tr>
<td></td>
<td>Flanagan &amp; Jacobsen, 2003</td>
<td>Seashore et al. (2009) (leadership type dependent</td>
</tr>
<tr>
<td></td>
<td>Anderson &amp; Dexter (2000/2005)</td>
<td>upon this area)</td>
</tr>
<tr>
<td></td>
<td>Schrum et al. (2011)</td>
<td>them)</td>
</tr>
<tr>
<td></td>
<td>Christensen (2008)</td>
<td>systems)</td>
</tr>
<tr>
<td>Collective inquiry</td>
<td>Williams et. al (2008)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(learning how to learn together)</td>
<td></td>
</tr>
<tr>
<td>Collaborative Teams</td>
<td>Williams et. Al. (2008)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hughes &amp; Zacharia (2001)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Robinson et. al, (2008)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Christensen (2008)</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>Shapely (2010)</td>
<td></td>
</tr>
<tr>
<td>Orientation/Experimentation</td>
<td>Phillips (2005)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Christensen (2008)</td>
<td></td>
</tr>
<tr>
<td>Continuous Improvement</td>
<td>Williams (2008)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Robinson (2008)</td>
<td>discussions)</td>
</tr>
<tr>
<td></td>
<td>Schrum et al. (2011)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Schrum et al. (2011)</td>
<td>Seashore et al. (2009/2010) (instructional leadership</td>
</tr>
<tr>
<td></td>
<td>Phillips (2005)</td>
<td>and connection to student achievement)</td>
</tr>
<tr>
<td></td>
<td>Christensen (2008)</td>
<td></td>
</tr>
</tbody>
</table>
Appendix I: Defined Terms

- **Social Media** - Technology used for communication and interactive dialogue (Nussbaum-Beach, 2012).

- **Web 2.0** - applications that facilitate information sharing and collaboration online (Nussbaum-Beach, 2012).

- **Blog** – web log or website or an online journal that is updated regularly by the blogger.

- **Facebook** – social networking website.

- **Twitter** – an instant messaging system that allows users to send messages of up to 140 characters in length to a list of followers.

- **Acceptance** – (working definition) mobile devices in the hands of students.

- **Large-scale technology initiative** – technology adoptions in public schools that seek to provide 1:1 computing or tablet device for every student in a section or level of the school system, e.g. one tablet or laptop for all students in grades 8-12.
# Appendix J: Initial Codes - Instructional Vision & Technology Implementation

<table>
<thead>
<tr>
<th>CODE</th>
<th>TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1 21st Century Learning Focus</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that the instructional vision focuses on critical thinking, collaboration, problem solving, technology use</td>
</tr>
<tr>
<td>RQ Authentic Learning Focus</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that instructional vision provides students with real world experiences and problem solving skills</td>
</tr>
<tr>
<td>RQ 1 Collaboration Focus</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that the instructional vision supports the development of collaboration skills</td>
</tr>
<tr>
<td>RQ 1 College &amp; Career Readiness Focus</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that the instructional vision provides students with skills for students to be prepared for college and career</td>
</tr>
<tr>
<td>RQ 1 Communication Focus</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that the instructional vision supports the development of communication skills with students</td>
</tr>
<tr>
<td>RQ 1 Creativity Focus</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that the instructional vision supports the development of creativity and innovation skills with students</td>
</tr>
<tr>
<td>RQ 1 Critical Thinking Focus</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that the instructional vision supports the development of critical thinking and problem solving skills with students</td>
</tr>
<tr>
<td>RQ 1 Literacy Focus</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that the instructional vision supports for the development of reading and writing skills with students</td>
</tr>
<tr>
<td>RQ 1 Student Engagement Focus</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that the instructional vision supports students as active participants in the psychological and behavioral aspects of their learning</td>
</tr>
<tr>
<td>RQ 1 Technology Use</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that the instructional vision supports the development of technology use skills with students</td>
</tr>
<tr>
<td>RQ 1 Whole Child-</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that supports the health and safety of each student and ensures they are engaged, supported and challenged by working with all stakeholders they are engaged, supported and challenged by working with all stakeholders</td>
</tr>
<tr>
<td>RQ 1 Differentiated Instruction</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that the instructional vision supports attending to the learning needs of a particular student or small group of students rather than the more typical pattern of teaching the class as though all individuals in it were basically alike</td>
</tr>
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<td>CODE</td>
<td>TYPE</td>
<td>DESCRIPTION</td>
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<tr>
<td>RQ 1 21st Century Learning</td>
<td>Superintendent Instructional Focus</td>
<td>Direct statement from the superintendent that the instructional vision focuses on critical thinking, collaboration, problem solving, technology use, real world experiences, creativity and innovation</td>
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<tr>
<td>RQ 2 21st Century Learning &amp; Technology</td>
<td>Technology Instructional Focus</td>
<td>Example provided of how technology provides students the skills all 21st century learning skills</td>
</tr>
<tr>
<td>RQ Authentic Learning &amp; Technology</td>
<td>Technology Instructional Focus</td>
<td>Example provided of how technology supports authentic learning experiences</td>
</tr>
<tr>
<td>RQ Collaboration &amp; Technology</td>
<td>Technology Instructional Focus</td>
<td>Example provided of how technology supports collaboration</td>
</tr>
<tr>
<td>RQ 2 Literacy &amp; Technology</td>
<td>Technology Instructional Focus</td>
<td>Example provided of how technology is used to support the development of reading and writing skills</td>
</tr>
<tr>
<td>RQ 2 Critical Thinking &amp; Technology</td>
<td>Technology Instructional Focus</td>
<td>Example provided of how technology is used to support critical thinking skills</td>
</tr>
<tr>
<td>RQ 2 CCR &amp; Technology</td>
<td>Technology Instructional Focus</td>
<td>Example provided of how technology is used to support college &amp; career readiness skills</td>
</tr>
<tr>
<td>RQ 2 Whole Child &amp; Technology</td>
<td>Technology Instructional Focus</td>
<td>Example provided of how technology is used to support the whole child approach</td>
</tr>
<tr>
<td>RQ 2: Student Engagement &amp; Technology</td>
<td>Technology Instructional Focus</td>
<td>Example provided of how technology supports student engagement</td>
</tr>
<tr>
<td>RQ 2 Communication &amp; Technology</td>
<td>Technology Instructional Focus</td>
<td>Example provided of how technology supports communication skills</td>
</tr>
<tr>
<td>RQ 2 Creativity &amp; Technology</td>
<td>Technology Instructional Focus</td>
<td>Example provided of how technology supports creativity skills</td>
</tr>
<tr>
<td>RQ 3 Supt. creates IV</td>
<td>Utilization of the Instructional Vision</td>
<td>Example provided of how the superintendent created the instructional vision</td>
</tr>
<tr>
<td>RQ 3 Supt. communicates IV</td>
<td>Utilization of the Instructional Vision</td>
<td>Example provided of how the superintendent communicates the instructional vision</td>
</tr>
<tr>
<td>RQ 3 Supt. helps implement IV</td>
<td>Utilization of the Instructional Vision</td>
<td>Example provided of how the superintendent helps to implement the instructional vision</td>
</tr>
<tr>
<td>RQ 3 Supt. IDs constraints with IV &amp; Tech.</td>
<td>Utilization of the Instructional Vision</td>
<td>Constraint between the instructional vision and technology is identified by the superintendent</td>
</tr>
<tr>
<td>RQ 3 DA involved with IV development</td>
<td>Utilization of the Instructional Vision</td>
<td>District administrator states or gives an example of how he/she was involved in the development of the instructional vision</td>
</tr>
<tr>
<td>CODE</td>
<td>TYPE</td>
<td>DESCRIPTION</td>
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<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>RQ 3 DA</td>
<td>Utilization of the Instructional Vision</td>
<td>District administrator communicates the instructional vision</td>
</tr>
<tr>
<td>IV Time</td>
<td>Utilization of the Instructional Vision</td>
<td>Time is created to provide support to the Instructional Vision</td>
</tr>
<tr>
<td>IV Data</td>
<td>Utilization of the Instructional Vision</td>
<td>Data is connected to the instructional vision</td>
</tr>
<tr>
<td>IV Resource</td>
<td>Utilization of the Instructional Vision</td>
<td>Resources are identified that help support the instructional vision</td>
</tr>
<tr>
<td>IV Communication</td>
<td>Utilization of the Instructional Vision</td>
<td>Instructional vision is communicated</td>
</tr>
<tr>
<td>IV Program</td>
<td>Utilization of the Instructional Vision</td>
<td>Programs are implemented to support the instructional vision</td>
</tr>
<tr>
<td>IV PD</td>
<td>Utilization of the Instructional Vision</td>
<td>Professional developed is offered to support the instructional vision</td>
</tr>
<tr>
<td>MO Frame</td>
<td>Frame Theory</td>
<td>Instructional vision used as motivational framing</td>
</tr>
<tr>
<td>PR Frame</td>
<td>Frame Theory</td>
<td>Instructional vision used as prognostic framing</td>
</tr>
<tr>
<td>DI Frame</td>
<td>Frame Theory</td>
<td>Instructional vision used for diagnostic framing</td>
</tr>
</tbody>
</table>

*Instructional visions articulated by each district administrator was categorized in the same manner as the superintendents (see RQ 1 list on this table).

Note: RQ 1 is associated with research question one. RQ 2 is associated with research question two. RQ 3 is associated with research question number three.
Appendix K: Codes for Superintendent Technology Use & Attitudes

<table>
<thead>
<tr>
<th>Parent Code</th>
<th>Child Codes</th>
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</thead>
<tbody>
<tr>
<td>Use of Technology</td>
<td>B = Blog</td>
</tr>
<tr>
<td></td>
<td>E = Email</td>
</tr>
<tr>
<td></td>
<td>G = Google Apps</td>
</tr>
<tr>
<td></td>
<td>I = iPad/tablet</td>
</tr>
<tr>
<td></td>
<td>L = Laptop</td>
</tr>
<tr>
<td>Use of Technology</td>
<td>PP = PowerPoint</td>
</tr>
<tr>
<td></td>
<td>SM = Social Media</td>
</tr>
<tr>
<td></td>
<td>SP = Smart Phone</td>
</tr>
<tr>
<td></td>
<td>T = Twitter</td>
</tr>
<tr>
<td></td>
<td>W = Word Processing/Newsletters</td>
</tr>
<tr>
<td>Use of Technology</td>
<td>COL = for collaboration</td>
</tr>
<tr>
<td></td>
<td>COM = for communication</td>
</tr>
<tr>
<td></td>
<td>EV = for evaluation</td>
</tr>
<tr>
<td></td>
<td>PD = for professional development</td>
</tr>
<tr>
<td>Attitudes About Technology</td>
<td>CCCC = for 21st century skills</td>
</tr>
<tr>
<td></td>
<td>CCR = for college and career ready</td>
</tr>
<tr>
<td></td>
<td>CE = to be cutting edge</td>
</tr>
<tr>
<td>Attitudes About Technology</td>
<td>DATA = for data collection/use</td>
</tr>
<tr>
<td>Influence of Attitudes</td>
<td>DI = for differentiating instruction</td>
</tr>
<tr>
<td></td>
<td>IT = as tool for instruction</td>
</tr>
<tr>
<td></td>
<td>TO = as tool for time and organization</td>
</tr>
<tr>
<td></td>
<td>BUD = secure funding, budget</td>
</tr>
<tr>
<td></td>
<td>MO = motivation and momentum of init</td>
</tr>
<tr>
<td></td>
<td>PD = provide professional development</td>
</tr>
<tr>
<td></td>
<td>SUS = Sustain the current direction</td>
</tr>
</tbody>
</table>
# Appendix L: Infrastructure Code Dictionary

<table>
<thead>
<tr>
<th>Topic</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Decision-Making Factors about Infrastructure</td>
<td>Device Cost</td>
<td>How much the device cost was a factor in its selection</td>
</tr>
<tr>
<td></td>
<td>Device Reliability</td>
<td>The reliability of the device was a factor in its selection</td>
</tr>
<tr>
<td></td>
<td>Device Brand Reputation</td>
<td>The reputation of the device manufacturer was a factor in its selection</td>
</tr>
<tr>
<td></td>
<td>Device Capabilities</td>
<td>The software and/or hardware capabilities (apps, keyboard, photo/video, memory) were a factor in its selection</td>
</tr>
<tr>
<td></td>
<td>Device Compatibility</td>
<td>The compatibility of the device with existing district technology or faculty knowledge was a factor in its selection</td>
</tr>
<tr>
<td></td>
<td>Device Battery Life</td>
<td>How long the battery would last when fully charged was a factor in its selection</td>
</tr>
<tr>
<td></td>
<td>Wi-Fi Reliability</td>
<td>The reliability of the Wi-Fi network was considered when making infrastructure decisions</td>
</tr>
<tr>
<td>2. Decision-Making about the Funding Design</td>
<td>Sustainability</td>
<td>The ability to financially sustain the initiative was considered in the planning.</td>
</tr>
<tr>
<td></td>
<td>Equity</td>
<td>Making sure that all students would have a device of equal capabilities was a factor</td>
</tr>
<tr>
<td></td>
<td>Parental Support</td>
<td>Parental support was a factor when considering how to fund the initiative</td>
</tr>
<tr>
<td></td>
<td>School Committee Support</td>
<td>School committee support was a factor when considering how to fund the initiative</td>
</tr>
<tr>
<td></td>
<td>School Fund Opportunity</td>
<td>School funds for the initiative were available due to budget conditions or a building project</td>
</tr>
<tr>
<td></td>
<td>Technology Staffing</td>
<td>The capacity of the technology staff to support the initiative was a factor</td>
</tr>
<tr>
<td>3. Acceptance of the Initiative</td>
<td>Device</td>
<td>The device chosen is perceived to have had an impact on the acceptance of the initiative</td>
</tr>
<tr>
<td></td>
<td>Funding</td>
<td>The funding design is perceived to have had an impact on the acceptance of the initiative</td>
</tr>
<tr>
<td></td>
<td>Wi-Fi</td>
<td>The reliability of the Wi-Fi network is perceived to have had an impact on the acceptance of the initiative</td>
</tr>
<tr>
<td></td>
<td>Technology Staffing</td>
<td>The capacity of the technology staff is perceived to have had an impact on the acceptance of the initiative</td>
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## Appendix M: PLC - Initial Set of Provisional Start-List Codes

<table>
<thead>
<tr>
<th>PLC construct</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared Mission, vision, values/Shared work</td>
<td>Shared understanding of the goals the group is working on for the school and their part in achieving the goal.</td>
<td>PLC-MVV</td>
</tr>
<tr>
<td>Collective inquiry</td>
<td>Group regularly reflects on where they are relative to shared goals and progress made toward those goals.</td>
<td>PLC-CI</td>
</tr>
<tr>
<td>Collaborative Teams</td>
<td>PLC educators work together interdependently within collaborative teams to achieve common goals for which they are mutually responsible.</td>
<td>PLC-CT</td>
</tr>
<tr>
<td>Action Orientation/Experimentation</td>
<td>Teams turn learning and insights into action. They recognize the importance of engagement and experience in learning and in testing new ideas.</td>
<td>PLC-AOE</td>
</tr>
<tr>
<td>Continuous Improvement</td>
<td>Members seek better ways to achieve mutual goals and accomplish their fundamental goals</td>
<td>PLC-CI</td>
</tr>
<tr>
<td>Results Orientation</td>
<td>Teams assess their efforts on the basis of evidence to inform and improve their practice.</td>
<td>PLC-RO</td>
</tr>
<tr>
<td>Shared Time</td>
<td>Time is provided during contractual school day or in a job-embedded fashion for working teams to collaborate.</td>
<td>PLC-ST</td>
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</table>

### Appendix N: Descriptive Codes Distributed Leadership

<table>
<thead>
<tr>
<th>CODE</th>
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<tbody>
<tr>
<td>CA</td>
<td>Concertive Action</td>
<td>Leadership is distributed in a more holistic fashion</td>
</tr>
<tr>
<td>CA-SC</td>
<td>Spontaneous Collaboration</td>
<td>Members with different skill sets (can be across organizational levels) form a team to solve a problem</td>
</tr>
<tr>
<td>CA-IW</td>
<td>Intuitive Working Relations</td>
<td>Members of the team are reliant on each other’s skills and form a close working relationship</td>
</tr>
<tr>
<td>CA-IP</td>
<td>Institutionalized Practices</td>
<td>Organization establishes structures for team members to work together.</td>
</tr>
<tr>
<td>CO</td>
<td>Coordination</td>
<td>Management of tasks</td>
</tr>
<tr>
<td>CO-I</td>
<td>Coordination—Implicit</td>
<td>Task responsibilities clearly written down</td>
</tr>
<tr>
<td>CO-E</td>
<td>Coordination—Explicit</td>
<td>Task responsibilities fall outside clear job responsibilities</td>
</tr>
</tbody>
</table>

### Appendix O: Pattern Codes

<table>
<thead>
<tr>
<th>CODE</th>
<th>TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-PATT</td>
<td>Primary Leader</td>
<td>One individual, identified by members of the technology leadership team and/or superintendent for taking primary leadership of the initiative</td>
</tr>
<tr>
<td>S-PATT</td>
<td>Secondary Leader</td>
<td>Additional member of technology team, identified by members of the technology leadership team and/or superintendent as being a vital contributor to the initiative.</td>
</tr>
</tbody>
</table>
# Appendix P: Instructional Vision Interview Questions

Research question 1: What is the instructional vision of superintendents who implement large-scale technology initiatives in a 1:1 or BYOD environment?

| 1. | Where did the idea of developing a 1:1 program come from? (policy window/strategic alignment) |
| 2. | What factors were considered when determining the design (BYOD, DPD, or blended for the technology initiative)? |
| 3. | What is the instructional vision for the district? How was that developed? Please explain. |

Research question 2: How does the superintendent connect his or her instructional vision with the implementation of technology within the district?

| 1. | Where did the idea of developing a 1:1 program come from? (policy window/strategic alignment) |
| 2. | In what areas were you hoping this technology initiative would help your district? |
| 3. | Who was involved in the planning & what steps were initially taken? Who did you need to convince to get buy-in and how did you go about this? |
| 4. | What and how were decisions made to implement technology infrastructure? |
| 5. | What is the vision for technology use in your district and how is that communicated to all stakeholders? Please explain. |
| 6. | How does the instructional vision and technology initiative relate to each other? |
| 7. | How is the instructional focus communicated out to all stakeholders? |
| 8. | How is the instructional vision used to gain acceptance for the technology initiative? |
| 9. | Who helps you integrate your technology program? |
| 10. | Who worked with teachers relative to implementing this new technology into classrooms? |
| 11. | Describe formal or informal structures at plan in the district around educator collaboration. |
| 12. | What training, activities, actions or documents helped to ease the implementation of this initiative in your system? |
| 13. | How do you communicate district initiatives? |
| 14. | How has your use of technology impacted the technology integration in the district? |
Research question 3: How do building-level administrators make sense of the superintendent’s instructional vision for technology?

1. Where did the idea of developing a 1:1 program come from? (policy window/strategic alignment)
2. Please describe the technology initiative in its current state.
3. What and how were decisions made to implement technology infrastructure?
4. What is the vision for technology use in your district and how is that communicated to all stakeholders? Please explain.
5. How does the instructional vision and technology initiative relate to each other?
6. How is the instructional focus communicated out to all stakeholders?
7. How is the instructional vision used to gain acceptance for the technology initiative?
8. Who helps you integrate your technology program?
9. Who worked with teachers relative to implementing this new technology into classrooms?
10. Describe structures that exist in the district around educator collaboration.
11. What training, activities, actions or documents helped to ease the implementation of this initiative in your system?
12. How do you communicate district initiatives?
13. How has your use of technology impacted the technology integration in the district?
## Appendix Q: Communicated Instructional Vision

### of Superintendents and District Administrators

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<tr>
<td><strong>WASHINGTON</strong></td>
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<td>Supt. Brody</td>
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<td>TIS Ava</td>
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<td>TIS Caitlin</td>
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