SUPPORTING TECHNOLOGY INTEGRATION LEADERSHIP OF ELEMENTARY SCHOOL ADMINISTRATORS THROUGH TECHNOLOGY-RELATED SELF-EFFICACY DEVELOPMENT

By
Alexander Steven Tietjen

A dissertation submitted to Johns Hopkins University in conformity with the requirements for the degree of Doctor of Education

Baltimore, Maryland
July 2020

Abstract

Meaningful use of technology by students is often unevenly distributed in schools. In order to increase outcomes for all students, a review of literature was conducted that identified the critical role school site administrators, principals and vice principals, play in making technology integration successful. After identifying the importance of school site administrators in supporting technology integration, a needs assessment was conducted that identified participants' self-conception as technology integration leaders as a likely avenue for intervention. The intervention was aligned with Bandura's (1986) social cognitive theory, specifically, the four sources of self-efficacy development, as a means to increase technology leadership among participants. Phase 1 of the intervention consisted of a 1-day professional learning workshop conducted in early October 2019. In Phase 2 of the study, four cases were selected for participation. Each of the four selected cases included the principal and vice principal at a school. Phase 2 consisted of a professional learning follow-up session and the delivery of a technology integration workshop to school site staff by the participants. To evaluate the effectiveness of the intervention, a mixed-methods analysis of the process was conducted, and the resulting data for this small sample revealed that the technology-related self-efficacy beliefs of participants increased following the intervention. Further analysis of the qualitative data revealed increased intent to act as technology integration leaders at their school sites following the intervention. Findings indicate that technology-related self-efficacy development may increase the intent of school site administrators to act as a technology integration leaders.
Keywords: technology integration, self-efficacy, elementary education, social cognitive theory
Advisors: Dr. Katrina Johnston-Smith and Dr. Elizabeth Todd Brown

JOHNS HOPKINS
SCHOOL of EDUCATION

Dissertation Approval Form

Student's Name: Alexander Steven Tietjen Date: July 15, 2020

Dissertation Title:

SUPPORTING TECHNOLOGY INTEGRATION LEADERSHIP OF ELEMENTARY SCHOOL ADMINISTRATORS THROUGH TECHNOLOGY-RELATED SELF-EFFICACY DEVELOPMENT

The student has made all necessary revisions, and we have read, and approve this dissertation for submission to the Johns Hopkins Sheridan Libraries as partial fulfillment of the requirements for the Doctor of Education degree.

Katrina M. Johnston-Smith	Katrina M Johnston-Smith	July 14, 2020
Adviser	Signature	Date
Sherri K. Prosser	Sherri K Prosser	July 15, 2020
Committee Member	Signature	Date
E. Todd Brown	E Todd Brown	July 14, 2020
Committee Member	Signature	Date
Committee Member	Signature	Date

Dedication

This dissertation is dedicated to my family:

To my in-laws, Dr. Mark and Anne Fulmer, whose support has been unwavering,

To my mother, Becky Tietjen, whose passion for education inspires me,

To my father, Dr. Steve Tietjen, whose example I follow,

To my daughters, Charlotte and Josephine Tietjen, who give this work meaning,

And finally, to my wife, Elisabeth Fulmer Tietjen, whose love, support, and patience made this all possible.

Acknowledgements

I would like to acknowledge the all of the help I have received in the process of writing this dissertation. I would not have completed this project without the tremendous amount of support, clear direction, and cogent advice provided by my co-advisers, Dr. Katrina Johnston-Smith and Dr. Elizabeth Todd Brown. I cannot adequately express my thanks to both Dr. Johnston-Smith and Dr. Todd Brown for the time they took to review the many iterations of this dissertation, and whose many revisions and suggestions has made me a better writer. I would also like to thank Dr. Sherri Prosser for the help and advice she provided throughout the process of completing this work, both as the professor who welcomed me into the doctoral program and, later, as a committee member.

In addition to the support provided by the faculty of Johns Hopkins, I would also like to thank the school administrators with whom I work. First, I would like to thank the principals and vice principals whose willing participation made this research possible. I would also like to thank Dr. Sharon Kamberg for her support in allowing me to initially pursue this course of study. I would also like to thank Sergio Mendoza whose support allowed me to conduct the intervention and has encouraged me to continue furthering the program of technology integration in the organization. Additionally, I would like to thank David Shimer who first hired me into a position focused on technology integration, and whose ongoing support and friendship has been invaluable. I would also like to thank Kirk Stinson whose collaboration has made me a more thoughtful school administrator. Finally, I would like to thank the members of the educational services department who have supported me through this process, including Dr. Anthony Martin, Audra Wilson, Briana Kehoe, Casey Rangel, Darren Faust, Karen Sidhu, and Vanessa Musquiz.

I would like to offer my final thanks to the study group with whom I have worked over the course of the last three years. We were assigned to work together in our very first class and though time zone issues were sometimes difficult to navigate, we spent a tremendous amount of time together over the course of this program. I appreciate the help and support of Alison Burrows, Jason McRaven, and Troy Gordon.

Table of Contents

List of Tables

List of Figures

Executive Summary

The first Macintosh computer debuted in 1984 and started a revolution in home computing. This revolution quickly spread to education and with it, the first attempts to meaningfully integrate digital technology into K–12 classrooms (Kapp, 1989). Since that introduction, schools have struggled with two kinds of barriers to meaningful technology use: first-order barriers and second-order barriers (Ertmer, 1999). First-order barriers to technology integration are the barriers related to physical access to devices (Ertmer, 1999). First-order barriers in the United States have largely been overcome (U.S. Department of Education, 2016). Many U.S. schools have access to the technology but now face another challenging problem—second-order barriers. Second-order barriers to technology integration are those barriers that interfere with the meaningful use of technology in schools (Ertmer, 1999). Schools that now have the resources to integrate technology into all classrooms must find a way to make sure those resources effectively support learning.

Problem of Practice

The problem of practice for this study was located in a K–12 school district in California's San Joaquin Valley that serves approximately 5,000 students each year. A one-to-one technology integration initiative has been in place across the organization for more than 7 years. Though the first-order barriers to technology integration (Ertmer, 1999), such as limited access to devices and Internet, have been overcome, other barriers remain. In its *2017 National Education Technology Plan Update*, the U.S. Department of Education (2016) identified the digital use divide as a major barrier to effective technology integration. The digital use divide was defined in the report as the discrepancy in the kind of work students complete with technology. In the context of this problem of practice, the digital use divide is a barrier to meaningful technology integration.

Literature Review

In order to understand the possible factors that affect this problem of practice, the researcher conducted a literature review focused on classroom technology integration. To present the findings of the review, the researcher used Bronfenbrenner's (1979) ecological system theory as the theoretical framework. Through this process, the researcher identified a variety of factors that contribute to the problem of practice, including the effectiveness of technology in schools (Angrist & Lavy, 2002; Lowther, Inan, Strahl, & Ross, 2008; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011), policy mandates (Cherian, 2009; Culp, Honey, & Mandinach, 2003; Park, Sinha, & Chong, 2007), students (Pittman & Gaines, 2015), teachers (Inan & Lowther, 2009; Miranda & Russell, 2011), district office administrators (Daniels, Jacobsen, Varnhagen, & Friesen, 2013; Larosiliere, McHaney, & Kobelsky, 2016; Webster, 2017), professional learning (Desimone & Garet, 2015; Windschitl & Sahl, 2002), and school site administrators (Machado & Chung, 2015; Metcalf & LaFrance, 2013; Stuart, Mills, & Remus, 2009), that include both principals and vice principals. After conducting the literature review, the researcher identified school site administrators as the most likely factor upon to act to address the problem of practice (Anderson & Dexter, 2005; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2009). However, before designing an intervention, the researcher conducted a needs assessment to ascertain whether the technology integration leadership, as identified in the literature, was a possible factor in this problem of practice.

Needs Assessment

Using the literature review as a guide, the researcher identified the role of school site administrators as a possible factor influencing the problem of practice. To better understand the role of school site administrators in technology integration, the researcher conducted a needs assessment. The needs assessment collected data from two groups. One of the groups was the teaching staff. The researcher surveyed this group to better understand the degree that school site administrators' beliefs regarding technology integration influenced the teachers' beliefs regarding technology integration, as suggested in the literature (Claro, Nussbaum, Lopez, & Contardo, 2017; Shapley et al., 2011). Of the approximately 230 possible respondents for the teacher survey, 19% participated. Those responding indicated that they did believe that the actions of their school site administrators affected the way they approached technology integration. The second group the researcher surveyed was the school site administrators in the organization. The researcher did this to better understand how the principals and vice principals felt about their ability to act as technology integration leaders. The literature suggested school site administrators' self-conception as technology integration leaders could have an effect on the progress of technology integration at their school site (Larosiliere et al., 2016; Machado & Chung, 2015; Topper & Lancaster, 2013). Of the 18 school site administrators working in the context, 72% participated in the survey. Overall, the responses identified that they were less confident in acting as technology integration leaders than in the other ways they managed technology in their school sites. Based on the results of the needs assessment, the researcher developed an intervention that had the potential to increase school site administrators' beliefs that they could act as effective technology integration leaders for their school.

Designing an Intervention

To develop an intervention based upon the results of the needs assessment findings, the researcher returned to the literature to identify methods and measures that may cultivate the technology leadership behavior and beliefs of school site administrators. Through this process, the researcher identified Bandura's (1986) social cognitive theory, specifically, the four sources of self-efficacy development, as a mechanism for possibly increasing school site administrators' technology-related self-efficacy beliefs. The researcher created a logic model for the intervention that identified activities intended to produce specific outcomes related to the development of technology-related self-efficacy beliefs in school site administrators. The short-term outcome of the intervention that aligned with the results of the needs assessment was an increase in school site administrators' technology-related self-efficacy beliefs. The long-term outcome was an increase in the technology integration leadership behavior of school site administrators. After the researcher determined the short-term and long-term goals of the intervention, the researcher next worked to identify an intervention model that could act upon those goals.

Intervention Model

This intervention is modeled after a study conducted by Tschannen-Moran and Gareis (2004) that operationalized Bandura's (1977) sources of self-efficacy. The study included a professional learning workshop, in-person follow-up between the researcher and participants, and the completion of a successful mastery experience by the participants. A mastery experience, as defined by Bandura, is the successful completion of a task that increases a participant's sense of self-efficacy.

The researcher also investigated models of professional learning and determined the structure described by Darling-Hammond, Hyler, and Gardner (2017) would work in the context.

The professional learning structure had two phases. Phase 1 consisted of a professional learning workshop, informed by the work of Darling-Hammond et al., and Phase 2, a one-on-one coaching session followed by a participant-led workshop. Four cases were selected for participation in Phase 2. Each case consisted of a principal and vice principal from an elementary school site in the organization.

Implementing the Intervention

Informed by the literature and needs assessment results, the researcher designed and implemented the intervention with all 17 school site administrators working in the context of the problem of practice. To guide the intervention, the researcher developed three questions:

1. How do school site administrators understand technology integration?
2. What technology-related self-efficacy beliefs are held by school site administrators?
3. How do the self-efficacy beliefs of school site administrators shape their vision for technology integration?

To answer these questions, the researcher conducted a convergent mixed-methods study (Lochmiller & Lester, 2017). Data were collected from participants throughout the intervention. Prior to the start of Phase 1 of the intervention, which began in early October 2019, participants completed an adapted version of the Principal Sense of Efficacy Scale questionnaire (Tschannen-Moran & Gareis, 2004). Phase 2 of the intervention concluded in mid-December of 2019 with individual, semistructured interviews conducted with each participant, after which the participants from both phases completed the survey a second time. In addition to quantitative data collected through the pretest and posttest survey, the researcher also collected qualitative data throughout the intervention. Sources of qualitative data included open-ended questions attached to the end of the adapted PSES, notes made in a researcher's journal, and recorded and transcribed semistructured interviews.

Findings

The pretest and posttest results of the adapted Principals Sense of Efficacy Scale indicated that technology-related self-efficacy beliefs increased over the course of the intervention for all participants. However, the self-efficacy beliefs of Phase 2 participants increased more than those of Phase 1-only participants. The qualitative data collected supported this finding and also revealed an increased sense of technology integration leadership among Phase 2 participants.

This small mixed-methods study helped identify ways that technology integration could be supported within the context of this problem. Though the results may not be transferable across organizations because of the limitations of the study, they may demonstrate a way for schools to potentially address the barriers that limit the ability of technology integration to benefit students and teachers in providing meaningful work. Strategies that affect the technology-related self-efficacy beliefs of school site administrators may increase the capability of those school site administrators to act as technology integration leaders.

Chapter 1

Factors Related to Technology Integration

The revolution in technology that has occurred over the last four decades creates educational possibilities for students heretofore impossible. Digital devices, in combination with the Internet, bring resources from the world over to even the most remote, under-funded classroom. The introduction of technology, unfortunately, has not yet fulfilled its potential in the classroom (U.S. Department of Education, 2016). Though it remains the case for some schools that the greatest barrier to technology integration by students is the availability of equipment (Pittman & Gaines, 2015), it may no longer be the most pressing problem facing technology integration in schools (U.S. Department of Education, 2016). Changes in federal testing policy that require the use of a computing device have driven a greater degree of technology adoption by schools (Smarter Balanced Assessment Consortium, 2017). The changes in federal policy have led to increased availability of devices in K–12 classrooms, but the availability of devices has not been accompanied by an increased focus on using technology to enhance student learning (Webster, 2017).

Research on K–12 technology integration, which is the use of technology in the classroom to support learning, has been conducted for over 30 years. Some of the earliest research in the field, done as part of the Apple Classrooms of Tomorrow Project starting in 1987, identified issues with classroom technology integration that are still persistent problems today. These issues include limited teacher comfort with technology, low student agency, low correlation between achievement test results and technology integration, and the relationship between technology and constructivist approaches to teaching (e.g., project-based learning; Knapp, 1989).

In the same way that Knapp's (1989) findings regarding problems with technology integration 30 years ago are reminiscent of the issues surrounding the field today, the findings regarding best practices in technology integration are similarly familiar. Seminal research conducted by Cuban (2001), Becker (2000), and Ertmer, Ottenbreit-Leftwich, and York (2006) have revealed much about technology integration in schools. A dominant argument in the field, championed by Cuban, is that technology does not meaningfully support educational achievement. In an examination of Cuban's arguments, Becker identified essential characteristics of teachers who use technology effectively in their classroom practices. In their research, Ertmer and colleagues have taken this thread further and found the intrinsic factors that make teachers more effective technology integrators. Though progress toward understanding how to effectively integrate technology in teaching has increased, the substantial increases in student achievement expected to occur as a result of integrating technology have not appeared (Angrist & Lavy, 2002; Harper & Milman, 2016).

Problem of Practice

Over the last 48 years, the integration of personal computing devices into schools has expanded exponentially (Cuban, Kirkpatrick, & Peck, 2001), but the significant gains in student achievement promised by the supporters of technology integration have remained elusive (Kirkpatrick et al., 2018; Lowther, Inan, Strahl, & Ross, 2008; Machin, McNally, & Silva, 2007). The necessary components of successful technology integration within schools (e.g., leadership, professional learning support, and congruent pedagogical philosophies of education) are often either absent or ignored (Berrett, Murphy, & Sullivan, 2012). Additionally, schools often adopt computing devices for the wrong reason; many purchasing decisions are driven out of a perceived need to keep up with current trends instead of considering the devices as pedagogical tools (Webster, 2017). The U.S. Department of Education's (2016) technology plan, once focused almost entirely on ensuring schools had access to basic infrastructure, has changed its focus to reflect a shift from the need to ensure equity of access to ensure equity of use. In a school district in California's San Joaquin Valley, personal computing devices have been deployed to every student across all school sites. However, the equitable use of technology to complete meaningful work that allows students to participate in the construction of their learning does not happen in all classrooms.

Theoretical Framework

Solving the problem of technology integration is not simple, but to formulate a possible solution, a systematic approach that includes a theoretical framework is helpful. This framework guides both the research into the factors of, and possible solution to, this problem of practice. The theoretical framework used to organize the factors influencing the investigation of this problem of practice is ecological systems theory (EST) proposed by Bronfenbrenner (1994). EST is used to understand the relationships between systems through an ecological model wherein relationships are nested within one another in a physical location (Bronfenbrenner, 1994). In EST, there are four conceptual groups: microsystem, mesosystem, exosystem, and macrosystem (Bronfenbrenner, 1994).

At the center of the ecological system is the focal individual. In the current problem of practice, the focal individual is the school site administrator. One's understanding of the system that they reside in is created through interaction with other systems in the ecology (Bronfenbrenner, 1994). As one moves from the center to the outer edges of the nested systems in EST, the first system encountered by the focal individual is the microsystem. Bronfenbrenner (1979) defined a microsystem as a "pattern of activities, roles, and interpersonal relations experienced by the developing person in a given setting with particular physical and material characteristics" (p. 22). Within this problem of practice, the microsystem is the school building where the focal individuals work. Within that microsystem, the school site administrators interact with a variety of groups, including students, teachers, and district office administrators.

The next system, the mesosystem, represents the interaction between two different physical locations where the focal individual interacts with others, or microsystems. In the case of school site administrators, a mesosystem would represent the relationship between the school where the school site administrator works and the district office, where they might report for meetings. However, there are no mesosystem present in this problem of practice.

The third system is the exosystem, which Bronfenbrenner (1979) defines as settings where events that affect the focal individual occur without the participation or attendance of the focal individual. An example of an exosystem for school site administrators is the state legislature. The focal individual is unlikely to be at the legislative session when funding bills or new policy mandates are passed, but the decisions made by lawmakers will have consequences for the school that the school site administrator serves.

The final system Bronfenbrenner (1979) identifies is the macrosystem. The macrosystem includes cultural and other influences that have wide-ranging impacts on the focal individual (Neal & Neal, 2013). In this system, the research that has been done on the effectiveness of technology in schools substantially informs the culture of technology use (see Figure 1.1).

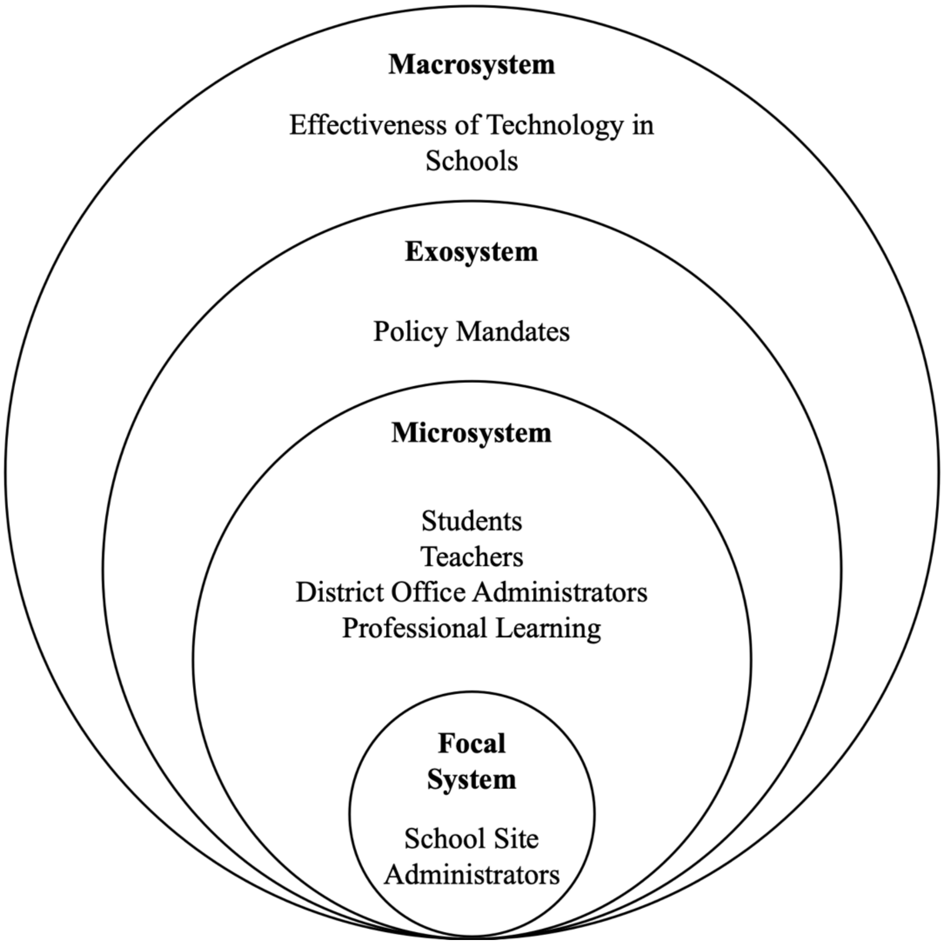


Figure 1.1. Factors contributing to the problem of technology integration in schools, organized using Bronfenbrenner's (1979) ecological systems theory. From "Nested or Networked? Future Directions for Ecological Systems Theory," by J. W. Neal and Z. P. Neal, 2013, Social Development, 22, p. 725. Copyright 2013 by John Wiley & Sons. Adapted with permission.

Synthesis of Research Literature

This following is a review of the literature concerning the problem of practice organized according to Bronfenbrenner's (1979) EST. Ecological systems theory is most often conceptualized as concentric circles. Each of these circles represents a different system that affects the microsystem at the center of the ecology. In Bronfenbrenner's (1979) original conception of EST, the outermost system is the macrosystem. However, the chronosystem was later added to address the element of change over time (Bronfenbrenner & Morris, 2006). For the purposes of this literature review, the outermost system is the macrosystem.

Macrosystem

In Bronfenbrenner's (1979) EST, the largest circle, at the outer bounds of the ecology, is the macrosystem. The macrosystem was described by Bronfenbrenner as the culture, or sub-culture, in which the focal group exists. What is most notable about the macrosystem is that it is a system where the focal group has no agency (Bronfenbrenner, 1979). What happens in the macrosystem affects the focal group but is not appreciably affected by the focal group. In this investigation, the macrosystem is federally mandated standardized testing. Although the federal government mandating standardized tests is an exosystem factor, the beliefs about how funding, management, and policy requirements drive instruction and pressure related to the need to do well on state testing are what make this a macrosystem factor. In other words, the effectiveness of technology integration is judged by how well, or poorly, students do on the state standardized test.

Effectiveness of technology in schools. The mixed findings regarding the impact of technology on student achievement does not make a clear case for, or against, the use of technology in schools. Angrist and Lavy (2002) used testing data from a nationally administered exam in Israel to determine the effectiveness of technology integration in elementary and middle schools. They found that technology integration in schools did not affect test scores or, in one case, even had an adverse effect on student mathematics scores. Lowther et al. (2008) conducted a statewide mixed-methods study in Tennessee that incorporated surveys, observations, and focus groups to investigate the impact that a one-to-one technology integration had on state test scores. Data were collected from 12,420 students and 927 teachers, and the researchers found mixed success. Shapley, Sheehan, Maloney, & Caranikas-Walker (2011) examined the effects of introducing one-to-one technology to middle schools in Texas using state testing data. They compared the results of the one-to-one schools to a control group of 21 middle schools that did not use technology and found that there was little initial growth, the introduction of technology tools was correlated with slow but positive growth in student test scores over several years. The results of these three studies are indicative of the findings in the literature (Cuban, et al., 2001; Havard, Nguyen, & Otto, 2018; Lee & Lind, 2011) and demonstrate that the effectiveness of technology in increasing student achievement is still an open question. These findings pose two questions: is the use of technology in schools worth pursuing and if so, should the success of a technology integration be judged by high-stakes test results?

To answer the questions posed by the lack of support in the literature for the effectiveness of technology in increasing student test scores, the definition of effective technology integration must be widened beyond increased state test scores. In his seminal work, Becker (2000), who based his research on a national sample of 4,051 fourth- to twelfth-grade teachers' responses to a technology-focused survey, disputed the appropriateness of the commonly accepted practice of using state test results to assess technology integration. Becker argued that "…the standardized nature of such an assessment would not permit students to employ any analytic tools or information resources that they happened to have experience with, such as computer software, that might be relevant to accomplishing the task" (p.10). Becker's research makes the case that learning through technology integration is not easily measurable through commonly accepted tools for assessing student learning; standardized testing results may not be an effective way to measure technology integration (Becker, 2000).

Bebell and Kay (2009) investigated the impact of integrating one-to-one technology and reached conclusions in line with Becker's (2000) research. Bebell and Kay conducted a 3-year quantitative investigation in five Massachusetts middle schools, using survey instruments to collect data. They found that the focus on standardized test results interfered with the adoption of technology and the acquisition of associated skills by students because teachers were so focused on achieving higher test scores.

In response to the inability of testing results to demonstrate the benefit of technology integration for student learning, other reasons for technology integration into classrooms have emerged. One mixed-methods study, conducted by Topper and Lancaster (2013), identified an alternative measure for assessing the outcome of technology integrations. The researchers investigated a one-to-one technology integration occurring in five Midwestern school districts. Data collected, through a combination of survey instruments and semistructured interviews, indicated that technology integration supported the acquisition and development of 21st century skills demanded by the workforce: creativity, collaboration, communication, and critical thinking. These skills are difficult to measure through standardized testing (Becker, 2000). Topper and Lancaster's findings both supports Becker's (2000) findings and undermine Cuban's (2001) arguments. If higher test scores are the sole point of education, as Cuban's argument can be reduced to, then technology has no place in education. However, if there are other reasons to incorporate technology into the classroom, as Becker argues and Topper and Lancaster's findings support, then technology is an important and necessary component of classroom instruction. In addition to promoting 21st century skills, research also suggests technology integration can support, challenge, and engage student learning in ways not possible in classrooms that lack technology (Shapley et al., 2011). Despite these examples, however, the benefits of technology integration do not come without a cost. The possibilities created by the presence of technology in the classroom may drive more substantial changes in the learning environment.

One apparent change that has occurred with the introduction of technology is that student engagement in academic work increased while student discipline issues decreased in the study, described earlier, by Lowther et al. (2008). In addition, Shapley, Sheehan, Maloney, and Caranikas-Walker (2009) conducted an experimental quantitative study on the effects of technology immersion in Texas middle schools; they used multiple data sources including a survey instrument, discipline and student attendance records, and results of standardized state tests. Shapley et al. found that the ability of students to complete computer related tasks not only increased as a consequence of the technology integration, especially for economically distressed students, but also allowed them to match the proficiency level of their peers from economically advantaged backgrounds.

In addition to closing the skill gap in technology integration between socio-economical distressed and advantaged students, there may be other benefits when technology is integrated into the classroom. Students may benefit from the introduction of technology because the integration of the technology changes the pedagogical approach of teachers, pushing them toward more student-centered instructional methods (Lowther et al., 2008). As Mueller, Wood, Willoughby, Ross, and Specht (2008) found in a survey of 389 elementary and secondary teachers' in the United States, that their beliefs regarding technology integration in the classroom, student-centered practices supported by technology increase both engagement with learning and more comprehensive technology integration.

However, though Shapley et al. (2009) and Lowther et al. (2008) make the case that technology integration benefits instruction in ways that go beyond increased scores on state testing. There are also non-testing related issues that technology creates for classroom instruction that must be acknowledged. Downes and Bishop (2015) identify one such area of concern. In their two-participant case study exploring the integration of a one-to-one technology deployment at a middle school in Vermont, Downes and Bishop found that once technology was introduced into the classroom but then later withheld, it diminished student trust in teachers. They also found that because of the increased familiarity that students had with technology, the students became more interested in taking technology integration further than the teachers were willing to go. Research conducted by Donovan, Hartley, and Strudler (2007) of a one-to-one initiative in an urban middle school in the United States, came to similar conclusions; the instructional changes technology necessitates from the teacher may be challenging, so teachers need to confidently embrace the use of technology to provide benefits to their students. Though Shapley et al. and Lowther et al. provide clear reasons for pursuing technology integration, Donovan et al.'s findings must be kept in mind. Integrating technology into the classroom will cause change. The data from these studies provides evidence that making instructional changes for effective technology integration can be challenging for teachers and will have consequences that must be accounted for, both good and bad.

There are several conclusions to be drawn from the literature regarding technology and student achievement. First, although technology has a long history of classroom use (Cuban, 2001), the pace of change in technology and the configuration of its use may have a greater impact than currently understood (Downes & Bishop, 2015). Second, the decision to integrate technology in schools with the hope of increasing student scores on federally mandated tests is not strongly supported in the research (Angrist & Lavy, 2002; Shapley et al., 2011). Third, measuring the growth of other skills, not typically included on standardized testing, may be a better gauge of the effectiveness of technology integration in the classroom (Becker, 2000). Although the organizations that drive the conditions that form the macrosystem remain focused on federally mandated test scores, the issue cannot be ignored. However, there are other viable reasons for pursuing technology integration in schools.

Exosystem

In EST, the exosystem represents the settings where the focal group is not a participant, but decisions are made that affect the focal group (Bronfenbrenner, 1994). In this ecology, policy and funding mandates promulgated by local, state, and national legislative bodies function as the exosystem.

Policy mandates. The integration of technology into classroom practices has been a central component of educational reform efforts since the recommendation by the A Nation at Risk (1983) report that computer science be added to the general curriculum of schools. Though *A Nation at Risk* demarcates the modern era of technology integration, the federal government has been supporting technology education since the launch of Sputnik and the passage of the National Defense Act of 1957 (Cherian, 2009). A policy paper prepared for the Center on Education Policy by Cherian (2009) identified a variety of these efforts. Early attempts at guiding technology integration varied widely, from underwriting Sesame Street to the development of Star Schools, a federally supported program intended to increase access to distance education.

In the modern era of technology integration, following the publication of *A Nation at Risk* (1983), the most prominent federal effort in guiding technology integration is e-Rate, a congressionally established fund that subsidizes Internet access for schools and libraries (Park, Sinha, & Chong, 2007). Although not universally successful in accomplishing its aims in the early years, more recently, e-Rate has proven successful in accomplishing the goal of connecting schools and libraries to the Internet. This is evident in a qualitative investigation of e-Rate conducted by Park et al. (2007); they analyzed data gathered from documents published by the organizations that run the e-Rate fund and provide oversight, as well as from interviews with employees and constituents of the program. In addition to subsidizing Internet access for schools and libraries, e-Rate has also been a valuable tool in providing regulatory leverage for the federal government (Villano, 2008). For example, e-Rate funding is contingent on adherence to congressional legislation that requires filtering of Internet access in schools.

Though e-Rate is the most well-known example of federal efforts to regulate technology integration, there is a long history of federal involvement. In a retrospective of more than 20 federally funded policy papers published since 1983 focusing on technology integration, Culp, Honey, and Mandinach (2003) identified three distinct themes as primary drivers for the integration of technology into schools. They are: "technology as a tool for addressing change in teaching and learning," "technology as a change agent," and "technology as a central force in economic competitiveness" (pp. 5–6). In their review, Culp et al. noted that these forms varied very little over the 20 years covered by the policy papers.

Though Culp et al.'s (2003) research was conducted using policy papers published in the United States, similar themes are evident in other nations as well. This suggests that the drivers the authors identified represent a common understanding, shared by national governments, regarding how technology should be used in school. Aesaert, Vanderline, Tonduer, and von Braak (2013) conducted a qualitative review of the national education technology policies of

Norway, Flanders, and England using the policy documents produced by each nation as their data source. The researchers found that although all three nations acknowledge the use of educational technology to support economic growth, echoing Culp et al.'s findings, Aesaert et al. found each nation also focused on using technology in education as a way to create equity. Though Aesaert et al.'s findings do not precisely align with Culp et al.'s two other factors, technology as a change agent and as a tool to change education, it could be understood as a synthesis of the two strands of thought present in the American policy documents.

The influence of policy mandates is not as strong as it may appear. In a report on how school officials make decisions regarding technology product selection for implementation, Roberts et al. (2017) found that few administrators pay attention to the results of federally funded, independent, research on educational technology products. Further, instead of relying on reports financed by federal grants or policy recommendations from governmental institutions, school leaders often rely on the advice of the companies that produce technology products (Roberts et al., 2017).

Policy and funding mandates are essential components of technology integration as they often guide the technology purchasing and implementation decisions made by schools. The amount of influence they exercise over the process, though, remains a matter of some debate. When funding is tied to federal policy, as in the case of e-Rate, efforts to guide technology integration by the federal government are successful (Park et al., 2007). However, as Roberts et al. (2017) point out, simple guidance, without funding, goes largely unheeded. This limited success in guiding local policy decisions is an issue that Culp et al. (2003) and Aesaert et al.'s (2013) findings bring into focus as national governments have clear goals for technology integration, without the promise of additional funding to drive local decision making, it is unlikely that federal policy will guide local practice. Instead, it is up to groups within the local educational organization to drive technology integration policies and practices. One method commonly used to do this is professional learning. Professional learning refers to learning that is focused on supporting the professional practice of teachers (Guskey, 2002). It varies in form, including small group collaboration time, large group direct instruction, or one-on-one work with an instructional coach (Darling-Hammond, Hyler, & Gardner, 2017).

Microsystem

The microsystem, as Bronfenbrenner (1979) defines it, represents interactions between the focal group and various other groups of interest in a specific setting. In this ecology there are four groups of interest: district technology administrators, students, teachers, and school site administrators. Each group will be examined independently.

District technology leadership. One of the groups functioning in this microsystem is made up of district office administrators. Three sub-components of this factor include district technology vision, technology purchasing decisions, and technology-focused professional learning. All three sub-components exercise influence on the way technology integration occurs in schools.

District technology vision. The district's vision for technology integration in schools, as identified by Daniels, Jacobsen, Varnhagen, & Friesen (2014) in their mixed-methods research into school purchasing decisions in 23 school districts in Canada, has a direct effect on the outcome of the technology integration that takes place in school. Daniels et al. collected survey data from students and teachers from 70 schools, conducted interviews and focus groups, and kept field notes from classroom visits. Daniels et al. believe that what they found was a consequence of the way the district's vision allocated resources. In a mixed method study also focused on district purchasing decisions Webster (2017) incorporated data from 20 district and site administrators from Virginia and identified purchasing decisions as a factor related to district vision, or more precisely, purchasing decisions were driven by a lack of district vision.

In addition to the district technology vision, there are other possible factors that district-level administrators may have to address that affect technology integration across multiple sites. One such issue, identified by Berrett, Murphy, and Sullivan (2012) in their qualitative research into the technology integration practices of five central California schools, is the requirement of district officials to implement technology integration reforms mandated by state or local governments. The research data for this study consisted of field notes, interview, and observation data. The researchers found that state mandates, which require district administrator time and attention, may distract technology leaders from focusing on practices that increase meaningful student use of technology.

One consequence of spending time focusing on regulatory issues is identified by Daniels et al. (2014). They found that district-level administrators were more likely to consider technology integration successfully concluded when all the devices were deployed because they were not directly responsible for the day-to-day operation of classrooms. Further, because district administrators are often in charge of meeting regulatory standards that ensure student safety, an issue identified and discussed as occurring in the exosystem, they may have erred on the side of caution when it came to enforcing more restrictive policies on technology integration, e.g., Internet filters (Daniels et al., 2014). For these reasons, the district technology vision, though valuable and vital for directing and technology integration, may be superseded by legal and logistical requirements.

Technology purchasing decisions. The selection of specific technology for school use is not necessarily driven by the curricular needs of students; often it is driven by a perceived need to keep up to date with other local school districts, the fiscal reality of the organization, or in response to current market pressure (Webster, 2017). The number of devices available for student use remains a central issue in the success or failure of technology integrations (Pittman & Gaines, 2015). This is especially true in small or rural school districts that have fewer resources to purchase devices as Larosiliere, McHaney, and Kobelsky (2016) found in their quantitative study that used preexisting survey data from 7,415 principals in Texas. Other barriers also exist; Webster (2017) found, in a study of 20 Virginia districts, that where technology integration had the necessary fiscal and structural support to make the number of purchased devices a non-issue, barriers to appropriate device selection remained. Technology purchasing decisions impact every stage of technology adoption and integration because the capabilities of the technology selected were often driven by the need to keep up with the market, not what was in the best interest of students (Webster, 2017). In the context of the problem of practice being investigated, it is true that access to technology is no longer a problem; all students have access to a personal device. Although Pittman and Gaines' finding that access to devices remains an issue for some school districts is an important reminder of the work left to be done across the field of education, it is not a concern for this study. It is the concerns Webster raises that are more representative of the context under study.

The influence of district technology leadership is an important factor in technology integration (Webster, 2017). From setting the vision for technology integration in the organization to final purchasing decisions, critical components of what technology integration looks like in a district occur at this level. However, though district technology leadership can set the vision and provide the tools, in many cases they do not exercise any direct influence over the students and teachers who are using the technology. Implementing the vision and providing the guidance for effective technology is often in the hands of school site administrators.

District technology professional learning. The power of professional learning to affect change in schools has been well researched. The ability of professional learning to impact technology integration was highlighted by Pittman and Gaines (2015) in a survey of 75 third-, fourth-, and fifth-grade teachers in Florida. The authors found that 13% of teachers who had not attended technology-focused professional learning reported using technology, though 47% of those who had participated in professional learning reported technology integration in their classrooms. Professional learning functions at a variety of levels and can meet the entire range of teacher needs, from guiding neophytes through first principles of technology to extending the professional repertoire of teachers who have mastered the domain (Mueller et al., 2008).

Characteristics of effective teacher professional learning, as identified by Darling-Hammond et al., (2017) include sustained professional learning, collaboration between teachers, and content that is focused on the observed need of the program that is responsive to the local school environment. One such characteristic of effective professional learning is collaboration (Darling-Hammond et al., 2017; Desimone & Garet, 2015). In a multi-case study conducted with three teachers in a parochial middle school in the Pacific Northwest, Windschitl and Sahl (2012) found the professionally isolated condition that most educators work in reduces their ability to collaborate and learn from their peers; this often stunts the adoption of innovative practices in their classroom.

In addition to collaboration, professional learning through sustained and explicitly planned events (Darling-Hammond et al., 2017) has the potential to break teachers out of their professionally imposed isolation and provide exposure to the larger world of professional practice. The power of sustained and explicitly planned events is demonstrated by Topper and Lancaster (2013) in their study of five midwestern school districts with one-to-one initiatives in place where explicitly planned, regular, and relevant professional learning was identified as key to technology integration success.

Technology focused professional learning for teachers delivered by school and district level administrators was one of the most often cited interventions in the literature (Berrett et al., 2012; Pittman & Gaines, 2015; Topper & Lancaster, 2013; Windschitl & Sahl, 2002). This does not imply, however, that all technology focused professional learning is effective. In a 3-year study of science classrooms that had ubiquitous access to technology, Drayton, Falk, Stroud, Hobbs, and Hammerman (2010) identified a common, but problematic, trend in the professional learning offerings available to support technology integration. Drayton et al. found that the technology focused professional learning opportunities, commonly one-shot workshops or conference style events, were popular with teachers but did not produce change because of the haphazard nature of the event. Explicitly planned and sustained technology focused professional learning as suggested by Drayton et al. may produce more positive results, a finding that aligns closely with Darling-Hammond et al. (2017) recommendations for high-quality professional learning.

Several problems with the many forms of technology-focused professional learning, like one-shot workshops and conferences, exist (Darling-Hammond et al., 2017). The Pittman and Gaines (2015) study found a “strong positive correlation between professional learning and overall technology integration,” but they also found that the “majority of their respondents rated them [professional learning opportunities] to be less-than-adequate” (p. 548). This finding may have been a consequence of a lack of continuity in professional learning practices, which reduced the quality of the professional learning; this is a common issue with one-shot workshops as identified by Darling-Hammond et al. Or, it may have been caused by a lack of opportunity to participate in reflection and feedback as Drayton et al. (2010) found. However, regardless of the quality of technology professional learning, without school site administrators focused on supporting the change at the school site, little change will occur (Machado & Chung, 2015).

Perhaps a missing component in making technology focused professional learning effective, implicitly identified by Topper and Lancaster (2013) and explicitly by Machado and Chung (2015), is a person or persons who are responsible for advocating, guiding, and leading technology integration in a school. Although several studies recommend a person be designated by the principal to provide both pedagogical and technical knowledge to the staff (Donovan et al., 2007; Machado & Chung, 2015), it may be that the technology leadership demonstrated by the school site administrator is the missing component (Claro, Nussbaum, Lopez, & Contardo, 2017).

Meaningful uses of technology by students. The issue driving this problem of practice is that students, in this context, have equitable access to technology but inequitable ability to complete meaningful work with technology. Students do not have the necessary agency to directly affect what kind of work they are allowed to complete or the technological resources they are allowed to access. However, understanding what kind of meaningful work students can complete with technology is instrumental in understanding how to resolve this problem.

As discussed in the introduction, the first-order barriers to technology integration in schools (Pittman & Gaines, 2015), access to devices and the Internet, have been solved for most schools (U.S. Department of Education, 2016), including the schools operating in this context.

The latest U.S. Department of Education (2016) Education Technology Plan acknowledges that many schools have resolved the first-order barrier of access. Instead of focusing on providing access, the Education Technology Plan is now concerned with overcoming the digital use divide. That is, it is focused on the separation between students who "use technology in ways that transform their learning from those who use learning tools to complete the same activities, but now with an electronic device" (p. 5). Though the report acknowledges this shift, it does not clearly define what are transformative uses of technology.

Instead of a concise definition, pedagogical approaches to learning are presented that include project-based learning, personalized learning, and blended learning (U.S. Department of Education, 2016). This approach to defining transformative uses of technology, though not concise, is useful. Further, after 40 years of attempting to use specific pieces of hardware and software to transform education, this definition acknowledges that the technological tools are less important than the learning processes they enable.

The learning processes identified by the *2017 National Education Technology Plan Update* (U.S. Department of Education, 2016) are the province of the teacher, not the student. The report identifies what the students should be doing with technology, but it is up to teachers to enact those changes. Therefore, although changing what students do with technology is the ultimate issue at the heart of this problem of practice, it is not the students whose practices need to change, at least initially. It is up to the teachers and the school site administrators to approach the use of technology in the ways the report recommends.

Teacher beliefs and practices. The teaching staff at a school comprise another group operating in the microsystem. There are two components that make up this group's structure:

teachers’ technology beliefs and teachers’ technology practices. These two components influence the way the teaching staff interact with, and implement, technology in their classrooms.

Teachers’ technology beliefs. The attitude that teachers hold toward technology is one of the most critical factors in determining how they will integrate, or whether they will integrate, technology into their classroom (Ertmer et al., 2006; Inan & Lowther, 2009; Mueller et al., 2008). Teachers who did not use technology with their students often felt they, the teachers, lacked the necessary expertise (Becker, 2000), lacked confidence in their ability to use technology, manage its use by students (Donovan et al., 2007), or did not feel they were very effective technology integrationists (Miranda & Russell, 2011). This last component, the self-efficacy beliefs a teacher holds in regard to their ability to use technology, is one of the most important elements in forming a teacher’s attitude toward technology integration in the classroom. Self-efficacy refers to the metacognitive activity that people use to judge their capability to deal with a specific set of circumstances (Bandura, 1986). Teachers who do not feel comfortable with technology, that is they do not have high technology-related self-efficacy, will not use it or allow its use by their students (Becker, 2000). Confidence, management, and self-efficacy are components that affect teacher attitudes about their ability to integrate technology.

As Miranda and Russell (2011) found in their survey of 1,040 teachers from 81 schools in 21 school districts in Massachusetts, an important factor contributing to teachers’ beliefs regarding technology integration in their classroom is their sense of self-efficacy. Self-efficacy beliefs are based on previous experiences and the degree that individuals felt successful in meeting a specific challenge (Flavell, 1979). Bandura (1977) who first introduced self-efficacy as a construct, identified four components of self-efficacy learning: mastery experiences, vicarious experiences, verbal persuasion, and emotional arousal. According to Bandura, it is possible to affect the self-efficacy beliefs of an individual through participation in these kinds of activities. Past experiences have a cumulative effect, and one lesson builds upon another to reinforce one's belief in one's capabilities (Bandura, 1986). Teachers who attempt to integrate technology into their classroom, but experience a failure that they feel is due to their facility with technology are less likely to try again in the future (Miranda & Russell, 2011), though teachers who experience success are more likely to incorporate technology in the future (Mueller et al., 2008). These findings are important for a several reasons, but one important reason is that belief systems are difficult to change, and they are strongly connected to behavior (Pajares, 1992). Fortunately, as Ertmer et al. (2006) described, systems based on "knowledge-based beliefs" (p. 32), regarding technology integration are easier to change than beliefs with greater existential import, like the belief in an after-life. According to Ertmer et al., it may be the case that because beliefs regarding technology in the classroom are knowledge-based, the ability to affect change in the beliefs is much more likely.

One possible target for learning of technology-related self-efficacy beliefs may be the way teachers personally use technology. Mueller et al. (2008) defined a teacher's comfort level as the ease and enthusiasm for using computers, based on their survey results of 389 K–12 educators. Hechter and Vernette (2013) found, in a survey of 430 K–12 science educators in Canada, that low comfort levels lead to decreased use of technology. Technology failure compounded this problem; when teachers with low self-efficacy experienced a technology integration failure, like the inability to get an application to produce the desired results or failure to connect to the Internet, either within the classroom or out, their willingness to attempt to use the technology again in the future decreased (Miranda & Russell, 2011). The experience of technology failure likely decreases teachers' feelings of self-efficacy (Miranda & Russell, 2011) and make technology integration success even less likely in the future.

In the same way that self-efficacy beliefs negatively affect the use of technology, strong self-efficacy beliefs regarding technology lead to increased use (Inan & Lowther, 2009). Even among groups where technology integration is otherwise low, such as teachers who lack technology experience, a strong sense of self-efficacy can ameliorate the effects of other factors that may reduce use (Pittman & Gaines, 2015). Beliefs regarding the importance of technology and its place in the classroom and society that are held by a teacher can either decrease or increase a teacher's willingness to incorporate technology integration into their classroom (Miranda & Russell, 2011).

The feelings of self-efficacy, events, and technology efficacy beliefs together may form the basis that teachers use to establish their technology self-efficacy. The more experience a teacher had with technology, the more likely they were to integrate it into their classroom practice (Miranda & Russell, 2011). The more successful experiences they have integrating technology, the more likely they are to continue to integrate in the future, and as Mueller et al. (2008) stated, "it may be the case that actual classroom success with computer technology is a prerequisite or catalyst for the integration of computers as an instructional tool" (p. 1532). If these experiences are positive, over time, a teacher with low self-efficacy may have their belief system altered.

What teachers believe about technology and their ability to use technology has profound implications for technology integration in the classroom (Miranda & Russell, 2011), and because these beliefs tend to be loosely held (Ertmer et al., 2006), they present an opportunity to intervene. Teachers who embrace technology for their own personal use are much more likely to use the tools with their students (Hechter & Vernette, 2013). Those who do not believe they are capable technology integrationists will not incorporate the tools into instruction, but those who do believe themselves to be capable technology integrationists will (Inan & Lowther, 2009). In fact, simply having a higher sense of self-efficacy will guard against other characteristics that would normally limit technology integration (Pittman & Gaines, 2015). Effective use of technology requires teachers to be comfortable using technology (Mueller et al., 2008).

Teachers' technology practices. The way that a teacher perceives their role in the classroom and the actions they take related to how to best educate students has a profound effect on the methods of technology integration by both the teacher and the students. Hsu (2016) conducted a mixed-methods study that involved 152 teachers and used a survey instrument, observations, and interviews to collect data. The researcher found that traditional instructional methods wherein the teacher presents all the knowledge the student is expected to learn, often through direct instruction (e.g., lecturing. Traditional instruction is not a good fit for technology integration as one of the most important uses of technology in classrooms is to conduct independent, student-driven, research (Hsu, 2016). Instead of employing traditional instruction methods, constructivist instruction methods of teaching, like project-based learning, problem-based learning, or exploratory learning where the teacher acts as facilitator, allow students to use the technology to find and incorporate information that the teacher may not have access to or knowledge of (Drayton et al., 2010). Further, the constructivist pedagogical perspective, wherein students construct their learning, also supports the meaningful use of technology by students as the devices act as tools through to construct their knowledge (Shapley et al., 2011).

Some researchers have found that constructivist approaches to instruction that incorporate technology reinforce a continued and more complex use of technology to support classroom learning (Becker, 2000; Windschitl & Sahl, 2002). Teachers who practice a constructivist approach tend to use technology more often, and the use of that technology is more varied (Becker, 2000). Other researchers found that technology integration often functioned to support whatever style of instruction already existed in the classroom (Mueller et al., 2008). Still others have found that the use of technology "requires a shift toward student-centered practices" (Donovan et al., 2007, p. 280). Donovan et al.'s (2007) work provided context to the relationship between technology integration and instructional style that Mueller et al. (2008) articulated. As is evident from the results of these studies, there is not complete agreement in the research on this issue.

In a review of the literature, several other issues related to constructivist approaches came to light. Chen (2008) identified a mismatch in research conducted with 12 Taiwanese high school teachers; the type of pedagogical perspective a teacher reported holding and the type of pedagogy they implemented within their classroom were not necessarily the same. A constructivist approach to learning is accepted by many researchers as the best pedagogical approach to support technology integration (Becker, 2000; Donovan et al., 2007; Windschitl & Sahl, 2002). Although constructivism is frequently espoused by teachers as their preferred way to teach, when observed, direct instruction was more often observed (Becker, 2000). The teachers in the study conducted by Chen (2008) pointed to a variety of reasons as for the disparity between espoused practices, constructivism, and actual classroom practices, typically direct instruction. Chen identified the relative complexity of constructivist instructional styles when compared with traditional instruction as the need to meet the primary goal of the school as they see it, which is increasing student test scores, as efficiently as possible.

Another issue related to the relationship between pedagogical viewpoints and technology integration relates to the research regarding teacher self-efficacy. When the incorporation and use of technology in the classroom requires a change in the teacher's belief system regarding instructional practices from traditional instruction to constructivist instruction, it is likely that the teacher will resist the use of technology and the new pedagogical approach (Ertmer et al., 2006). Ertmer et al. (2006) found that when many changes are required in a teacher's practice, it can be overwhelming, and as a result, all change is resisted. Supporting this shift from a traditional approach to instruction to a constructivist approach to instruction, especially when teachers are resistant to change, is not easy. Though according to Shapley et al. (2011), professional learning opportunities and a school site administrator focused on technology integration can help ease the transition.

In addition to teachers' beliefs regarding technology integration, teachers' beliefs regarding instruction is another important factor in the successful integration of technology in the classroom. Constructivist pedagogical strategies better align with the capabilities of technology tools (Becker, 2000). Placing devices in a classroom is not enough; a shift in pedagogical practice is required for the full realization of technology integration to occur (Drayton et al., 2010). Although some teachers are capable of making this transition on their own, support and direction from their school site administrators is often key to the process.

School site administrator beliefs and practices. School site administrators are the focal group in this ecology. Their approach to technology integration is a critical determinant for successfully integration technology into schools identified in the literature. The ability of school site administrators to affect technology integration in schools, may be the most influential factor in technology integration success (Bebell & Kay, 2009; Claro et al., 2017; Larosiliere et al., 2015; Metcalf & LaFrance, 2013; Shapley et al., 2011).

Technology beliefs of school site administrators. Research identified the importance of the school site administrator's leadership in setting and maintaining a vision (Berrett et al., 2012; Larosiliere et al., 2016; Machado & Chung, 2015; Topper & Lancaster, 2013). The expected practice for technology integration in schools, identified by the International Society of Technology Educators (2009), is an administrator's ability to "inspire and lead development and implementation of a shared vision for comprehensive integration of technology to promote excellence and support transformation throughout the organization" (p. 1). This role is an important component of the school site administrator's ability to exercise technology leadership (Larosiliere et al., 2016). A strong expectation of technology integration results in increased classroom technology integration and a clear understanding of the purpose of incorporating technology into classroom practice by teachers (Larosiliere et al., 2016). Schools with site administrators that have a strongly held personal expectation for technology integration among their staff had stronger outcomes when integrating technology (Shapley et al., 2011). There is, sometimes, a gap between the school site administrator's expectations for technology integration and the teacher's pedagogical approach, but the more intimately involved a school site administrator was in daily classroom activity and use of technology, the greater the alignment of the technology vision among school site administrators and teachers (Claro et al., 2017).

School site administrator's expectations for technology integration, may also be the least realized factor in successful technology integration. As Metcalf and LaFrance (2013) found in their qualitative study that included responses from 102 principals from a large urban school district in the American southeast, school site administrators ranked visionary leadership as the issue they were least prepared to address. Similarly, Machado and Chung (2015) found, in their mixed-methods research focused on four principals, that school site administrators ranked their influence over technology integration below professional learning and the teacher's willingness to use technology. According to the research presented in this review there is a disconnect between what school site administrators believe about their role in maintaining the expectation for technology integration and the effect they can have.

As was found to be the case for teachers (Inan & Lowther, 2009; Miranda & Russell, 2011), the self-efficacy beliefs of administrators regarding technology integration are also important. However, because of the institutional authority held by school site administrators in the school system, their beliefs, and how those beliefs affect their perspective, are more important than the beliefs of any one teacher (Claro et al., 2017). The school site administrators set the expectation and hold teachers accountable for following that expectation at each school site (Shapley et al., 2011). If a school site administrator does not hold strong self-efficacy beliefs about their ability to use technology, it is much less likely they will call for its use at their site, which in turn would dramatically affect technology integration in classrooms and among teachers and students.

Technology culture of school site administrators. In much the same way that school site administrators are responsible for establishing and maintaining a vision for technology in their school, they are also the primary leaders of school technology culture (Machado & Chung, 2015). The culture of technology integration is established through the school site administrator's expectations, their demonstrated commitment to that expectation, and the action they take in support of their expectations (Larosiliere et al., 2016). The established culture has a substantial impact on the success or failure of technology integrations (Berrett et al., 2012).

In a study of 605 Taiwanese principals, Chang (2012) found that a mediating factor for the effect that school site administrators have over technology integration is their comfort level with technology integration. In a survey of 64 school leaders in New Zealand, Stuart, Mills, and Remus (2009) found that school site administrators who understood and were comfortable with technology were more likely to support its use. This can be challenging because technology, as Anderson & Dexter (2005) noted, is constantly changing and leaders who are not comfortable with technology are unable to keep up with rapid changes. Fortunately, professional learning for school site administrators aimed at redressing their lack of knowledge has shown positive results in addressing the issue (Stuart et al., 2009). Administrators who have a clear understanding of effective technology in classrooms demonstrate the most progress in integrating technology into practice at their school (Chang, 2012). It is likely then, that providing support to the school site administrators to grow their understanding of meaningful technology integration will lead to increased meaningful technology integration by teachers and students.

Vision and culture are both important components of a school site administrator's ability to affect technology integration. The actions taken by the school site administrator have the most direct effect on the use of technology in a school (Anderson & Dexter, 2005). In their study, Shapley et al. (2011) found that schools that had successfully integrated technology had administrators who worked to convince teachers that technology integration was necessary. School site administrators who are successful in integrating technology in their school also support teachers to make changes in classroom practice necessitated by the introduction of technology (Berrett et al., 2012). The more visible the school site administrator's actions are in supporting technology integration, like incorporating technology into staff meetings, the faster the integration process occurs (Larosiliere et al., 2016).

The limits of the school site administrator's actions that affect technology leadership beyond their comfort and understanding of technology may affect technology adoption as well. When school site administrators call for technology integration but do not include the use of technology in interactions with their staff, like site-led professional learning, communication, or the presentation of school-wide data, the successful implementation of technology is threatened (Anderson & Dexter, 2005). Without an understanding of how technology can promote student learning and effective instruction school site administrators will not be effective advocates for its use (Chang, 2012).

Another limiting factor of school site administrator influence is the implementation of technology focused professional learning. School site administrators who do not implement a structure for supporting technology professional learning by teachers also have less success in integrating technology across their school (Berrett et al., 2012). Common styles of technology focused professional learning, like conferences and one-shot workshops, cannot be the norm if content covered in professional learning is going to take hold (Darling-Hammond et al., 2017). School site administrators may need to provide focused, ongoing support for technology integration to be successful.

Finally, leaders who promote the use of technology to support methods of traditional instruction, like simply taking notes from a lecture or writing papers, will not see success (Chang, 2012). Instead, uses of technology that support constructivist approaches to instruction are necessary (Hsu, 2016). Approaches to technology integration that include independent research and artifact creation, must be pursued by school site administrators to support technology integration (Drayton et al., 2010).

Much like the beliefs held by teachers, school site administrators' personal practice, meaning their own use of technology in professional learning and communication, is an important factor in the success of technology integration at the school level. Policy leaders can call for specific actions to be taken in schools, district leaders can make purchasing decisions and set the district vision, and professional learning can provide support, but if the school site administrators do not have a vision for technology integration at their school, it will not happen (Claro et al., 2017). The vision setting and leadership of school site administrators are critical to the success of technology integration (Shapley et al., 2011).

Summary

This review of the literature revealed a number of factors that influence technology integration in schools. The use of state mandated achievement test results to evaluate the success of technology integrations (Bebell & Kay, 2009; Becker, 2000) looms over this problem. This is especially problematic as the kind of learning that technology best supports may not be measurable using achievement tests (Becker, 2000).

Moving to the more local level, the problem of practice can be conceived of as an interrelated network of systems (see Figure 1.2). At the center of the network is effective technology integration—the desired outcome. Two systems exert direct pressure upon this outcome: technology policies and teachers' beliefs and practices. Policies create the culture wherein technology integration is enacted and affects what is possible to accomplish (Aesaert et al., 2013). Teachers are the ultimate arbiters of what happens in the classroom; without their involvement, little of consequence will happen (Ertmer et al., 2006).

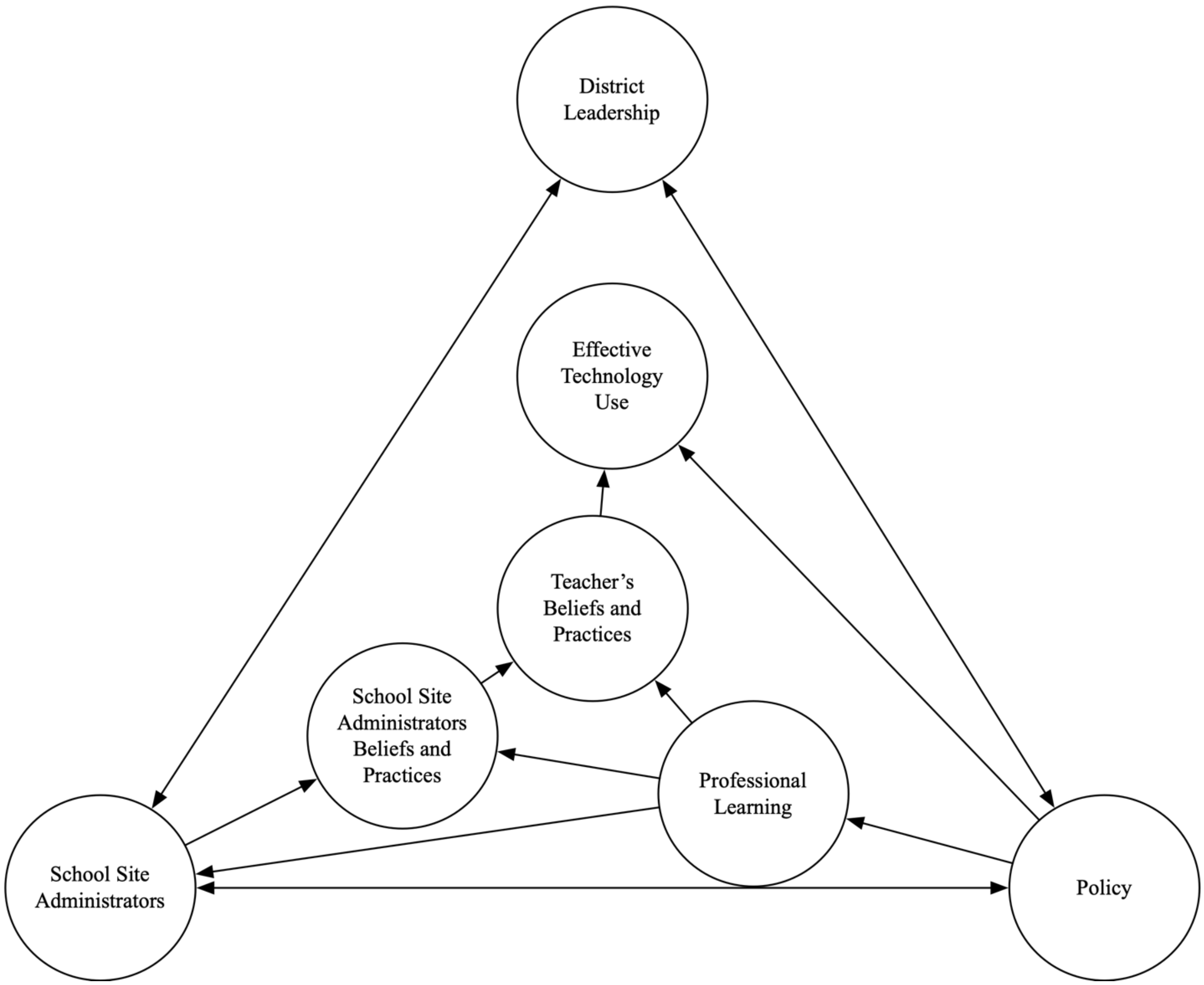


Figure 1.2. This conceptual framework organizes the interaction between factors identified as components of the problem of practice. Arrows connecting the identified topics describe the relationship between each, with effective technology use identified as the end-goal.

Teachers are not, however, the focal group for this problem of practice. The preceding literature review that guided the organization of this conceptual framework acknowledged the role that teachers play in addressing ineffective technology integrations that are neither equitable nor support the completion of meaningful work by students (Ertmer et al., 2006; Inan & Lowther, 2009; Mueller et al., 2008) but ultimately revealed school site administrators as the group with the most potential for addressing the problem (Claro et al., 2017; Shapley et al., 2011). The literature review also identified the use of professional learning to influence technology integration (Darling-Hammond et al., 2017). It may be the case that school site administrators who support technology integration through professional learning with their staff have the greatest opportunity to address the problem of practice. The aim of this problem of practice is to enable equitable access to meaningful technology integration across entire schools. One teacher alone cannot make that happen. School site administrators, then, are the best situated group for enacting this change. School site administrators are affected by policy decisions (Culp et al., 2003; Roberts et al., 2017), the direction of district technology leadership (Chang, 2012; Webster, 2017), and professional learning (Berrett et al., 2012; Topper & Lancaster, 2013) but the prime driver of what is possible on a school site is the school site administrator (Larosiliere et al., 2016; Metcalf & LaFrance, 2013). School site administrator's beliefs and practices determine what is valued on a school site (Machado & Chung, 2015), and what can and will be accomplished. School leadership has the greatest ability to influence technology integration implementation (Shapley et al., 2011). For this reason, school site administrators are the focus of this problem of practice.

Chapter 2

Needs Assessment of School Site Administrator Technology Leadership

In recent years the first-order barriers to technology integration, such as adequate access to personal computing devices by students (Ertmer, 1999), have largely been overcome (U.S. Department of Education, 2016). Concerted efforts have been made toward successful technology integration, however, second-order barriers, such as teacher mindset, remain (Ertmer, 1999) and continue to create variability in the success of technology integration. Although there are many factors that one could focus on, as identified in the literature review, this needs assessment focused on the degree of influence school site administrators may have over the success of a technology integration. This factor was chosen because the reviewed literature identified school site administrators as one of the most influential, but little-understood, means for improving technology outcomes. The need to understand the connection between school site administrators influence and the failure of technology integrations makes this study necessary.

The literature review identified six factors operating in the context of this problem of practice: efficacy of technology integration in schools (Bebell & Kay, 2009; Becker, 2000), usefulness of technology-focused professional development practices (Berrett et al., 2012; Topper & Lancaster, 2013), policy and funding mandates of state and federal agencies (Culp et al., 2003; Roberts et al., 2017), district offices' vision for technology integration (Chang, 2012; Webster, 2017), beliefs and practices of teachers regarding technology integration (Ertmer et al., 2006; Donovan et al., 2007; Hechter & Vernette, 2013; Hsu, 2016), and the beliefs and practices of school site administrators as they relate to the technology integration process (Larosiliere et al., 2016; Metcalf & LaFrance, 2013). After identification, these factors were organized according to the nature of their connections to and influence over the focal microsystem: school site administrators. School site administrator leadership was identified as the system with the most likelihood for affecting change because of its potential to influence a number of other systems and the meaningful use of technology by students (Anderson & Dexter, 2005; Berrett et al., 2012; Chang, 2012; Larosiliere et al., 2016; Machado & Chung, 2015).

Context of the Study

This study focused on a K–12 school district in central California, where personal computing devices have been deployed to every student across all school sites. The district covers nine square miles on the western edge of the third most populous town in the county, serving nearly 5,000 students. The district is made up of nine schools, the demographics of each school site vary little. The area where this town is located is heavily agricultural, and 76% of the students qualify for free and reduced lunch; the latter is an indicator of socioeconomic status used by the United States Department of Education (2003). The district consists of six elementary schools, two middle schools, and a high school.

The personnel employed by the district include 100 staff members in non-instructional roles, 230 teachers, 10 district office administrators focused on the instructional priorities of the district, and 18 school site administrators who served as the research focus group. Each school currently has one principal and one vice principal. Along with administrators, teachers at the nine sites were also part of the study population. Although the sample population for this study was school site administrators, the long range purpose of an intervention will be to affect change in the technology practices of the teachers and students.

Statement of Purpose

Although technology is prevalent in the district, varying degrees of technology integration have resulted. Some schools more thoroughly incorporate technology use, while others fail to affect student growth positively. The purpose of the needs assessment was to investigate the degree of influence school site administrators exercise over the process of technology integration in their schools. The focus of this study was appropriate because, although research on technology integration has identified the major factors involved, the influence of school site administrators has often been noted, but not closely examined (Donovan et al., 2007). It may be the case that the technology beliefs of school site administrators around technology integration, both intentionally and unintentionally, influence the classroom practices of their teachers. This study may illuminate whether an interaction between school site administrator beliefs and teacher attitudes and actions regarding technology integration exist. The constructs analyzed in this study were school site administrators' technology-related self-efficacy beliefs (Shapley et al., 2011), school site administrators' technology-related practices (Anderson & Dexter, 2005), and teacher perceptions of principal beliefs about technology (Larosiliere et al., 2016). This descriptive study was conducted to answer the following questions.

1. What do school site administrators believe about the utility of technology integrations within their educational practice?
2. How do school site administrators view their role in supporting technology integration in their school?
3. How do teachers view the role of school site administrators in promoting technology integration in their school?

Methods

This descriptive study was designed to examine the interaction between the administrator's beliefs and actions regarding technology integration and the resulting change, or lack of change, regarding technology practices in the classroom and whether teachers believe their administrators affect their practices in the classroom. To understand the interaction between these variables, two previously validated survey instruments were identified and adopted to investigate the research questions.

Participants

To answer the research questions, data were collected from two distinct populations: school site administrators and teachers. The identification and data collection from these two populations were appropriate because they are intimately involved in the problem of practice as they may both exercise influence over the integration of technology into classrooms.

School site administrators. To recruit this population, the student researcher began with a brief email to the school site administrators in the school district requesting their participation and describing the purpose behind the request. They were assured of the anonymity of the process, informed that they would be receiving a link to the electronic survey separately from an administrative assistant, and clarified that their participation was completely voluntary. As this instrument collected data entirely electronically, the student researcher inserted the consent language provided by the Institutional Review Board. The question requesting their consent was the only required question in the instrument. If they chose to withhold consent, the survey immediately concluded.

This population was comprised of the 18 school site administrators in this context (i.e., principals and vice principals). The instrument used to collect data from this sample did not include demographic data, and as the population was small, nearly any specific demographic data collected could have been used to identify participants. However, because the makeup of the participation pool is known to the student researcher, some general demographic information can be supplied without concerns over the loss of the anonymity of the participants. The participants were four men and 14 women and ranged in age from 31 to 57. All participants have a master's degree, and two are currently pursuing doctoral degrees in educational leadership. The shortest length of tenure in their current position is one year, and the longest is nine years.

Teachers. For the recruitment of this population, the student researcher began by composing a brief email requesting their participation and indicating the purpose of the request (see Appendix B). The message included a notice that participation in this survey was completely voluntary, and they could discontinue participation at any time. As this instrument collected data entirely electronically, the student researcher inserted the consent language provided by the Institutional Review Board at the beginning of the survey. The question requesting their consent was the only required question in the instrument. If they chose to withhold consent, the survey immediately concluded. This population comprised the entirety of all certificated teaching staff in the context, a total of 230 possible participants. The instrument collected demographic information related to the length of tenure in the profession, as is highlighted in Table 2.1.

Table 2.1

Length of Teaching Tenure

Length of tenure	Teachers (N = 44)
Less than 5 years	16
5 to 9 years	8
10 to 20 years	13
More than 20 years	7

As the student researcher was familiar with the participant pool, some other general demographic information could be provided regarding the entire pool. Nearly 75% of the teaching staff employed by this district had three or fewer years in the profession. About 60% of the teaching staff were not fully qualified, in that they had not completed the requirements to receive a state teaching license. Of the 230 possible participants, 55 were male, and 175 were female.

Measures and Instrumentation

This section describes the measures, data collection methodology, and data analysis used to conduct this needs assessment. Quantitative data were collected using two different survey instruments. Both instruments were externally validated and have been used in other studies (Banoglu, 2011; Rakes, Fields, & Cox, 2006).

Principals Technology Leadership Assessment. The Principals Technology Leadership Assessment (PTLA) was developed by the American Institutes for Research (see Appendix A). The PTLA "is intended to assess principals' technology leadership inclinations and activities over the course of the last school year" (McLeod, 2005, p. 1). The PTLA was piloted with 74 school administrators in 2005, and analysis of both validity and reliability were completed. Reliability for this instrument is high. A Cronbach's alpha was conducted with a score of 0.95 (McLeod, 2005). The PTLA was used to collect quantitative data from school site administrators. The subscales in the instrument are aligned to the International Society for Technology Educators (ISTE) standards for administrators. Responses to this survey were collected via a Likert scale ranging from one (*not at all*) to five (*fully*). The PTLA is broken into six subscales; each subscale corresponds with a specific standard from the ISTE standards for administrators. All six subscales collect data related to the construct of the administrator's role. Face validity was established through the review of the instrument by 10 experts in the field selected by the authors of the survey (McLeod, 2005).

The first construct, the beliefs held by an administrator regarding their role in technology integration, hereafter referred to as *administrator role*, is defined as the role that school site administrators believe they have in relation to the introduction, use, and support of technology in their school (Larosiliere et al., 2016) and was measured using the PTLA. These scales were selected because of their alignment with the ISTE (2002) National Educational Technology Standards for Administrators and are specifically designed to show how a school administrator implements the use of technology in their school. Table 2.2 includes examples of questions used in the PTLA.

Table 2.2

Examples of PTLA Subscale Items for the First Construct

Subscale	Subscale question example
Leadership and Vision	To what extent did you communicate information about your district's or school's technology planning and implementation efforts to your school's stakeholders?
Learning and Teaching	To what extent did you disseminate or model best practices in learning and teaching with technology to faculty and staff?
Support, Management, and Teaching	To what extent did you allocate campus discretionary funds to help meet the school's technology needs?
Assessment and Evaluation	To what extent did you promote the evaluation of instructional practices, including technology-based practices, to assess their effectiveness?
Social, Legal, and Ethical issues	To what extent did you work to ensure equity of technology access and use in your school?

The second construct, the beliefs held by an administrator regarding the utility of technology integration, hereafter is referred to simply as *administrator beliefs* (Stuart et al., 2009). To measure this construct, the PLTA Productivity and Personal Practice subscale was used. A sample of the questions for this construct is listed in Table 2.3.

Table 2.3

Examples of PTLA Items for the Second Subscale

Subscale construct	Subscale question example
Productivity and Personal Practice	To what extent did you use technology to help complete your day-to-day tasks (e.g., developing budgets, communicating with others, gathering information)?
	To what extent did you encourage and use technology (e.g., email, blogs, video conferences) as a means of communicating with education stakeholders, including peers, experts, students, parents/guardians, and the community?

LoTi Digital Age Survey for Teachers. The Levels of Technology Innovation (LoTi) Digital Age Survey for Teachers was first developed by Moersch (1995) and was redesigned using the International Society for Technical Educators; National Education Technology Standards for Teachers (LoTi Connection, 2009; see Appendix B). This instrument was designed to collect information from teachers regarding the progress of technology integration and use in their classroom (Mehta & Hull, 2013). In this needs assessment, the LoTi survey was used to collect quantitative data from the teaching staff. In a review of the LoTi, Mehta and Hull (2013) identified cross-loading issues between several of the factors and recommended that the five factors be condensed into three factors. The two factors that Mehta and Hull recommend be eliminated or condensed had reliability scores of 0.90 and 0.94. Neither of these factors were germane to the data from the LoTi that was used in this needs analysis, thus do not present a threat to the validity of the data gathered using this instrument. For the current study, only one construct was used to measure teachers' understandings of their school site administrator's beliefs regarding technology integration in their school. Although the entire survey was administered to the teachers, the only factor of interest for use in this needs assessment is the first factor, which is broken into two distinct constructs: teacher perception and school climate. The remaining four factors are not relevant to this study as they focus on the teacher's use of technology.

The construct *teacher's understanding of their administrator's technology beliefs*, hereafter referred to as teacher's beliefs, is defined as the understanding of the importance of technology integration by teachers as it is communicated to them by their school site administrators in both explicit and implicit ways (Claro et al., 2017). To measure this construct two subscales were used: titled Teacher Perceptions, with five questions; and School Climate, with four questions. Possible responses to questions to both scales were: *strongly agree, agree, no opinion, disagree*, and *strongly disagree*. Table 2.4 includes example items from the LoTi.

Table 2.4

Examples of LoTi Subscale Items

Subscale constructs	Subscale item examples
Teacher Perceptions	I receive useful feedback on the integration of digital resources into my instruction from my administrator(s).
School Climate	Understand and support the shared vision for our school's use of digital resources along with other key stakeholders.

Procedure

The student researcher began the data collection process by selecting two instruments to measure the identified variables. Following that selection, the electronic survey system was identified, and the surveys were created. Next, emails soliciting survey participation were sent out to potential participants in the student researcher's context.

Data collection methods. Solicitation of data for both instruments was accomplished through email and collected in Google Forms. To minimize concerns regarding coercion, the link to the survey was sent to school site administrators by an administrative assistant. The teacher survey was emailed to the teaching staff by a teacher on special assignment. No personal identifiable data were collected, and all participants were adults. The data were collected in a Google Sheets spreadsheet.

Data analysis. Data for each of the constructs were collected and analyzed using descriptive statistics in order to describe and summarize the data in the expectation that patterns would emerge. Scores for each of the subscales were computed into a single variable, and the mean score for that variable was then calculated. The data analysis was accomplished via the use of the statistical analysis package, SPSS. The results of the analysis for each construct appear below.

Administrator beliefs. Analysis of administrator beliefs was conducted through the use of the PTLA instrument, subscale three. This subscale is designed to capture the administrator's use technology in personal practice. The subscale is comprised of five Likert questions with possible range of responses from -2 (*not at all*) to 2 (*fully*). Out of a possible participant pool of 18, 11 school site administrators participated.

Administrator role. Analysis of the administrator's role was also conducted through the use of data collected using the PTLA instrument. Out of a possible participant pool of 18, 13 school site administrators participated, but two participants did not respond to all of the questions. Five subscales from this instrument were used: Leadership and Vision, Learning and Teaching, Supervision and Management, Assessment and Evaluation, and Social and Ethical Uses of Technology. As with the subscale productivity and practice, examined in the previous construct, all of these subscales are aligned with the ISTE Standards for Administrators (2009).

Table 2.5 presents the results of the PTLA. Mean scores for each of the subscales were calculated, as well as the SD as called for in the instrument's scoring guide. The possible responses ranged from -2 (*not at all)* to positive 2 (*fully*). Scores approaching two indicate that the participants strongly align with the values regarding technology integration present in the ISTE standards used as a basis for the questions. Responses closer to negative two indicate the lack of agreement with the values represented by the ISTE standards aligned with the subscale.

Table 2.5

Principal Technology Leadership Assessment

Subscale constructs	*N*	Minimum	Maximum	Mean	*SD*
Visionary Leadership	12	-2.0	1.0	.01	1.0
Learning and Teaching	13	-1.2	1.2	0.4	0.6
Productivity and Personal Practice	13	0.8	1.8	1.3	0.3
Support, Management, and Teaching	11	-1.3	1.0	-0.1	0.8
Assessment and Evaluation	13	-0.8	1.2	0.3	0.5
Social, Legal, and Ethical Issues	13	-0.9	1.6	0.5	0.7
Valid *N* (listwise)	11				

In this data set, there is much more variation than in the subscale used to evaluate administrator beliefs. The composite variable productivity and personal practice had a higher score than all of the others that hover around the middle point scale, *somewhat*. A limiting factor of this study may be the small sample size.

Teacher's beliefs. This construct was measured using the school climate subscale of the LoTi instrument. Of the possible 230 participants, 44 responded. Table 2.6 presents the results of the LoTi survey instrument. The possible responses to each question ranged from negative two to positive two. Scores approaching two indicate that teachers believe that their school site administrators have an impact on technology integration and use at their school site.

Table 2.6

LoTi Digital Age Survey for Teachers

Subscale constructs	N	Minimum	Maximum	Mean	Std. Deviation
School Climate	44	-1.5	2.0	1.3	0.8
Teacher Perceptions	44	-0.2	2.0	1.2	0.5
Valid N (listwise)	44				

Both school climate and teacher perceptions subscales had a range from a possible negative two to positive two. The scores were 1.3 and 1.2, respectively, indicating relatively strong agreement with the construct. However, the low percent of respondents to this survey make the data available for analysis, and the resulting conclusions, less generalizable. Although this is not enough data to make a strong claim for the importance of this construct, when examined in conjunction with the other constructs measured, it does suggest a variable to continue to examine.

Findings and Discussion

This needs assessment investigated technology-related beliefs of school site administrators and the way that teachers understand the technology-related leadership role of those administrators. In analyzing the data collected by this needs assessment, three findings related to the research question were identified:

1. School site administrators see the value of technology in their work.
2. School site administrators do not see themselves as effective leaders of technology integration in their schools.
3. Teachers perceive school site administrators as having an important role in directing the use of technology in classrooms.

The first research question, “What do school site administrators believe about the utility of technology integrations within their educational practice?” was answered using data from the Productivity and Personal Practice subscale of the PTLA. The descriptive statistics results from this subscale highlight several important findings. A mean value of 1.3 demonstrates that the administrators who participated do feel comfortable using as a score of two would indicate that they fully align with that component of technology leadership. It is important that school site administrators are comfortable using technology because personal comfort with technology increases the likelihood school site administrators will support its use in the classroom (Stuart et al., 2009).

There were two findings related to the second research question: “How do school site administrators view their role in supporting technology integration in their school?” First, the results clearly identify a distinction between the personal comfort of school site administrators when using technology, and their lack of confidence when leading technology integration at their school. This theme is supported by two findings. The mean score for Visionary Leadership is 0.1, and the mean score for Support, Management, and Teaching is -0.1. A score of zero on the PTLA indicates neutrality on the issue. These scores may be an indicator that the school site administrators who participated in this survey do not see themselves as technology leaders in their schools, even if they use technology in their daily practice, and they do not view themselves as actively damaging the use of technology. It is important that school site administrators have a vision for technology integration, as Larosiliere et al. (2016) found leaders who drive technology integration increase the speed of technology adoption.

The third question: “How do teachers view the role of school site administrators in promoting technology integration in their school?” was investigated using the data collected by the LoTi from teachers. These results suggested that teachers held positive beliefs about their administrator's view of technology integration in their school. However, the second finding suggests the school site administrators do not see themselves as leaders of technology integration at the school.

As the review of literature in the preceding chapter demonstrated, school site administrators can exercise a significant role in the success of technology implementation (Anderson & Dexter, 2005). A critical component of that success hinges on the vision for technology integration championed by the school site administrators (Shapley et al., 2011). As the needs assessment found, the teaching staff believe that their administrators have a vision for technology integration. The school site administrators, however, do not share this belief. This apparent contradiction holds promise for future research in two areas. First, if the school site administrators, self-admittedly, do not have a vision for technology integration, then what vision are the teachers reporting belief in? Second, the research points to the importance of a vision for technology integration led by school site administrators (Shapley et al., 2011). A possible threat to the continued success of technology integration is the absence of a technology site vision held by a school site leader (Claro et al., 2017). The support of school site administrators is necessary, and the strategies for increasing technology self-efficacy belief in administrators identified in the research need to be investigated to resolve this problem.

A limitation existed for this needs assessment. The number of possible participants for the first instrument, the PTLA, was small, $N = 18$. Just more than half completed the survey, $n = 13$, but only 11 completed it entirely. The small sample size limits the generalizability of the data.

Though the response rate was low and not adequate to establish generalizable data across the field of education, this needs assessment is not interested in describing the issues with technology integration generally. This needs assessment is concerned with the issue of technology integration in a very specific context. For that singular purpose, this needs assessment establishes that the school site administrators in this context do not see themselves as technology leaders. An intervention that focuses on school site administrator's technology-related self-efficacy beliefs may provide a way to affect the uneven quality of technology integration across the school sites in this context.

Chapter 3

Literature Review of Technology-Related Self-Efficacy Development in School Administrators

The literature review conducted in Chapter 1 identified the self-efficacy beliefs of school site administrators as a possible method for influencing their ability to lead effective technology integration in their schools. The current conceptualization of self-efficacy was established in Albert Bandura's (1977) seminal work. In a later work, Bandura (2012) provided a clear definition of the concept: "Self-efficacy is a judgment of personal capability" (p. 247). The intervention into the problem of practice guiding this research focused on increasing the self-efficacy beliefs of school site administrators so that they can act as technology leaders for their school sites. Although the power of self-efficacy to affect the behavior of educators is often cited throughout the reviewed literature (Claro et al, 2017; Inan & Lowther, 2009; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011), there is a paucity (Versland & Erickson, 2017) of self-efficacy literature that focuses specifically on self-efficacy interventions with school site administrators. Consequently, the intervention literature reviewed here will draw from a variety of investigations into self-efficacy development among diverse groups; these investigations will then guide the design of an intervention focused on self-efficacy development for school site administrators.

In addition to findings that suggest self-efficacy may be a useful focus of the intervention, the initial literature review also established the power of professional learning in facilitating increased technology-related self-efficacy beliefs among educators. Consequently, the intervention focused on self-efficacy development as the proximal outcome and as the organizing structure for the intervention. The intervention took place partly within the context of a professional learning event aligned with Guskey's (2014) model for professional learning.

Although other models for organizing professional learning exist, Guskey's work was selected because it also provided a method for evaluating the effectiveness of professional learning events, an important component in determining whether the intervention accomplished its intended purpose.

Summary of Empirical Findings

A survey of educator beliefs regarding technology was conducted in spring 2018 that was interested in finding the answers to two questions. The first question focused on the capability of school site administrators to act as technology leaders. This question was investigated with the Principal Technology Leadership Assessment (PTLA), which explored the technology-related beliefs and capabilities of school site administrators. The second question was interested in whether teachers viewed school site administrators as technology leaders. This question was investigated with the Levels of Technology Integration (LoTi) survey, which explored the relationship between the administrator's actions and the teacher's understanding of the principal's role as a technology leader.

The PTLA is aligned with the International Society of Technology Educators National Technology Standards for Administrators to evaluate participants in five categories: visionary leadership, learning and teaching; productivity and personal practice; management and teaching; assessment and evaluation; and social and ethical issues. Descriptive statistics of the data were calculated, and one of the five subscales identified a likely area for intervention: visionary leadership. Visionary leadership was identified because the mean score, 0.01 on a scale of -2 to 2 with a SD of one, indicated school site administrators had no confidence in their ability to act as a visionary technology leader for their school site. Four participants, or one-third of all respondents, reported no ability to act as a visionary leader for technology integration at their school site.

Two sub-scales from the LoTi survey were used to gauge the effect of administrators' technology-related beliefs and practices on teachers. The survey was administered to determine whether an intervention focused on school site administrators could affect teacher practices and student outcomes. Descriptive statistics of the data showed that on a scale of -2 to 2 the mean score for this construct was 1.2 with a *SD* of 0.5, which suggest that the technology-related self-efficacy beliefs and practices of administrators may influence the classroom technology practices of teachers. Twenty teachers reported strong agreement with the statements that formed this construct.

To address the need for additional support in visionary leadership, an appropriate intervention must be identified and acted upon. To do this, a theoretical framework for investigating possible intervention strategies is necessary. The literature review conducted identified the self-efficacy beliefs of school site administrators as a possible avenue for increasing the leadership beliefs of school site administrators. Self-efficacy as a construct was first identified by Bandura (1977) and it was later incorporated into a larger theory of learning, social cognitive theory. Therefore, social cognitive theory (Bandura, 1986), specifically the components of the theory that deal with methods for increasing self-efficacy, is used as the framework guiding this investigation into possible interventions. In this problem of practice, social cognitive theory is used to organize the development of increased technology-related self-efficacy beliefs; as such, it is used to guide the review of intervention literature.

Theoretical Framework

The intervention aimed to increase the ability of school site administrators to exercise visionary leadership for technology integration. To do this, the research suggests that intervening to increase the technology-related self-efficacy beliefs of school site administrators may lead to increased technology leadership capabilities (Claro et al., 2017; Shapley et al., 2011).

In his seminal work on self-efficacy, Albert Bandura (1977) identified four prime drivers of self-efficacy development: mastery experiences, vicarious experiences, verbal persuasion, and emotional arousal. These categories are defined as:

Mastery experiences: The most powerful source of self-efficacy development, mastery experiences are the result of a person's prior attainment of a goal (Usher & Pajares, 2008).

Vicarious experiences: This source of self-efficacy is derived from the observation of peers' successful completion of "threatening activities without adverse consequences" (Bandura, 1977, p. 145).

Verbal persuasion: These are verbal suggestions made by one person to another person or group of other people, that attempt to convince them that they are capable of completing a task; though widely used because of its availability, it is not an overly effective source of self-efficacy (Bandura, 1977).

Emotional arousal: The emotional state of an individual in a "stressful and taxing situation" (Bandura, 1977, p. 146) can affect a person's perceived competency.

Bandura's work on self-efficacy was later subsumed into his broader theory of knowledge acquisition, social cognitive theory (Bandura, 1985). Triadic reciprocality (see Figure 3.1) is a component of social cognitive theory that explains the way internal and external forces drive learning.

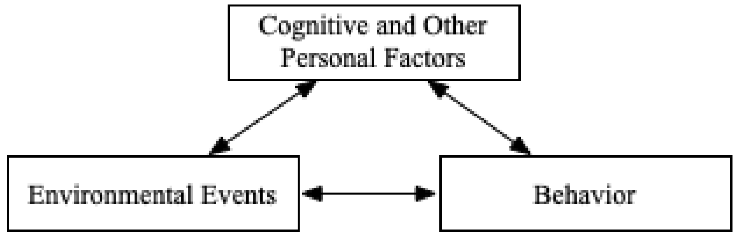


Figure 3.1. Visual representation of triadic reciprocality from social cognitive theory. From "Model of causality in social learning theory," by A. Bandura, 1985, *Cognition and Psychotherapy,* p. 81. Copyright 1985 Springer Nature. Reprinted with permission.

According to social cognitive theory (Bandura, 1986), three factors interoperate to affect knowledge acquisition: behavior, environmental events, and cognitive and other personal factors. The sources of self-efficacy identified in Bandura's (1977) earlier work align with, and exist between, these three categories. Mastery experiences, vicarious experiences, and verbal persuasion are interactions between cognitive events and environmental events. Emotional arousal is largely a cognitive factor but is certainly influenced by environmental events, and influences behavior in turn (see Figure 3.2).

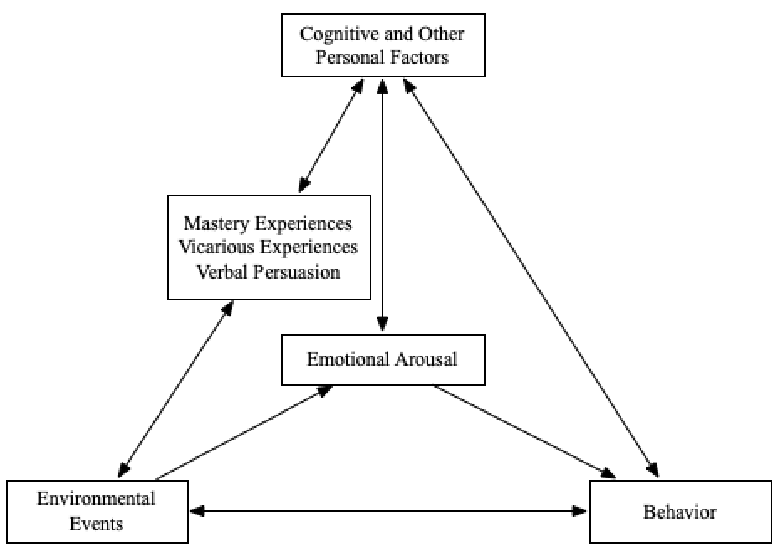


Figure 3.2. The concept of triadic reciprocality from social cognitive theory represents the three factors that drive learning. The four drivers of self-efficacy development are embedded into the framework of triadic reciprocality to illustrate their relationships to each other.
Because self-efficacy was identified as a possible driver of the problem of practice, the labels used in Bandura's (1977) earlier work will be used to organize this literature review. From "Model of causality in social learning theory," by A. Bandura, 1985, *Cognition and Psychotherapy,* p. 81. Copyright 1985 Springer Nature. Adapted with permission.

Synthesis of Intervention Literature

The four sources of self-efficacy development identified by Bandura (1977) serve to organize this review of the literature. Additionally, the factors are organized, according to Bandura, from most to least effective: mastery experiences, vicarious experiences, verbal persuasions, and emotional arousal. Both Bandura and other researchers (Chen & Usher, 2013; Tschannen-Moran & McMaster, 2009; Versland & Erickson, 2017) suggest that mastery experiences are the most effective way to increase one's sense of self-efficacy and attempts to change beliefs through emotional arousal are the least effective and least understood.

Mastery Experiences

The primary source of self-efficacy development Bandura (1977) identified is a performance accomplishment, or as Bandura and others termed it in later research, a mastery experience (Bandura, 1984; Versland & Erickson, 2017). These are experiences or challenges that have been completed successfully by an individual (Bandura, 1977). As a psychologist, Bandura's early work was focused on coping strategies for patients who struggled to deal with situations that made them anxious (Bandura, 1977). The earlier treatments for anxiety in patients were based upon behaviorist assumptions of learning (Bandura, 1977). Bandura (1977) instead proposed a framework for increasing self-efficacy beliefs of patients that was founded upon a cognitive understanding of learning, rather than the prior behaviorist paradigm.

Bandura (1977) and others (Tilton & Hartnett, 2016; Usher & Pajares, 2008) found that individuals who accomplished an objective increased their expectation of future success, and if they were successful enough for long enough, that success insulated them from future loss of self-efficacy, as is typically a consequence of occasional failures. Furthermore, this improved sense of self-efficacy could be generalized over associated experiences, shielding the individual from decreased feelings of self-efficacy in novel, but related, situations (Bandura, 1977). Later research supports Bandura's claims regarding the importance of mastery experiences in building self-efficacy; in a review of self-efficacy research conducted by Usher and Pajares (2008), the authors found widespread support for the claim that mastery experiences are the most important component in leading to increased self-efficacy beliefs.

Self-efficacy beliefs, as they relate to a number of disciplines, have been reviewed in order to establish a thorough understanding of the drivers of self-efficacy development. One such study focused on the science-related self-efficacy beliefs of 1,225 middle and high school students from southeastern United States. This study, conducted by Chen and Usher (2013), reached similar conclusions as Usher and Pajares (2008) regarding the importance of mastery experiences. During this quantitative study, a survey, adapted from a mathematics self-efficacy instrument (Usher & Pajares, 2009), was administered to the students in their science classrooms. The researchers were interested in determining the most salient component of self-efficacy development and found, based on the collected survey data, that mastery experiences were the most important component of increased beliefs of self-efficacy.

In addition to reinforcing the importance of mastery experiences, Chen and Usher (2013) found that the students who felt that all four components of self-efficacy development had contributed to their increased self-efficacy also experienced the greatest gain in their sense of self-efficacy. Furthermore, Chen and Usher found that the age of the student was a factor in whether the students benefited from all methods of self-efficacy development or focused more on mastery experiences. The older the age of the student, the less they valued multiple forms of self-efficacy development and relied more heavily on mastery experiences as their only valued form of self-efficacy. This finding has implications for an adult-focused self-efficacy intervention. If it is the case, as Chen and Usher found, that mastery experiences become more important as participant age increases, then the intervention should focus more heavily on mastery experiences to affect participants self-efficacy beliefs instead of attempting to utilize all four sources of self-efficacy development equally.

Focused on teachers instead of students, a study conducted by Tilton and Hartnett (2016) investigated the self-efficacy beliefs related to technology of secondary teachers at an international school in Germany. This year-long qualitative study investigated the perceptions of five teachers involved in a one-to-one implementation of iPad. The participants were interviewed three times throughout the initial year of the implementation. In coding the interviews, Tilton and Hartnett found that mastery experiences were the most important component identified by the teachers in their self-efficacy development. The teachers in this study reported that time exploring the specific technology being implemented at the school, through formal training and informal experiences, was beneficial; these experiences, another example of a mastery experience, contributed to the teachers' sense of mastery and self-efficacy.

An investigation of self-efficacy development in education leadership programs came to similar conclusions regarding mastery experiences when preparing school site leaders. A mixed-methods study conducted by Versland and Erickson (2017) used a self-efficacy focused survey instrument and a structured interview protocol to collect qualitative data from 292 principals in Montana. Additionally, the researchers collected qualitative interview data from six respondents to the initial survey, all of whom were selected because they had reported a very high sense of self-efficacy. Versland and Erickson found that mastery experiences were the greatest driver of self-efficacy development. In addition to the increased skill and content mastery that resulted from these mastery experiences, the participants also reported that the experiences increased their ability to build relationships, improved their ability to communicate, and supported their development of systems for their schools. These quantitative findings, taken together with Tilton and Hartnett's (2016) qualitative research on mastery experiences, provide empirical support that self-efficacy research from both research paradigms have found support for self-efficacy development through mastery experiences.

Tschannen-Moran and McMaster (2009) conduced a quasi-experimental study that came to similar conclusions as Tilton and Hartnett (2016). The study focused on the self-efficacy belief development of 93 kindergarten through second-grade teachers. Data for this study were collected using two self-efficacy survey instruments. The study included four different treatment groups that were exposed to different professional learning formats; the first used only one source of self-efficacy development, and each successive treatment added an additional source of self-efficacy development. The final treatment group was exposed to all four sources of self-efficacy development. Additionally, the final two groups included two different types of mastery experiences: protected mastery experiences and authentic mastery experiences (Tschannen-

Moran & McMaster, 2009). A protected mastery experience is a simulated mastery experience conducted during the initial professional learning event in an environment where failure is less likely. An authentic mastery experience occurs in the participants natural environment; in this study it occurred when the participants returned to their classrooms and implemented their new learning with their students. Tschannen-Moran and McMaster found that although both types of mastery experiences had value, the authentic mastery experience was the more powerful of the two. Furthermore, the researchers found "the most powerful professional development format included an authentic mastery experience" (p. 240). Although identified as being less powerful, it would be a mistake to dismiss the protected mastery experience identified by Tschannen-Moran and McMaster as either unimportant or sub-optimal. Based on the research of self-efficacy development, protected mastery experience may be a practical way to increase self-efficacy during a professional learning event without disturbing classroom environments.

Similarly, Bautista (2011) conducted a study that investigated the self-efficacy beliefs of early childhood education students, instead of practicing teachers. The intervention was focused on the way mastery experiences increase self-efficacy beliefs. This mixed-methods study included 44 female preservice teachers enrolled at a university in the Midwest. Quantitative data were collected using a self-efficacy survey instrument with a pretest and posttest model. Qualitative data were collected using an instrument that included seven open-ended questions. The mastery component of this intervention included participant participation in inquiry-based lessons within their university classroom. Both the quantitative and qualitative data collected showed that this mastery experience increased participants feelings of self-efficacy. Quantitative measures of the intervention found that 72% of the participants (n = 30) identified the in-class mastery experience beneficial for their sense of self-efficacy. Qualitative data from one participant included the statement that, “the activities we did in the class give me a much better idea of what science looks like in the classroom” (p. 345). These findings support both Versland and Erickson (2017) and Tilton and Hartnett (2016) findings regarding mastery experiences. Furthermore, Bautista’s research came to similar conclusions as Tschannen-Moran and McMaster (2009) as authentic mastery experiences were utilized as well. Although the results of the mastery experience reported by Bautista (2011) provide support for one type of mastery experience, another type of mastery experience was also included in the research design. The participants in Bautista’s study were also required to complete a field assignment to design and implement science lessons with elementary students in an elementary classroom setting. Data were collected on these experiences as well. The quantitative measure of self-efficacy growth found that 93% of the participants (n = 41) identified the field assignment as helpful in increasing their confidence in their ability to teach science. This use of mastery experience represented a 21% increase in self-efficacy growth over the other type of mastery experience employed in the research. These findings demonstrate that the kind of mastery experience matters. Experiences that are most similar to the original context that the participant operates in or will be operating in lend credibility to the exercise and impart greater gains to the participant.

Another quasi-experimental study that made use of preservice education students, like Bautista (2011), was also interested in the differential effect that the authenticity of the mastery experience exerted over the outcome of its use. Conducted by Stewart, Allen, and Bai (2011), this study investigated the difference between types of mastery experiences. The study included 293 participants enrolled in an education course at a southeastern university in the United States. They completed a self-efficacy focused survey instrument as a pretest and posttest. The participants were split into two groups. Each group completed 15 hours of service-learning in a licensed teacher's classroom. One group was required to teach a lesson to the class, and the other group was required to tutor students in a small group and/or one-on-one settings. As a consequence of the intervention, Stewart et al. found the self-efficacy scores of both groups increased, and there was no difference between the groups. Like Bautista (2011) and Tschannen-Moran and McMaster (2009) whose research was focused on populations with similar characteristics, this finding suggests that the most important component of a mastery experience is not a specific task but being engaged in authentic work in an authentic environment. Though Stewart et al. supposed that the whole class experience was likely to result in greater gains, as that setting is more reflective of the classroom environment, small group settings are often used in elementary education and were not dissimilar enough from authentic practice to affect the outcomes of the mastery experience.

Although the presented research on mastery experiences focused on the benefits of completing a mastery experience, research conducted by Fong and Krause (2014) described the impact on participants who failed to complete a mastery experience. This mixed-methods study, which focused on the self-efficacy beliefs of 49 undergraduate college students, used surveys, journal entries, and student grade point average to identify underachieving students and examine their self-efficacy beliefs. Fong and Krause found that mastery experiences exercise the most influence over students' feelings of self-efficacy. When participants failed to complete a mastery experience successfully, they were less likely to attempt to complete a similar activity in the future (Fong & Krause, 2014). This is an important finding when designing an intervention. A mastery experience that is too difficult and results in failure may do more than simply waste time; it may actively damage the participant's self-efficacy.

A quantitative study conducted by Knoblauch and Woolfolk Hoy (2008) was interested in the way the context of school setting affected the self-efficacy beliefs of 102 student teachers and came to a similar conclusion as Fong and Krause (2014). Knoblauch and Woolfolk Hoy hypothesized that participants placed in urban school settings would experience less self-efficacy development than students placed in suburban settings as “educators acknowledge that (for a variety of reasons such as poverty, cultural differences, and violence) teaching in an urban school is challenging” (p. 167). For those reasons, the researchers expected that participants working in urban schools would have more difficulty successfully completing mastery experiences than participants working in suburban schools. The findings proved otherwise. Through the use of three administrations of the Teacher Sense of Efficacy Scale developed by Tschannen-Moran and Woolfolk Hoy (2001), the authors found that student teachers placed in urban settings had greater than expected self-efficacy gains because the participants were able to complete a mastery experience that they perceived to be more difficult because of the school setting. Although Fong and Krause are likely correct in that the experience of failing may make participants more risk-averse in the future, Knoblauch and Woolfolk Hoy’s (2008) findings demonstrate the increased gains that may be made when a difficult mastery experience is completed successfully. Authentic mastery experiences must be included as Tschannen-Moran and McMaster (2009) have clearly identified the strength of these experiences in design of their intervention, however, Fong and Krause’s and Knoblauch and Woolfolk Hoy’s findings must be weighed carefully. The mastery experiences designed for the intervention must have a low risk of failure but, if possible, be perceived by the participants to be challenging so that increased self-efficacy growth could be achieved.

Although mastery experiences are likely the most powerful source of self-efficacy development (Usher & Pajares, 2008), as Fong and Krause (2014) and Knoblauch and Woolfolk Hoy (2008) demonstrate, mastery experiences, may also be the most challenging to implement correctly. As a means for measuring the efficacy of school site principals, Tschannen-Moran and Gareis (2004) conducted a quantitative study to help validate a research tool. In this quantitative study that included 544 school principals from Virginia and used a self-efficacy focused survey instrument, the authors reached similar conclusions as Bautista (2011), Fong and Krause (2014), and Tschannen-Moran and McMaster (2009) regarding the strength of mastery experiences. However, in addition to supporting the strength of mastery experiences in increasing self-efficacy, they did add a caution. Tschannen-Moran and Gareis' findings suggest that mastery experiences may be difficult to deliver to principals who have low-efficacy beliefs. For mastery experiences to affect self-efficacy, Tschannen-Moran and Gareis argue, the principal must have a sense that they can effectively complete that task. Essentially, self-efficacy builds upon itself, so when it is low to begin with, it is difficult to increase. Consequently, the authors suggest, mastery experiences focused on low-efficacy participants should begin low and grow in difficulty, a finding that supports Fong and Krause's research on mastery experiences.

Mastery experiences are, as Bandura (1977) asserted, a very important factor in self-efficacy development. When designing an intervention that intends to make use of mastery experiences, several considerations identified in the research should be kept in mind. First, as Chen and Usher (2013) found, the relative value participants place on mastery experiences increases with their age. It is likely that mastery experiences will be more useful in attempting to increase the self-efficacy beliefs of adults than any other factor. Second, mastery experiences can take multiple forms, and none should be discounted. It is likely that the final mastery experience of the intervention should be an authentic mastery experience as Stewart et al. (2011) and Tschannen-Moran and McMaster (2009) suggest, although protected mastery experiences, that do not occur in an authentic context, are effective drivers of self-efficacy development too. Finally, although mastery experiences are powerful in affecting one's sense of self-efficacy, an overly ambitious mastery experience that fails is likely to do more harm than good (Fong & Krause, 2014), but a difficult but attainable experience could pay increased dividends (Knoblauch & Woolfolk Hoy, 2008). It is perhaps for this reason that alternative forms of self-efficacy development must also be employed. If mastery experiences are the sole tool for increasing self-efficacy beliefs, the risks of not getting it right are multiplied. When used in conjunction with the other factors, mastery experiences may serve as concluding experiences that are supported by less powerful methods of self-efficacy development.

Vicarious Experiences

Another component of self-efficacy development is vicarious experiences (Bandura, 1977). Vicarious experiences happen when a person sees "others perform threatening activities without adverse consequences" (Bandura, 1977, p. 197). Although Bandura provides a concise theoretical definition of vicarious experiences, the term is applied to a wide variety of learning experiences in the literature. In some cases, vicarious practices are associated with collegial collaboration, and others focus on watching recordings of teaching practices. Although not as powerful a factor in developing self-efficacy beliefs as mastery experiences, vicarious experiences do contribute to the development of self-efficacy beliefs.

A three-year experimental mixed-methods study conducted by Mintzes, Marcum, Messerschmidt-Yates, and Mark (2013) focused on improving the self-efficacy beliefs of 116 elementary school teachers. Mintzes et al. used a self-efficacy focused survey instrument to collect pretest and posttest data as well as interviews conducted 1-year after the study concluded. The study investigated self-efficacy development that occurred through the use of science instruction-focused professional learning communities (PLC). PLCs are a system of collaboration among teachers that stresses reflection on the outcomes of practices driven by data. The PLC in the Mintzes et al. study used discussion and collaboration among participants to drive changes in science instruction-related self-efficacy beliefs. Mintzes et al. found that these discussions, which were identified as vicarious experiences, affected the science instruction-related self-efficacy beliefs of the participants. The opportunity to collaboratively discuss experiences in science instruction with fellow participants helped increase self-efficacy outcomes for the teachers, increased their understanding of the science concepts they taught, and enhanced outcomes for students (Mintzes et al., 2013).

In the research discussed earlier that examined the self-efficacy beliefs of 102 student teachers, Knoblauch and Woolfolk Hoy (2008) identified vicarious experiences as the second most important component in self-efficacy development, after mastery experiences. In their study, the participants were paired with model teachers whom they observed at work. Participants then received feedback from the model teacher when they taught the class. Knoblauch and Woolfolk Hoy found that the person who served as the model in a vicarious experience influenced the strength of the vicarious experience for the participant. If the model is someone with whom the participants can relate, it is much more likely they will benefit from the vicarious experience. Knoblauch and Woolfolk Hoy's research reinforces Bandura's (1997) finding that the level of competence displayed by the model in a vicarious experience strongly influences the degree that the vicarious experience influences the participant's self-efficacy belief development. Further, the more competent the model, the more influence they may exert when participants are novices in a domain (Knoblauch & Woolfolk Hoy, 2008). As in the preceding model used by Mintzes et al. (2013), Knoblauch and Woolfolk Hoy focused on discussion and collaboration as an example of vicarious experiences. Unlike Mintzes et al., Knoblauch and Woolfolk Hoy's participants' vicarious experiences occurred between participants with unequal standing. Model teachers were providing a vicarious experience for less experienced teachers.

As in Knoblauch and Woolfolk Hoy's (2008) study, vicarious experiences were also used in Bautista's (2011) research into the self-efficacy beliefs of student teachers. A variety of vicarious experiences were identified as having exercised some influence over participants self-efficacy beliefs, including self-modeling, symbolic modeling, simulated modeling, and cognitive self-modeling. Self-modeling, in the study, happened when participants videotaped themselves, and then reflected on their practice. Symbolic modeling involved participants watching other teachers in person or on video. Simulated modeling entailed participants assuming the role of the students they teach. Finally, cognitive self-modeling consisted of participants imagining themselves completing a task in the classroom. Analysis of the quantitative survey results and qualitative open-ended survey question responses for this study found that of the various models of vicarious experience symbolic-modeling and cognitive self-modeling proved to be the most efficacious. The most successful uses of vicarious experiences in this model differed from Mintzes et al. (2013) and Knoblauch and Woolfolk Hoy (2008) in that individual participants imagined their vicarious experience. This definition is perhaps the most difficult to reconcile with Bandura's (1977) definition of vicarious experiences as no outside model is involved.

Reinforcing Bautista's (2011) finding regarding symbolic-modeling, an experimental mixed-methods study was conducted by Beisiegel, Mitchell, and Hill (2018), with 146 participating third- through eighth-grade teachers. This mixed-methods study used a pretest, midtest, and posttest model and collected data through a survey that included closed and open-ended questions. The researchers asked participants to view, score, and discuss videos of mathematics instruction. Then Beisiegel et al. reviewed the survey data and responses to open-ended questions and found support for using videos to provide vicarious experiences. However, the ability to generalize the experience was found to be lacking, and Beisiegel et al. suggest "that a clear, concrete bridge that leads teachers to apply video-watching protocols to their practice explicitly may be essential for success" (p.86). This finding could suggest that simply showing a video to participants may not be enough to create a meaningful vicarious experience. Providing directions to participants to guide them through a vicarious experience may be necessary.

Similarly, in an examination of professional learning that included vicarious experiences, Tschannen-Moran & McMaster (2009) collected survey data that indicated a weakness in vicarious experiences. Self-efficacy development that only consisted of watching a presenter or video diminished the power of a vicarious experience's ability to affect self-efficacy beliefs, contradicting Bautista's (2011) findings regarding symbolic modeling. This does, however, support Bandura's assertion that vicarious experiences are fraught, as the varying definitions represented in each article demonstrate. Further, Bandura (1977) warns that "Vicarious experience, relying as it does on inferences from social comparison, is a less dependable source of information about one's capabilities than is direct evidence of personal accomplishments" (p. 197). That is not to say that vicarious experiences are not valuable―as the research demonstrates, they are. To be effective, vicarious experiences cannot be used alone but must be used in conjunction with mastery experiences and the other elements of self-efficacy production, especially social persuasion (Tschannen-Moran & McMaster, 2004).

Usher and Pajares (2008) reached similar conclusions in their review of the literature around self-efficacy. To select articles for inclusion in the review, the authors conducted a keyword search that included terms related to self-efficacy development since the year that Bandura introduced the construct. Because they were specifically interested in self-efficacy development in education, only studies that focused on education were included. Both quantitative and qualitative studies were selected for inclusion. Usher and Pajares found that vicarious experience as a construct is difficult to measure, and there is variability in the strength a vicarious experience exercises over individuals. Of special note are the contextual factors surrounding vicarious experiences, Usher and Pajares found several studies (Bandura, 1997; Fiske, 1992; Schunk, 1987) that identify the age and gender of participants as mediating factors. This finding is not unlike Knoblauch and Woolfolk Hoy's (2008) findings regarding model teachers. In their research, Knoblauch and Woolfolk Hoy identify the power of vicarious experiences when there is alignment between the model and the participant. Usher and Pajares identified the same issue in different terms; there is a lack of power when there is a lack of alignment between the model and the participant.

In contrast to Usher and Pajares (2008) findings from the literature review regarding mediating factors for self-efficacy development, Tschannen-Moran and Johnson (2011) came to very different conclusions. In a quantitative study of 648 literacy teachers' self-efficacy beliefs that used a self-efficacy focused survey instrument, Tschannen-Moran and Johnson found that mediating factors like age, sex, and the length of a person's teaching career do not meaningfully moderate self-efficacy development. In addition to their findings on demographic influences for self-efficacy development, the researchers also found that self-efficacy beliefs are often established relatively early and become resistant to change unless they are strongly challenged.

This second finding agrees with Bandura's (1997) earlier research that came to the same conclusion. Tschannen-Moran and Johnson found that vicarious experiences do have an impact on self-efficacy development, especially when paired with verbal persuasion.

Vicarious experiences, as the preceding literature demonstrates, are not a well-defined construct in the literature. They can include interactions ranging from collegial collaboration (Mintzes et al., 2013) to master-student modeling (Knoblauch & Woolfolk Hoy, 2008). Vicarious experiences are often also defined as a variety of modeling strategies including imagining oneself in a situation and watching video footage of another teacher successfully completing a task (Bautista, 2011; Beisiegel et al., 2018). Although the term is used to indicate a variety of experiences, the vicarious measures investigated do indicate that they can affect self-efficacy development. For the intervention vicarious experiences were limited to the most widely supported definition of the construct; participants who share similar job duties and responsibilities will have the opportunity to watch each other complete tasks.

Verbal Persuasion

Verbal persuasion is another component of self-efficacy development identified by Bandura, and it is a useful tool because of its ease of use and ubiquity (Bandura, 1977). However, the ubiquity of verbal persuasion also makes it a weak component of self-efficacy development as nearly every type of interpersonal interaction includes verbal persuasion, so individuals are often desensitized to its effects (Bandura, 1977). The simple act of speaking about something with an agenda is an example of verbal persuasion. For this reason, specific research on the use of verbal persuasion is limited. However, studies that examine the use of verbal persuasion as a component of self-efficacy development exist.

In a mixed-methods study by Palmer (2011), verbal persuasion was found to be an effective means of supporting the science-related self-efficacy beliefs of elementary level teachers. Teachers responded to a self-efficacy focused survey instrument and additional open-ended questions added to the end of the survey; Palmer found that the 12 participants responded most strongly to two of the factors of self-efficacy development: mastery experience and verbal persuasion. The participants reported that positive comments made by the facilitator after observing a science-based lesson increased their sense of self-efficacy, although the mastery experiences were explicitly identified as being more influential in their self-efficacy development.

A larger, quasi-experimental quantitative study conducted by Abusham (2018) used a self-efficacy focused survey instrument to collect data that examined the role of self-efficacy belief creation in school leadership preparation programs. Survey data were collected from 176 participants, who were concurrently enrolled in a school leadership preparation program. Abusham found that verbal persuasion was an element of self-efficacy development that could affect the self-efficacy beliefs of the participants. One finding that emerged from Abusham's study was that verbal persuasion was the component of self-efficacy development most often deployed in order to increase self-efficacy beliefs, supporting Bandura's (1977) earlier finding. The problem this raises is that verbal persuasion, according to Bandura, is the least effective way to increase self-efficacy beliefs. This means that simply utilizing self-efficacy development interventions that rely solely on one-to-one coaching will not work. Though Tschannen-Moran and McMaster (2009) found that verbal persuasion was an important part of their most successful trial, it is important to note that it may only be effective when used in conjunction with the other components of self-efficacy development.

Garvis, Twigg, and Pendergast (2011) conducted a quantitative study on the formation of arts-related self-efficacy beliefs among 21 teachers in their first three years of teaching. Their findings, collected using a survey instrument, revealed the power of verbal persuasion to make them less self-efficacious. The researchers sought to understand how the beliefs and actions of supervising teachers influenced the self-efficacy beliefs of the preservice teachers. Nearly all participants reported that their supervising teachers held negative views regarding the value of arts integration, and the participants consequently reported lower arts-related self-efficacy beliefs. When understood within the context of the other research on verbal persuasion, it appears that it may be easier to decrease self-efficacy beliefs through verbal persuasion than to increase self-efficacy beliefs through the same. This suggests that any intervention that seeks to make use of verbal persuasion should closely scrutinize the language being used to limit the possible loss of self-efficacy as a result of a poorly phrased response to participants. This finding is especially important in light of Abusham's (2018) previously discussed finding that verbal persuasion is the most often used form of self-efficacy development. In planning an intervention, this finding is important to keep in mind; incidental messages that serve to reduce self-efficacy may occur simply as a result of the amount of verbal persuasion that occurs.

Wright, O'Halloran, and Stukas (2016) conducted a quantitative study that investigated the effect of verbal persuasion and vicarious experiences. Using three different survey instruments, the researchers found that the effect of verbal persuasion to affect self-efficacy beliefs related to a physical activity, such as a person's ability to hit a golf ball, was more powerful than mastery experiences in increasing the self-efficacy of the 96 participants. These results run counter to the other findings that have been presented on verbal persuasion in that it found verbal persuasion to be very effective. However, as Bandura's (1985) model of triadic reciprocality identifies, the factors vary in influence and strength based upon the situation. Wright et al.'s findings suggest self-efficacy beliefs based on primarily cognitive behaviors are affected differently than self-efficacy beliefs based on primarily physical behaviors. However, a single study does not provide enough evidence to guide the design of the intervention. Instead, this finding should be considered in the context of the other research related to verbal persuasion; an increased reliance on verbal persuasion when participants are engaging in activities that are primarily physical should be considered.

Attempting to affect change in participants' self-efficacy beliefs through verbal persuasion alone is unlikely to produce change (Bandura, 1977), but that is not to say it is without benefit. Verbal persuasion, through the necessity of speaking to participants, is a part of nearly every professional development and as Wright et al. (2016) found, the strength of verbal persuasion may vary with the task at hand. In conjunction with the thoughtful use of other self-efficacy building strategies, verbal persuasion can be useful as "people who are socially persuaded that they possess the capabilities to master difficult situations and are provided with provisional aids for effective action are likely to mobilize greater effort than those who receive only the performance aids" (Wright et al, 2016, p. 198).

In considering the use of verbal persuasion when designing an intervention, it is a factor of self-efficacy building that is double-edged and impossible to exclude. As such, it is imperative that the use of verbal persuasion is closely considered, and that words and phrases used to attempt to increase the self-efficacy beliefs of participants are carefully chosen and utilized.

Emotional Arousal

Emotional arousal is the final component of self-efficacy development and in the context of social cognitive theory is concerned with a specific subset of emotional states: fear, stress, and anxiety (Bandura, 1977). Bandura contends that emotional arousal, as defined, would be detrimental to increased self-efficacy beliefs, and although there is support for this understanding, there is also support against it. Emotional arousal can have a debilitating effect on self-efficacy beliefs in many circumstances, but under the right conditions, it can increase self-efficacy beliefs.

Putwain, Remedios, and Symes (2015) found the way emotional arousal was operationalized mattered when using it to develop self-efficacy beliefs. The researchers conducted a quantitative study of 1,433 secondary school students in England, and their findings were based in data collected using three survey instruments. When emotional arousal was used to challenge students to attain increased results, then self-efficacy beliefs rose. When emotional arousal was used as a threat, then self-efficacy beliefs fell (Putwain et al., 2015).

Emotional arousal was found by Howardson and Behrend (2015) to affect self-efficacy development negatively. The authors defined emotional arousal as having three components:

> individuals must (1) ascribe an affective quality to the situation (e.g., 'This training is worrying'); (2) perceive feelings of that same affective quality (e.g., 'I feel worried'); and most importantly, (3) attribute the feelings from (2) to the situational features of (1) that evoked the affective quality (e.g., '*This* training *made me feel* worried'). (p. 235)

In their study of 278 adults who participated in training on a software application and then completed a self-efficacy focused survey instrument, Howardson and Behrend found that the emotional state of the participants was a component of their self-efficacy development. However, both mastery experiences and vicarious experiences embedded in the training exercised more influence over the self-efficacy development of the participants.

The lack of corroborative findings for emotional arousal as a useful component of self-efficacy development is a consistent finding in the literature. This is evident in a quantitative study conducted by Mohamadi and Asadzadh (2012) that investigated the relationship between the self-efficacy beliefs of 284 high school teachers in Iran and the academic achievements of their students. Their findings, based on a self-efficacy focused survey instrument, indicated that the four sources of self-efficacy development are not equally effective. Like the other studies reviewed, Mohamadi and Asadzadh found mastery experiences to be the most important factor of self-efficacy development followed by verbal persuasion and vicarious experiences. They also collected survey data on emotional arousal and found that emotional arousal had no impact on self-efficacy development. The researcher's findings related to emotional arousal suggest that emotional arousal may play no role at all in self-efficacy development. These findings contradict Howardson and Behrend's (2015) findings as Howardson and Behrend found that emotional arousal did have a minor affect. The results of these two studies, when considered in relation to Putwain et al.'s (2015) findings regarding the possible negative consequences of emotional arousal, suggest that using strategies aimed at arousing emotions in participants may serve no purpose, at best, and be actively harmful at worst. As a consequence of the highly contextual nature of emotional arousal, harnessing its power in creating a professional learning event that only addresses the attainment of increased results is unlikely. These findings suggest that the best use of emotional arousal in self-efficacy development is to attempt not to use it.

Both verbal persuasion and emotional arousal are challenging components of self-efficacy development to effectively incorporate into professional learning strategies. Emotional arousal is highly contextual, and the way a participant reacts to each situation is contingent upon their previous experiences (Bandura, 1977). Anticipating the way participants will react to strategies intended to affect self-efficacy beliefs through emotional arousal is difficult and may be challenging to collect in the context of this problem of practice. Although significant research on emotional arousal exists, little of it is specifically concerned with self-efficacy development. The negative effects that Bandura and others have noted may best be addressed by focusing on the use of other components of self-efficacy development, especially mastery experiences.

Summary of Intervention Literature

This literature review has investigated the four factors of self-efficacy development identified by Bandura (1977). Of the four sources of self-efficacy development Bandura (1977) identified, mastery experiences have received the most support in the literature (Chen & Usher, 2013; Fong & Krause, 2014; Knoblauch & Woolfolk Hoy, 2008; Tilton & Hartnett, 2016; Tschannen-Moran & McMaster, 2009; Usher & Pajares, 2008). Mastery experiences exercise the most influence over the development of self-efficacy beliefs. However, there is not universal agreement on how those mastery experiences ought to be framed. For instance, Fong and Krause (2014) warn against mastery experiences that may fail because decreased self-efficacy beliefs may result, though Knoblauch and Woolfolk Hoy (2008) found that the greater the risk, the greater the reward, suggesting more difficult to complete mastery experiences may be more powerful.

All four sources of self-efficacy working in concert produced the most self-efficacy growth (Chen & Usher, 2013; Fong & Krause, 2014; Knoblauch & Woolfolk Hoy, 2008). Tschannen-Moran and McMaster (2009), however, found that a mastery experience embedded in the context wherein the knowledge would be used was more effective for increasing self-efficacy beliefs than treatments that made use of three of the four sources of self-efficacy development. Although the research disagrees on many of the specifics of mastery experiences, there is general agreement that mastery experiences are powerful, especially mastery experiences that closely mirror actual practice (Tilton & Hartnett, 2016; Tschannen-Moran & McMaster, 2009).

The findings regarding vicarious experiences, although identified as less powerful than mastery experiences, are also less mixed. Much of the research agreed that vicarious experiences, when managed correctly, exercise influence over the self-efficacy development of individuals (Bautista, 2011; Knoblauch & Woolfolk Hoy, 2007, Mintzes et al., 2013). For instance, video clips used in isolation to provide a vicarious experience resulted in a decreased ability by the participants to generalize the experience. However, when video clips are used in combination with other strategies and other types of vicarious experiences, they can be effective (Beisiegel et al., 2018). For vicarious experiences to be the most effective, Knoblauch and Woolfolk Hoy (2008) and Usher and Pajares (2008) found that there must be congruency between the people involved in the vicarious experience. In other words, for a vicarious experience to be effective, the person experiencing the event must be able to identify with the person participating in the event.

Research on verbal persuasion, unlike mastery experiences and vicarious experiences, was not as positive. Although verbal persuasion is often used according to Abusham (2018), there is little support for its ability to increase self-efficacy beliefs. However, as Garvis et al. (2011) found that it may result in decreased self-efficacy beliefs if the facilitator displays a dismissive or derogatory attitude toward the object of self-efficacy development. Interestingly, Wright et al. (2016) found that verbal persuasion was more powerful than vicarious experiences when it came to self-efficacy related to physical actions. Taken together, these findings make it clear that the language used when attempting to increase a participant's self-efficacy may have a variety of unintended, and difficult to anticipate, consequences.

Finally, emotional arousal is the least studied factor in self-efficacy development. The relatively sparse literature on the subject recommends that heightening emotional arousal is likely to lead to sub-optimal outcomes (Putwain et al., 2015). For that reason, it is rarely operationalized when attempting to change self-efficacy beliefs.

Overview of Intervention

In the preceding review of literature, a number of strategies for developing self-efficacy were identified. The most effective of those strategies will be used to guide an intervention that intends to increase the technology-related self-efficacy beliefs of school site administrators.

Intervention Framework

An important and recurring theme in the reviewed literature reinforces one of Bandura's (1997) findings regarding self-efficacy development: self-efficacy beliefs are established early in the learning process and are not easy to change. To do so, a combination of factors must be used. Thus, a self-efficacy focused intervention presents a challenge. This intervention is focused on school site administrators who have already developed technology-related self-efficacy beliefs. Consequently, simply identifying ways to increase self-efficacy is insufficient; a framework for understanding how to affect self-efficacy beliefs is necessary as well.

One such theory is Everett M. Rogers's (2003) theory of diffusion. Rogers presents a theory for understanding how innovations spread through a population. Although useful, Rogers's work is most appropriate for understanding the introduction of a new idea. This intervention did not attempt to diffuse a new idea. Instead, it was concerned with increasing the technology-related self-efficacy beliefs among school site administrators who have an extant knowledge of the innovation and a pre-existing set of technology-related self-efficacy beliefs.

A more appropriate theory for affecting a change in existing belief systems was presented by Gregoire (2003). Gregoire's cognitive-affective model is useful for understanding how attempts to introduce reforms are processed by individuals. Gregoire's cognitive-affective model of conceptual change (see Figure 3.3) is more appropriate for the intervention because the cognitive-affective model is not focused on a new idea, such as Rogers's (2003) theory, but on a reform message, which is more in line with the goal of the intervention. The model provides a theoretical understanding of how reforms are processed by participants. Of the three possible outcomes, true conceptual change is the only desired outcome for this intervention.

The cognitive-affective model begins with the presentation of a reform message. The individual who is encountering this reform message must then decide whether the reform message implicates their practice. If they decide it does not represent a change from their pre-existing practice, then they assimilate the reform without making any meaningful change (Gregoire, 2003). If, instead, their existing practice is at odds with the reform they find their work is implicated in the reform and they must make several judgments. After assessing the level of stress this reform provokes, they move to an assessment of their motivation, which is highly reliant upon their self-efficacy beliefs (Gregoire, 2003). If their beliefs are strong enough that they do not perceive the reform as a direct threat to their practice, then they next assess their ability. If they do not have sufficient motivation or do not believe they can implement the reform, they re-appraise the reform as a threat. This results in an attempt to minimize the threat, avoidance of the reform, processing of the reform, and a resulting decision that either superficially adopts the reform, or rejects the reform completely (Gregoire, 2003).

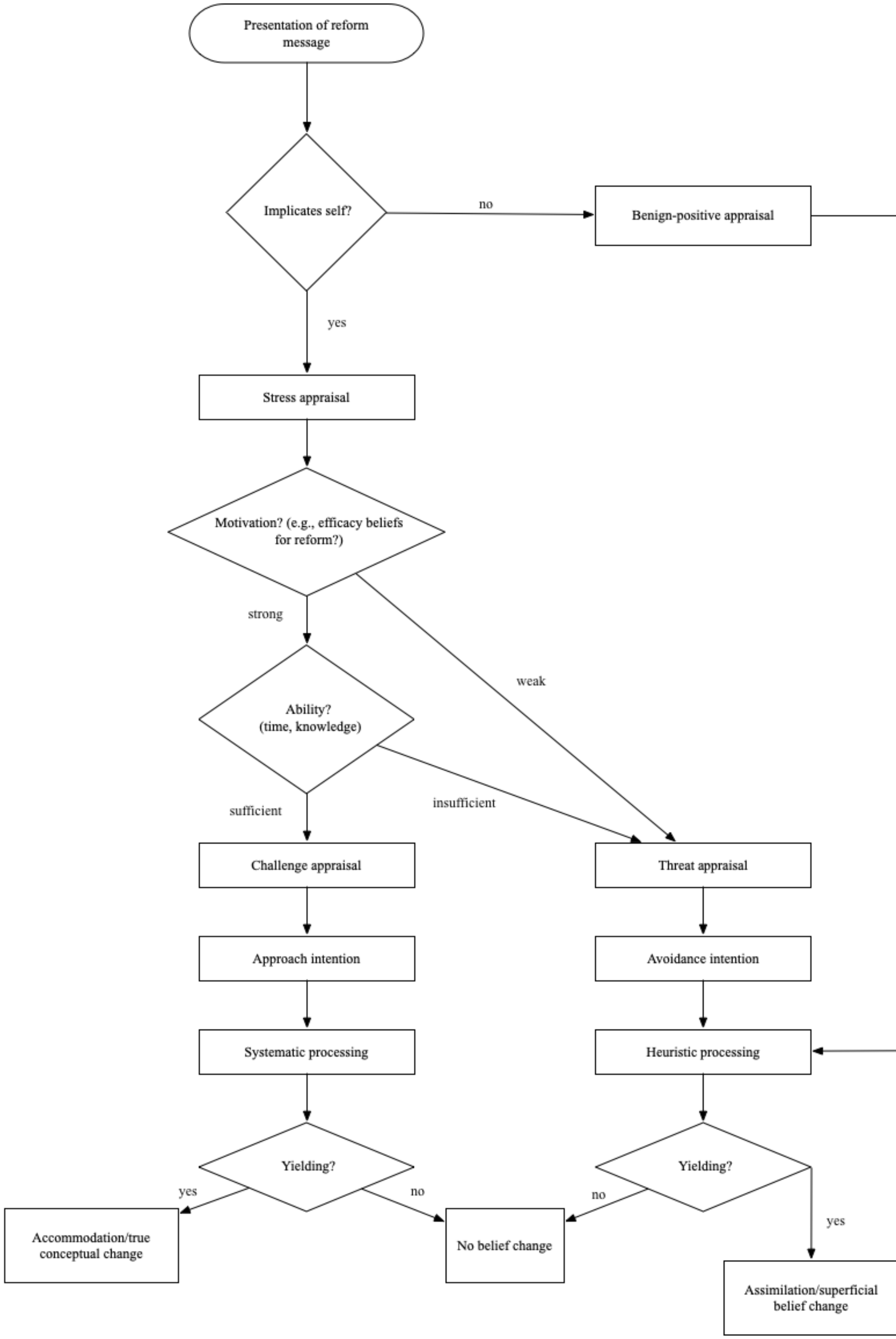


Figure 3.3. The cognitive-affective model of reform describes the way that reform messages are processed and acted upon by individuals. From "Is it a challenge or a threat? A dual-process

model of teachers' cognition and appraisal processes during conceptual change," by M. Gregoire, 2003, *Educational Psychology Review, 15*, p. 165. Copyright 2003 Springer Nature. Reprinted with permission.

If, instead, the individual judges their ability sufficient to embrace the change they move on to an appraisal of the challenge this reform presents. Next, they make a plan for approaching the reform and then engage in processing of the reform. Finally, if they embrace the reform, they accommodate their pre-existing practice and change their beliefs. If they do not, no belief change appears (Gregoire, 2003). Gregoire's (2003) model provides a clear structure for understanding how participants in the intervention would interpret and attend to the attempts to affect changes in their technology-related self-efficacy beliefs.

According to Bandura (1997) and supported in the review of literature conducted by Usher and Pajares (2017), the technology-related self-efficacy beliefs that this intervention is attempting to affect will be relatively resistant to change because they are pre-existing and will require an instigating event to allow for movement. Gregoire provides a clear model for understanding and anticipating what the intervention must focus on to create change. The reform message that will be presented is the ability of school site administrators to act as visionary technology leaders for their campuses. Through mastery experiences, vicarious experiences, and verbal persuasion both the motivation and ability of the participants will be supported such that they feel sufficiently able to embrace the reform. The intervention was organized according to Gregoire's (2003) cognitive-affective model and uses the components of self-efficacy development to support the reform of the school site administrator's technology-related self-efficacy beliefs.

Intervention

The intervention was intended to increase the ability of school site administrators to be visionary technology leaders for their school sites as a means to increase the equity of student access to use technology to do meaningful work. The proximal outcome of this intervention is an increase in the technology-related self-efficacy beliefs of school site administrators. To achieve this outcome, the intervention took place in three stages, each stage informed by the reviewed research on the factors of self-efficacy development and the cognitive-affective model of change.

Phase 1 of the intervention was built upon Tschannen-Moran and McMaster (2009) most successful design for increasing self-efficacy beliefs; a professional learning workshop that made use of a variety of sources of self-efficacy development, including verbal persuasion, vicarious experiences, and a protected mastery experience that was followed by an authentic mastery experience with coaching support that provided avenues for vicarious experiences and verbal persuasion. As the research suggested, the use of emotional arousal for self-efficacy development was not addressed, except insomuch as increased feelings of stress and anxiety on the part of the participants was avoided. The intervention did the same. However, in addition to the use of Tschannen-Moran and McMaster's model for self-efficacy development, additional considerations regarding the design of effective professional learning were included, specifically Guskey's (2014) model for planning professional learning which is interpreted in see Figure 3.4.

Guskey's (2014) model for planning effective professional learning begins with a consideration of the learning goal for participants, the identification of new practices to be implemented, identification of organizational support, identification of desired skills and outcomes for educators, and finally, the selection of optimal professional learning activities.

Figure 3.4. Guskey's model for professional learning planning. It is a backward map of Guskey's (2014) model for professional learning evaluation.

The outcome for students, equitable access to meaningful technology integration, was identified as the learning goal. The reformed practices to be implemented included the ability to effectively develop a technology integration plan for the school site. Organizational support for the professional learning event was relatively straightforward as the facilitator of the event was embedded in the professional context of the organization and had access to the resources necessary to host a day-long professional learning event. The initial literature review identified technology-related self-efficacy development as the desired set of skills and outcomes for educators. Finally, the intervention literature review guided the selection of the types of professional learning activities that may have resulted in optimal technology-related self-efficacy development.

The 1-day professional learning workshop was structured so that the participants—school site administrators, were exposed to a reform message (Gregoire, 2003) that may have implicated their practice. The activities throughout the day were focused on their motivation and ability to lead to the creation of a technology integration plan. The participants had several opportunities to engage in protected mastery experiences and participate in vicarious experiences throughout the training, concluding with a protected mastery experience wherein they revised the technology integration plan for the school district so that they could create a plan that supported the established integration plan with their site staff. Having completed these tasks, they then returned to their sites prepared to implement a site plan to with their staff.

Following the 1-day professional learning workshop, I met individually with each set of school site administrators at each campus to discuss their development of a site-specific plan for implementing the technology integration plan at their site, with their staff. I then observed the staff meeting wherein the school site technology plan is shared with their site staff. Though Guskey's (2014) model, Bandura's (1977) theory of self-efficacy development, and Gregoire's (2003) cognitive-affective models will provide an organizational structure for the 1-day professional learning workshop, the intervention research on vicarious experiences and verbal persuasion guided the professional learning follow-up session. Self-efficacy development was addressed in the one-on-one meetings and debriefings through the use of vicarious experiences and verbal persuasion. The on-site site plan development workshop served as an authentic mastery for the participants (Tschannen-Moran & McMaster, 2009) that was reviewed in the final one-on-one discussion with the facilitator, who was present at the school site for the event.

The intervention made use of a variety of frameworks to ensure that the target of the intervention was clearly described. Further, this proposal made use of those frameworks to clearly identify the manner of the intervention implementation. Though the desired final outcome of this intervention is equitable student use of technology to complete meaningful work, the mediating variable that was the focus of intervention was the technology-related self-efficacy belief of school site administrators. The desired outcome of this intervention was an increase in equitable access to technology by students so that they may do meaningful work. Through an increase in those self-efficacy beliefs, it may be possible to effect this meaningful change for students.

Chapter 4

Intervention Procedure and Program Evaluation Methodology

The investigation of this problem of practice began with a general investigation into the problems educators face integrating technology into the classroom effectively, coming to the conclusion that school site administrators are instrumental in affecting the success of technology integrations (Claro et al., 2017; Larosiliere et al., 2016; Machado & Chung, 2015). The needs assessment investigated the ways school site administrators approach technology in the researcher's context and found that they do not see themselves as technology integration leaders. To address this problem, possible solutions were investigated in the intervention literature review and found that addressing technology-related self-efficacy beliefs through professional learning designed to address components of self-efficacy development may be a workable solution.

After identifying the development of technology-related self-efficacy beliefs as a possible solution to this problem of practice in Chapter 3, the mechanisms for enacting this change were investigated. Tschannen-Moran and McMaster's (2009) research on sources of self-efficacy development provided a sound structure for creating an intervention. Guskey's (2014) model for planning professional learning was identified as a framework with which to structure the first phase of the intervention: a professional learning workshop. Gregoire's (2003) model of conceptual change was identified as a framework for understanding how to implicate the practice of the participants and engage them in a reform of their technology-related self-efficacy beliefs.

The purpose of this was study to understand the technology-related self-efficacy beliefs of school site administrators. An underlying purpose of this study was to understand the relationship between the technology-related self-efficacy beliefs of school site administrators and changes in their intent to act as a technology integration leader for their school site.

This mixed methods study was guided by three research questions.

1. To what extent was the intervention implemented with fidelity?
    a. To what extent did all nine principal and all eight vice principals attend the entire professional learning workshop?
    b. To what extent did all four principals and all four vice principals selected to participate in Phase 2 of the intervention attend the entire follow-up session?
    c. To what extent were participants engaged with the professional learning workshop?
    d. To what extent were participants engaged with the professional learning follow-up session?
2. To what extent was the technology integration plan that was created during the professional learning session and follow-up session communicated in the site-based workshop?
    a. Did participants communicate the technology integration plan to their staff?
    b. Did participants incorporate activities that reinforced the technology integration plan?
    c. How did participants describe their successes or barriers to implementing their site technology plan?
3. What are school site administrators' technology-related beliefs?
    a. To what extent did school site administrators' sense of technology-related self-efficacy, as measured by the adapted Principal Sense of Efficacy Scale and interviews, change during the course of the study?
    b. How do school site administrators describe their role as technology leaders?

Research Design

A mixed-methods, quasi-experimental, convergent parallel design (Creswell & Plano-Clark, 2018) was used organize and examine the results of the intervention. The design used a pretest and posttest model (Shadish, Cook, & Campbell, 2002) to evaluate changes in the proximal outcome, identified as the participants' technology-related self-efficacy beliefs. A convergent parallel mixed method was used to collect quantitative and qualitative data simultaneously to allow a more complete picture of the intervention, and its outcome, to emerge (Creswell & Plano-Clark, 2018).

The proximal outcome for this intervention was an anticipated change in the technology-related self-efficacy beliefs of school site administrators (see Appendix C). The short-term outcome of was an increased intent to act as technology integration leaders by school site administrators. The medium-term outcome of the study was increased meaningful integration of technology by teachers, though this was outside of the scope of the study. The long-term goal of this intervention was that all students would be able to equitably use technology to complete meaningful work, which was also outside of the scope of this study.

Judging whether the outcome of an intervention was a result of the planned intervention requires an evaluation of both the outcome and the process of implementation. To accomplish this, the first research question focused on the process of implementation of the intervention. The second and third research questions focused on the outcome of the intervention.

Process Evaluation

As Park, Hironaka, Carver, and Nordstrum (2013) found, the field of education often takes a black box approach, which is when the inputs and outputs of an expected change are identified, but the mechanism which produces the change is not clearly articulated. Educators know what they want to change, and they know what they want the outcome to be, but they do not explicitly identify the steps required to get from one point to the other (Park et al., 2013). Process evaluations help to open the black box and explicitly identify the steps that will guide the intervention from implementation to realization of results (Nelson, Cordray, Hulleman, Darrow, & Sommer, 2012). To guide this process evaluation, the first research question is: "To what extent was the intervention implemented with fidelity?" This question had two purposes: identifying the extent to which participants received an adequate dose of the intervention and participant responsiveness to the intervention (Dusenbury, Brannigan, Falco, & Hansen, 2003; Fredricks, Blumenfeld, & Paris 2004).

The first construct of interest in the process evaluation is attendance. *Attendance* is a component of dose, which is an element of implementation fidelity identified by Dusenbury et al. (2003) and defined as "the amount of program content received by the participants" (p. 241). Two sources of information were used to measure dose: field notes and an attendance log. The attendance log was used to measure the amount of time participants were present during the intervention. Data captured in the field notes were also used to document that participants remained at the professional learning workshop for its entire duration.

Participant engagement is the other construct used to evaluate the process evaluation. Fredricks et al. (2004) define participant engagement as the way the participants "involvement in learning and academic tasks and includes behaviors such as effort, persistence, concentration, attention, asking questions, and contributing to class discussion" (p. 62). Participant engagement was measured in two ways. Participant engagement was first measured by the notations in the researcher's journal during the discrete activities about the number of participants who were fully engaged, somewhat engaged, or not at all engaged. Second, the frequency and length of participant utterances longer than 2 seconds during the professional learning workshop was tallied and noted.

Outcome Evaluation

All too often, the decision to integrate technology is made for the wrong reason (Webster, 2017), and subsequent technology integration decisions are evaluated based upon the misplaced expectation that technology integration will result in increased scores on high-stakes tests (Angrist & Lavy, 2002; Buckenmeyer, 2010; Topper & Lancaster, 2013). A review of the literature has identified the role school site administrators (e.g., principals and vice principals) play in setting a technology vision for their school as critical to the future success of technology integration (Machado & Chung, 2015; Stuart et al, 2009). This intervention endeavored to increase the technology-related self-efficacy beliefs of school site administrators to become effective technology leaders, and consequently, ensure the students in their schools had more equitable access to meaningful uses of technology.

Two outcome evaluation questions were developed to evaluate this intervention. The first question served to evaluate the extent that the technology integration plan created during the professional learning workshop was delivered by the participants to site staff during the site-based workshop. This question included three additional sub-questions to determine: (1) whether the technology integration plan was communicated to site staff, (2) how participants integrated activities that supported the technology integration plan, and (3) what barriers and success participants encountered when introducing the technology integration plan. The data used to evaluate this question included field notes made during the site-based workshop and transcribed audio recordings of the participant interview.

The second outcome question involved two constructs: the technology-related self-efficacy beliefs of participants and their intent to act as technology integration leaders. This research question included two sub-questions: (1) To what extent did school site administrators' sense of technology-related self-efficacy, as measured by the adapted Principal Sense of Efficacy Scale and interviews, change during the course of the study? and (2) How do school site administrators describe their role as technology integration leaders? Data were quantitative data gathered using the Adapted Principal Sense of Efficacy Scale (PSES; Tschannen-Moran & Gareis, 2004), responses to open-ended survey questions, and transcriptions of the participant interviews. These data sources helped discern the technology-related self-efficacy beliefs of school site administrators.

Method

This section describes the participants and measures. A summary matrix that outlines the research questions, constructs, measures, data collection tools, frequency of collection, and analysis can be found in Appendix D.

Participants

The participants in this intervention were 17 school site administrators (i.e., principals and vice principals) from nine school sites. See Table 4.1 for a description of the participant demographics. The level of participants' administrative experience varied; of the nine principals two had no previous experience in the role, one had 2 years of experience, three had 3 years of experience, and three had more than 5 years of experience. Two of the principals were new to the organization. The other seven principals had spent more than 5 years with the district. Six of the principals led elementary school sites, two of the principals led middle schools, and one principal led a high school. One of the principals was between 30- and 34-years-old, two were between

35- and 39-years-old, and the other six were between 40- and 50-years old. Five of the principals were Hispanic. The remaining four principals were Caucasian. Seven of the principals were female and two were male.

Table 4.1

Participant Demographics

Characteristic	Principal (*N* = 9)	Vice Principal (*N* = 8)
Length of tenure in role		
No experience	2	3
2 years	1	3
3 years	3	1
> 5 years	3	1
Tenure with organization		
Novice	2	1
Experienced	7	7
School site type		
Primary	6	5
Secondary	3	3
Age		
30–34-years-old	1	0
35–39-years-old	2	3
40–50-years-old	6	5
Ethnicity		
Hispanic	5	3
Caucasian	4	4
African American	0	1
Gender		
Female	7	5
Male	2	3

As with the level of experience among the principals, the level of experience varied among the vice principals as well. Of the eight vice principals who participated in the study, three had no experience in the role, three vice principals had 2 years of experience in the role, one had 3 years of experience, and one had more than 5 years of experience in the role. One of the vice principals was new to the district and the other seven had more than 5 years with the district. Five of the vice principals served elementary school sites, two served middle schools, and one served a high school. Three of the vice principals were between 35- and 39-years-old and five were between 40- and 50-years-old. Three of the vice principals were Hispanic, four were Caucasian, and one was African American. Five of the vice principals were female, and three were male.

Phase 1 participant criteria. Criterion sampling was used to select participants for the first phase of the intervention. Criterion sampling is a method for selecting research participants "that exhibit certain predetermined criterion characteristics" (Patton, 1990, p. 177). Criterion sampling is appropriate for this intervention because of the contextual nature of this problem of practice. All participants must have been school site administrators working in this context, as the problem of practice is concerned with the effective implementation of technology in school sites. District office administrators were excluded because they do not directly influence school-level implementation of technology.

Phase 2 participant selection. The second phase of the intervention was structured as a multiple case study (Baxter & Jack, 2008), a structure that attempts to identify patterns across similar cases or identify contrasting results. Four Phase 2 cases were selected using stratified purposeful sampling (Patton, 1990). Stratified purposeful sampling is a combination of two qualitative sampling strategies, such as typical case sampling and criterion sampling. Typical case sampling is often used to select cases that are representative of the conditions of the program being studied. The purpose of this selection strategy is to "describe and illustrate" (p. 173) what is common in a program. Criterion sampling, as discussed in the description of participant criteria for Phase 1, is used to include or exclude participants because of specific characteristics (Patton, 1990).

Two criteria were applied to participant selection for Phase 2. The first criterion was that participants must be a school site administrator at an elementary school site within this school district. Secondary (i.e., middle and high school) site administrators were excluded so that the Phase 2 sample remained typical across all cases. Further, the conditions and roles of leadership in secondary schools are much different than those in elementary school; including secondary site leaders would, therefore, be counterproductive to the benefits of typical case sampling.

The second criterion for Phase 2 participants related to their length of tenure. As noted in the participant description school site administrators who were either new to their role, new to the organization, or both were excluded. The demands of assuming a new role in a new organization could be overwhelming and limit their ability to focus on technology integration. Those school site administrators who were new to their role but not the organization would only have been considered for inclusion in the study if no other experienced participants consented to participate; one participant was included who met these criteria.

Measures

This section describes the measures that were used to gather data for this study: the Adapted PSES and demographic survey, field notes, a semistructured interview, and the researcher's journal.

Principal Sense of Efficacy Scale and demographic survey. The PSES was used to measure the technology-related self-efficacy beliefs of school site administrators (see Appendix E). The PSES is a valid and reliable instrument (Tschannen-Moran & Gareis, 2004). However, it does not specifically measure technology-related self-efficacy beliefs. Consequently, the items were adapted so that participant responses are related to technology-related self-efficacy. Although this invalidates the survey as a tool for identifying empirical results, the participant pool is not large enough to establish an effect size. The PSES data were used solely to establish descriptive statistics.

The PSES includes 18 questions that comprise three subscales of six questions each: (a) efficacy for management, (b) efficacy for instructional leadership, and (c) efficacy for moral leadership. The subscale, efficacy for moral leadership, is not germane to this study and was excluded. A sample question for the efficacy for management subscale is: "In your current role as principal, to what extent can you motivate teachers' use of technology?" A sample question for the efficacy for instructional leadership subscale is: "In your current role as principal, to what extent can you manage technology-related change in your school?" The participants were directed to rate themselves on a scale from 1 (*none at all)* to 9 (*a great deal*). Data collected from this measure was used to inform three research question in regard to administrator's technology-related beliefs.

Open-ended survey questions. An additional qualitative component was added to the Adapted PSES. Three open-ended questions were added that further examine issues of technology leadership intent raised by the Adapted PSES. A sample open-ended question is: "How do you manage technology-related change at your school site? If you do not manage technology-related change at your school, why do you think that is?" This measure in particular was used to inform the research question three.

Sign-in and sign-out sheet. Attendance was recorded during Phase 1 of the intervention through the use of an attendance sheet. Participants were required to sign in at the start of the professional learning workshop and out when they left for the day. This measure was used to address the process evaluation questions focused on intervention dose.

Field notes. Field notes are a widely acknowledged source of data in qualitative research (Phillippi & Lauderdale, 2018). Phillippi and Lauderdale (2018) list several uses of field notes, including to "prompt researcher(s) to closely observe environment and interactions. . . encourage researcher reflection and identification of bias. . . facilitate preliminary coding and iterative study design. . . increase rigor and trustworthiness. . . provide essential context to inform data analysis" (p. 382). Field notes were used to collect data once, during the site-based workshop. The field notes were used to inform responses to research question two.

Participant interview. A semistructured interview protocol was used to collect interview data from participants (see Appendix G). The interview was audio-recorded and transcribed. A sample question for this interview was: "Would you please describe your sense or understanding of the district vision for technology integration?" The interview questions were adapted from a qualitative case study on leadership and technology integration conducted by Berrett et al. (2012). Data collected from the audio transcripts of the school site administrator interview was used to inform conclusions reached with regard to research questions two and three.

Researcher's journal. A researcher's journal was used to record qualitative data and to capture the essential components of an interviewee's answers and information about the interview experience (Flick, 2009). A journal was kept to record thoughts and reflect on the events during the intervention. The researcher's journal is also a tool to engage in reflexivity, a component of the qualitative process that helps to account for the "assumptions, biases, experiences, and identities that may impact any aspect of your research study" (Lochmiller & Lester, 2017, p. 95). Journal entries were made following the professional learning workshop, the professional learning follow-up session, the site-based workshops, and the participant interviews. This data served two purposes. It was used in part to assess the process evaluation, and for data triangulation, a common triangulation strategy used for case studies (Lochmiller & Lester, 2017). Data collected using this measure were used to inform conclusions reached regarding research question one.

Procedure

This section describes the methodology used for recruiting participants, a description of the intervention, and the methodology that was used to collect and analyze data.

Participant recruitment. To recruit participants, I met individually with each participant during the two weeks before the intervention, read them the consent form, answered any questions, informed them of the intervention timeline, and collected the signed consent form. The form that the potential participants completed provided them the ability to give, or withhold, their consent (see Appendix H).

Intervention. The professional learning workshop activities and objectives are included in Appendix I. The specific details of Phase 1 and Phase 2 of the intervention will be discussed in this section.

Professional learning workshop. The first activity planned for this intervention was a professional learning workshop. The workshop was designed in accordance with Guskey's (2014) model for planning professional learning. This workshop incorporated three of the four sources of self-efficacy identified within social cognitive theory, as described in Chapter 3: mastery experiences, vicarious experiences, and verbal persuasion (Bandura, 1987).

The workshop began with a short video clip that presented a vision of meaningful technology integration, the first vicarious experience of the day. For a schedule of the day, see Table 4.2. Participants were asked to report to the group what they noticed about the vision for technology integration demonstrated in the video clip and to report what they wondered about the same. Next was a planned guided discussion toward meaningful technology integration based on the report on education technology created by the U.S. Department of Education (2016). Each participant read a portion of the report and then shared out and discussed with group members on the way this plan related to their practice and context. The discussion concluded with a question about the role school site administrators play in making the use of technology a reality in their school. As the conclusion of the discussion, I explained that the intent of this workshop was to jointly update the technology integration plan for the organization and for each participant to create a technology plan for their school site.

The next activity was intended to provide an example of effective technology integration. The example mirrored the work students and teachers should be engaged in to integrate technology in the classroom. The participants used the type of technology resources that are readily available to the teachers and students in their sites. The results of the activity were discussed and debriefed during a working lunch. Following lunch, participants viewed several videos (i.e., a vicarious experience) that presented differing uses of technology in classrooms and supported the development of a common working definition of what effective technology integration looks like at the elementary and secondary levels.

Finally, I returned to the intent of the workshop that I presented at the start of the day, which was to jointly update the technology integration plan for the organization and then for each participant to create a technology plan for their school site. At the conclusion of the workshop, the participants were instructed to lead the development of a technology plan for their school site that was aligned with the district technology integration plan they helped create, but also reflective of the specific needs of their staff and students.

Table 4.2

Professional Learning Workshop Schedule

Time	Activity Title	Description
8:45 a.m.–9:00 a.m.	Data collection	Consent form Demographic survey
9:00 a.m.–9:20 a.m.	"Homework oh Homework…" video clip and discussion	Participants will view, deliberate, and discuss the content of this video clip and the vision of technology integration it presents.
9:20 a.m.–9:40 a.m.	Document discussion	Participants will review and discuss the implications of the education technology report published by the Department of Education.
9:40 a.m.–9:50 a.m.	Break	
9:50 a.m.–11:30 a.m.	Design a civilization	Participants will complete a protected mastery experience, wherein they use digital tools to create artifacts that represent a civilization.
11:30 a.m.–12:30 p.m.	Working lunch	While participants eat lunch, they will share the artifacts they created and explain how and why they create the specific artifacts. Participants will then debrief the experience of using digital tools to complete this work.
12:30 p.m.–1:00 p.m.	Video vignettes	Participants will view short video clips of technology integration in classrooms and discuss how they are alike, or unalike, the experience in which they participated.
1:00 p.m.–1:45 p.m.	Defining effective technology integration	Participants will discuss the content of the workshop and synthesize a definition of effective technology integration for the organization.
1:45 p.m. – 2:00 p.m.	Break	
2:00 p.m.–3:30 p.m.	Develop a common technology integration plan	Participants will develop a common technology integration plan.

Professional learning follow-up session. Following the professional learning workshop, I contacted each of the cases selected for participation in Phase 2 and scheduled follow-up sessions. To maintain the anonymity of participants, I assigned each site a pseudonym: Site A, Site B, Site C, and Site D. Similarly, I assigned the principal and vice principal from each site a pseudonym that maintains their relationship with that site, e.g. Principal A and Vice Principal A. Each follow-up session occurred in the principal's office, at their school site. After the completion of the professional learning workshop, a 1-hour, professional learning follow-up session was scheduled with each school administrator who met the criteria and had agreed to participate in Phase 2 of the intervention. The purpose of this follow-up meeting was to support their development of a specific technology plan for their school site based upon the district technology integration plan created at the professional learning workshop. Each meeting was scheduled to occur in the principal's office at their school site and include the principal and vice principal.

Site-based workshops. The final component of the intervention was a site-based workshop for school site staff that was to be led by both the principal and vice principal. They were to outline, and jointly present, the technology integration plan for their school site, based upon the district technology integration plan created at the professional learning workshop. The site-based workshop was to occur after the professional learning follow-up session, but before winter break, that began in mid-December.

Data collection. In this section, a description of how data were collected for each of the data sources: attendance, adapted PSES, open-ended questions attached to adapted PSES, field notes, transcripts school site administrator interviews, and the researcher's journal. Table 4.3 outlines the data collection timeline.

Principal Sense of Efficacy Scale and open-ended questions. The participants were sent the Adapted PSES and open-ended questions via email. The data were collected using Google Forms. I was the sole person able to access the survey results. Following participant submission of their survey, the data were transferred from Google Forms to Google Sheets, an online spreadsheet program, which only I have access. Once the responses were transferred to the spreadsheet, each participant was given a pseudonym so that the data were no longer identifiable by a third party, but I could still use the responses for triangulation. Demographic data were moved to a separate Google Sheet, accessed via a separate account so that demographic information cannot be used to identify specific participants should the PSES responses somehow be compromised. The adapted PSES was sent to participants again following the conclusion of Phase 2 of the research study. The survey was sent via email using Google Forms after the participant-led workshops were complete. Participants completed the survey prior to being interviewed. Participants names were replaced with their previously assigned pseudonyms to preserve anonymity but allow for data triangulation.

Field notes. Field notes were written during the professional learning workshop while participants worked independently and during the observations of the participant-led site-based workshops. They were used to determine implementation fidelity, assess intervention outcomes, and aid in triangulation of findings.

Professional learning workshop follow-up session. The follow-up sessions were audio recorded and transcribed using the online service Rev Voice Recorder. The follow-up session took place after the professional learning workshop, but before the participant-led site-based workshop. The length and frequency of participant utterance was measured using the transcribed recordings of the follow-up sessions to help determine participant engagement.

School site administrator interview. An interview was conducted with each Phase 2 participant at the conclusion of the intervention. The interviews were audio recorded and transcribed using the online service Rev Voice Recorder. The time and place of the interview was at the discretion of the participant, and generally occurred within a week of the participant-led site-based workshop.

Table 4.3

Data Collection Timeline

Activity	Timeline	Description
PSES pretest, open-ended questions, and demographic survey	October 2019	School site administrators completed the Adapted PSES using Google Forms.
Field notes	October–December 2019	I took field notes during the independent group-work activity portion of the professional learning workshop and during the participant-led workshop.
Professional learning follow-up session	October-November 2019	I audio recorded and transcribed the discussion held during the professional learning follow-up session
Participant interview	October–December 2019	I audio recorded and transcribed the interview conducted following the conclusion of the participant-led workshop.
PSES posttest	October–December 2019	School site administrators completed the Adapted PSES using Google Forms.
Researcher's journal	October–December 2019	I kept a researcher's journal throughout all stages of the intervention.

Researcher's journal. A password-protected electronic researcher's journal was kept using the Notes application on my iPad, as it allows for multiple types of data entry, including typed notes, handwritten notes, drawings, and audio transcriptions. This journal was used to record reflections after the conclusion of each intervention activity.

Data analysis. Two types of data were collected for this mixed method convergent parallel study. Each type of data were analyzed separately and then examined in concert to help triangulate the findings and answer the research questions guiding this study.

Quantitative data analysis. The target population for this study was not of a sufficient size to establish an effect size, consequently, the quantitative data collected for this study were limited to an analysis of the mean and range of scores. As the PSES was adapted to focus on technology-related self-efficacy beliefs of school site administrators, the individual subscales were not computed. Instead the overall mean was calculated.

Qualitative data analysis. Thematic analysis (Braun & Clarke, 2006) was used to analyze the qualitative data generated by this study, including field notes, the researcher's journal, and the school site administrator interview. Braun and Clarke (2006) describe six steps to conduct thematic analysis. First, one is to familiarize themselves with the data by rereading the data several times. The second step is to generate initial codes. The third step is to search for themes in the codes that were identified. The fourth step is to review and refine the candidate themes that I had identified. The fifth step is to define and name the themes. The sixth, and final, step is to write up the report.

Researcher Subjectivity

Researchers are the primary instrument used to collect data in qualitative research (Golafshani, 2003). There is, consequently, an acknowledgement that the values and biases held by the researcher may color the outcome of their study (Creswell & Miller, 2000). Accounting for these biases, the qualitative researcher must acknowledge them to the greatest extent possible to ensure that the reader can assess the trustworthiness of the study (Creswell & Miller, 2000). Accordingly, I must clarify my position, bias, and personal views as thoroughly as possible. The following discussion presents my background within the context of the study in order to minimize any unintended consequences resulting from the views and biases I hold.

My educational background is in environmental education, history, instructional technology, and administration. I spent the first year of my educational career as a naturalist at an outdoor school. I was employed as a middle school history teacher for 3 years in the district in which this study was conducted. Next, I served as an instructional technology coach for 1 year. After that, the one-to-one technology integration program in my organization expanded to include all nine school sites, and I became the technology integration program coordinator and worked in that role for 3 years. Finally, 2 years ago I was appointed to the role of educational technology director for the same school district. My work as a coordinator and director has brought me into contact with teachers and administrators throughout the district for the last 5 years, including the participants in this study.

My experiences as a classroom teacher in striving to integrate technology effectively, which continued with my expanded duties related to technology integration district-wide, have driven my focus on effective instruction technology integration. As the person primarily responsible for the technology integration that is currently in place in my district, I have a vested interest in making technology integration successful. My focus on technology integration, and the widespread contact I have had with administrative and teaching staff means that all participants in this study came to the intervention with an understanding of my actions, stated beliefs, and implementation of technology integration.

Chapter 5

Findings and Discussion

The study was an investigation of elementary school administrators' technology related self-efficacy beliefs and if there was a link to their technology integration practices. Self-efficacy beliefs are the beliefs a person holds about their expected ability to successfully complete a task (Bandura, 1977); technology-related self-efficacy beliefs, then, are those beliefs a person holds about their ability to successfully integrate technology. Technology integration is the process of using technology to support effective pedagogical practices in the classroom. The expected long-term outcome of the intervention was that the technology integration leadership of school site administrators would change as a consequence of increased technology-related self-efficacy beliefs, the short-term outcome.

Process of Implementation

The intervention took place over 10 weeks, beginning in October 2019 and concluding in December 2019. The intervention was organized into two phases: Phase 1 included 17 participants, all principals and vice principals in the school district, while Phase 2 included four cases (i.e., school sites). During Phase 1 of the intervention, the school site administrators participated in a daylong professional learning workshop. This workshop served two purposes. First, it was designed to change the participant's technology-related self-efficacy beliefs. Second, it supported the development of a district technology integration plan that would provide guidance for Phase 2. The four cases included in Phase 2 each consisted of a principal and vice principal serving at the same elementary site. Phase 2 consisted of a professional learning follow-up session and a site-based workshop. I led each of the professional learning follow-up sessions, and both the principal and vice principal from each case participated. The principal and vice principal who comprised the four Phase 2 cases led the site-based workshops, and I attended as an observer. Selection for participation in Phase 2 was consistent with the criteria for inclusion outlined in Chapter 4.

Phase 1: Professional Learning Workshop

Phase 1 of the intervention was modeled on a study conducted by Tschannen-Moran and McMaster (2009) that used a 1-day professional learning workshop to change the self-efficacy beliefs of participants. The professional learning workshop for this intervention occurred in early October of 2019. It was divided into eight discretely organized activities. Each of the activities is described in detail below.

The workshop began with a 20-minute activity focused on a video that, although intended as a commercial for the hardware and software sold by Apple, demonstrated what creative, constructivist, and engaging uses of technology by students may look like. In the video, students are given an open-ended task: to explore gravity. The video then shows the students using an iPad to demonstrate their understanding of the principles of gravity. They do this in ways that incorporate the use of the iPad as a tool to collect and construct evidence of their learning. The intent in using this video to begin the day was to challenge participants' beliefs of what was possible through technology integration. Gregoire's (2003) cognitive-affective model makes clear that participants beliefs will only change if they are presented with a plan that challenges their practice. The video was used to facilitate that goal.

Following the *Gravity* video, the participants were randomly divided into groups of three and assigned a section of the *2017 National Education Technology Plan Update* (U.S. Department of Education, 2016). Each group had 20 minutes to read over a section of the plan and discuss the major findings and recommendations for that section of the report. I then facilitated a discussion for the purpose of sharing the totality of the report's recommendation with the whole group. Of the 17 participants, all but three of the principals engaged in the discussion. There was general agreement on the understanding of technology integration presented by the *2017 National Education Technology Plan Update* (U.S. Department of Education, 2016), especially around the need to increase the equity of meaningful technology use by students.

For the next activity I divided the participants into five groups of three and one group of two. I then explained that they were to use the technology available to them, an iPad and a laptop computer, to outline an imaginary civilization and then develop artifacts that were representative of that civilization. They were instructed to use multimedia applications on the iPad in the creation of the cultural artifacts for their imaginary civilization. The purpose of this activity was to mirror the type of open-ended, creative work, presented in the introductory video, to give participants an experience with a student-led approach to use with technology. It was also intended to function as both a vicarious experience and protected mastery experience (Bandura, 1977) to increase participants technology-related self-efficacy beliefs. This activity functioned as a protected mastery experience because participants were able to have success completing a task in a structured environment with a low chance of failure. This activity also functioned as a vicarious experience because participants were able to view their fellow participants completing tasks and receiving recognition from the group for their work. Both mastery experience and vicarious experiences are the two components of self-efficacy development that have been found to have the greatest effect on self-efficacy growth (Bandura, 1977).

During the lunch break, groups presented the artifacts they had created. As the artifacts were presented, the participants were actively listening and involved as their colleagues shared their imaginary civilization artifacts. According to the researcher's journal, they were asking each other questions about the artifacts, encouraged each other, and complimented each other on successfully completing the work. It was evident the participants felt a sense of accomplishment from this activity. In creating a setting where participants could be successful in front of their peers, I was employing two of Bandura's (1977) principles of self-efficacy development: mastery experiences and vicarious experiences. Participants presented their artifacts in front of their peers and me and received positive feedback. The successful completion of a risky activity, a mastery experience, is the component of self-efficacy development that Bandura found to be the most efficacious in increasing self-efficacy. In watching the presentations and seeing the feedback that others received, the participants also benefited from vicarious experiences. Bandura found that people who watch their peers successfully complete a task also experience an increase in their self-efficacy as a result.

Following the presentation of the civilization artifacts the participants viewed a series of three videos. Each video reflected different examples of technology integration in the classroom. After viewing each video, participants were given time to engage in dialogue about the video content and how or if it related to use of technology in their school. The viewing of the video vignettes was intended as an opportunity for participants to compare and reflect on what they viewed to what they currently see in the classrooms at their sites. Based on the observational notes in the researcher's journal, the participants made comparisons between the vignettes and the vision of technology integration presented by the *Gravity* video and the *2017 National Education Technology Plan Update* (U.S. Department of Education, 2016). This activity also aligned with Bandura's (1977) source of self-efficacy development, and with vicarious experiences, as Beisiegel et al. (2018) found that viewing and discussing video vignettes could function as vicarious experience.

The final component of the professional learning workshop was originally planned to be two different sections. However, the work of the first activity involving defining what effective technology integration would look like in the context of this organization shifted into the discussion of a new technology vision for the district. During the final 2 hours of the workshop, participants discussed what they had learned during the day and how it should be integrated in the district and their sites specifically. I organized participants into two groups of three and two groups of four and asked them to independently develop technology integration vision statements for the entire district. While they accomplished the task, they had access to all of the materials that had been presented to them during the workshop, including the *Gravity* video, the *National Education Technology Plan Update* (U.S. Department of Education, 2016), and the video vignettes.

After giving the participants an hour to work, I facilitated a discussion in which all of the participants worked to integrate the various vision statements developed by each group into one statement that would serve to guide the work of technology integration for all nine schools. To do this, a spokesperson for each group read their statement aloud, and I transcribed them exactly as stated on a computer that was projected in the room. This was done without editing their statements in order to allow them to be seen as having successfully completed the task in front of their peers. This served as another mastery experience and vicarious experience for the participants (Bandura, 1977). Once all of the proposed vision statements were visible to the whole group, I facilitated a discussion in which they worked toward a synthesis of a common statement for the entire district. I solicited feedback from participants on each of the individual statements. I then culled the components that the group agreed were the best and most reflective of their intent. Once the components were identified, I asked for feedback on wording, and various participants suggested changes until we reached general agreement on the final wording.

At the conclusion of the professional learning workshop, I explained Phase 2 of the intervention. All participants were asked to organize and conduct a participant-led workshop for their school site staff, though only four cases had been selected for further participation in the research. I also offered the coaching and support that Phase 2 participants were to receive as part of the intervention to all other school sites.

Phase 1 deviations. The professional learning workshop generally proceeded as designed, however there were several deviations from the plan. First, two participants did not remain at the professional learning workshop for its entire duration. A secondary principal left midway through the day because she was feeling ill and did not return. A secondary vice principal excused herself in the late morning to deal with a disciplinary issue on campus and returned in the early afternoon.

The second deviation from the plan occurred in the afternoon. During the civilization artifact activity, participants were asked to design artifacts for an imaginary civilization using iPad. Participants' clarity about the activity varied. As I circulated the room, I was asked by several groups to re-explain the task. In each case, I referenced the open-ended guidelines of the activity. It appeared that due to the confusion about the open-ended nature of the task, some groups lost time in starting the work. Some groups began by finding examples of artifacts on the Internet and duplicating them or incorporating them into a presentation. When they did, I redirected them to the screen that indicated they should use multimedia applications, so that they understood they were to create their own artifacts. Although I had redirected participants to the projected directions for this activity, several of the final products were mere copies of images that they had found on the Internet.

The final deviation involved combining activities. The professional learning workshop plan had identified two distinct activities in the afternoon. The first was time to define what participants understood to be effective technology integration. The following activity was the development of a common vision for technology integration.

Phase 2: Follow-up Session and Site-Based Workshop

Phase 2 began with a professional learning follow-up session intended to help the participants review the professional learning workshop and design their site-based workshops. Each session was held in the principal's office at their school site. Three of the four principals began this conversation by asking me how I wanted their site-based workshop to be structured. Instead of providing specific directions, I asked what they wanted technology integration to look like at their site, what they liked about the district technology integration plan they had crafted during the professional learning workshop, and how that vision could be contextualized to the specific needs of their school site. These three questions guided the discussion away from my expectations and helped us collaboratively build a plan for the workshop they would present to their staff.

In two of the professional learning follow-up sessions, the participants selected the substitution, augmentation, modification, redefinition (SAMR; Puentedura, 2014) technology integration framework that I had intentionally excluded from the professional learning workshop. Though this was not an outcome I desired, I did not attempt to prohibit or discourage them from using the framework because I wanted the workshop to be generated by the administrators themselves.

In all but one of the cases, the participants requested that I share the *Gravity* video with them, so that they could show it to their staff to start the workshop. After that, each group discussed different ways in which they could emphasize their technology integration priorities to their staff members. Though each site reproduced one of the components of the professional learning workshop they had attended, they all also included components that were unique to their campus's practices.

Phase 2 deviations. Each follow-up session included the principal and vice principal, as planned. However, two sessions began without the vice principal's presence. In both cases the vice principal joined shortly after the follow-up session began.

Summary. In each case, I began the follow-up session with a review of the professional learning workshop. Next, I explained that the goal of the site-based workshop was to present the technology integration plan that had been developed during Phase 1 to their site staff in a manner appropriate to the concerns of their site. Next, I worked collaboratively with the participants to help them plan the site-based workshop. In two cases, material that had not been covered during Phase 1 was introduced into the plan for the site-based workshop. As stated earlier, if I had interposed and directed them along a different path of technology integration, I may have undermined the successful completion of a mastery experience and their sense of technology-related self-efficacy.

Each of the site-based workshops was scheduled within the timeframe established by the intervention plan in Chapter 4. In three of the four cases, the follow-up workshop occurred as scheduled shortly after the follow-up session. However, Site D was forced to reschedule their planned site-based workshop because of events outside of their control. Instead of running the site-based workshop shortly after the follow-up session nearly a month and a half elapsed between the two.

Findings

This study was designed using a convergent mixed-methods approach to data collection (Creswell & Plano-Clark, 2018). The qualitative data sources included open-ended survey questions, field notes, and transcribed semistructured interviews. The quantitative data included results from pretest and posttest administration of the adapted PSES survey instrument. In addition to the unique benefits that both quantitative and qualitative data sources provide, the two data sets were used to triangulate the data (Lochmiller & Lester, 2017) and increase the trustworthiness of the conclusions reached (Guba, 1981). The presentation of the findings and discussion have been organized using the three research questions:

4. To what extent was the intervention implemented with fidelity?
    a. To what extent did all nine principal and all eight vice principals attend the entire professional learning workshop?
    b. To what extent were participants engaged with the professional learning workshop?
    c. To what extent did all four principals and all four vice principals selected to participate in Phase 2 of the intervention attend the entire follow-up session?
    d. To what extent were participants engaged with the professional learning follow-up session?
5. To what extent was the technology integration plan that was created during the professional learning session and follow-up session communicated in the site-based workshop?

a. Did participants communicate the technology integration plan to their staff?

b. Did participants incorporate activities that reinforced the technology integration plan?

c. How did participants describe their successes or barriers to implementing their site technology plan?

6. What are school site administrators' technology-related beliefs?

a. To what extent did school site administrators' sense of technology-related self-efficacy, as measured by the adapted Principal Sense of Efficacy Scale and interviews, change during the course of the study?

b. How do school site administrators describe their role as technology integration leaders?

Process Evaluation

The first research question asked, "To what extent was the intervention implemented with fidelity?" The fidelity research question included four sub-questions that were specifically focused on participant attendance and engagement. Two of the sub-questions included the attendance and engagement during the professional learning workshop in Phase 1 of the intervention. The other two sub-questions focused on attendance and engagement during the professional learning follow-up session in Phase 2 of the intervention.

Professional learning workshop attendance (RQ1A). This question asked, "To what extent did all nine principals and all eight vice principals attend the entire professional learning workshop?" To satisfy this research question two data sources were used. The first data source was the sign-in and sign-out attendance sheet used during the intervention (see Table 5.1). The second data source was the researcher's journal. Of the 18 participants, 16 attended the entire professional learning workshop. One principal left the professional learning workshop two hours early. According to a note recorded in the researcher's journal the principal complained of feeling ill. She did not return.

Table 5.1

Professional Learning Workshop Attendance Frequency Table

Participants	Total
Principal	
Attended the entire event	8
Left early	1
Left, but returned	0
Vice Principal	
Attended the entire event	7
Left early	0
Left, but returned	1

The other participant, a vice principal, who was not present for the entire professional learning workshop left at 11:28 am. She returned to the professional learning workshop at 1:30 pm. According to a note recorded in the researcher's journal, she was called back to his school site in response to a student discipline issue. Upon returning, she remained at the professional learning workshop until it concluded.

Professional learning workshop engagement (RQ1B). This research question asked, "To what extent were participants engaged with the professional learning workshop?" Participant engagement was defined as the way the participants were involved in the academic work of the intervention, including their "effort, persistence, concentration, attention, asking questions, and contributing to class discussion" (Fredricks et al., 2004, p. 62). Participants who were noted as being *fully engaged* were focused on the work of the professional learning workshop throughout the session. Participants who were noted as being *minimally engaged* were engaged with the professional learning workshop session for at least half of the session. Those participants who were noted as being *not engaged* were engaged with less than a quarter of the professional learning workshop. One data source was used to answer this question, the researcher's journal. I made notations in the researcher's journal during the professional learning event when participants were engaged in independent work. These notes included when participants were not engaged with the content of the professional learning workshop and were tallied as seen in Table 5.2.

Table 5.2

Participant Engagement at the Professional Learning Workshop

Professional learning workshop activity	# of Participants Engaged	# of Participants Minimally Engaged	# of Participant Not Engaged
Gravity video	18	0	0
Education technology report	16	1	1
Civilization builders	13	3	1
Video vignettes	14	3	0
Defining technology integration and developing a technology integration site plan	11	2	4

The first component of the professional learning workshop was the one element of the day in which all participants remained engaged. The next component, the review of the educational technology report and discussion resulted in less participant engagement. One participant, a principal, was minimally engaged as I observed her using her phone throughout the discussion, while the other less-engaged participant, also a principal, was noted in the researcher's journal as being occupied with answering her email.

The next component of the intervention was designed as groupwork. As one of the participants had left to address an issue at their school site, participants were randomly divided into six groups of three and given time to independently complete the work of the session. After the groupwork began a vice principal left the professional learning workshop to address an issue at their school, reducing the total number of participants present. While participants were working, I moved from group to group, answering questions, checking on progress, and monitoring engagement with the work. In three of the six groups all participants remained actively engaged. In two other groups three members were noted as being minimally engaged. In the final group, one member was not engaged. According to a note made in the researcher's journal she was occupied designing a slideshow presentation unrelated to the professional learning activity.

During the fourth component of the professional learning workshop, a principal left and did not return and the vice principal who had left during the previous activity returned. Three of the remaining 17 participants were minimally engaged during components of this activity. Though the minimally engaged participants did watch the video clips, they did not participate in the follow-up discussion. One participant was not engaged throughout the entire activity; according to a note made in the researcher's journal this participant continued to work on a task unrelated to the professional learning workshop.

The final session of the professional learning workshop, which was originally designed as two separate components, was combined into one. Due to the nature of a 1-day professional learning event, interest and attention waned. Of the 17 remaining participants, 11 were engaged with this activity, two were minimally engaged, and four were not engaged at all. The two participants who were minimally engaged participated in the work at the beginning of the session but were not active participants at the end of the session. According to notes made in the researcher's journal, the four participants who were not engaged at all were distracted with administrative tasks like answering email, sending text messages, designing a slideshow presentation, and reviewing student discipline concerns logged in the student information system.

Professional learning follow-up session attendance (RQ1C). This research question asked, "To what extent did all four principals and all four vice principals selected to participate in Phase 2 of the intervention attend the entire follow-up session?" To satisfy this question two data sources were used. The first data source was the researcher's journal; notes made in the researcher's journal identified which professional learning follow-up sessions had all participants in attendance for the entirety of the session. The second data source was the transcript logs for the professional learning workshops. Timestamps contained within the logs were used to identify when participants arrived.

According to notes made in the researcher's journal, Vice Principal A was late to arrive to the professional learning follow-up session. Her first recorded utterance, according to the transcript, did not occur for nearly 12 minutes. The first statement Vice Principal A made was "Hi," indicating that she had just joined the follow-up session. According to notes made in the researcher's journal, Principal A had stated when I arrived that Vice Principal A was dealing with a discipline issue and would join the discussion as soon as she could. In all other cases, the participants attended the entire professional learning follow-up session according to the timestamps recorded within the transcript of the sessions.

Professional learning follow-up engagement (RQ1D). This research question asked, "To what extent were participants engaged with the professional learning follow-up session?" One data source, the professional learning follow-up session transcripts, was used to satisfy this research question. To evaluate engagement, the frequency and mean length of utterances were analyzed (see Table 5.3). During the professional learning follow-up session, the school principals spoke more frequently than their vice principals. Principal A spoke 12 more times than her vice principal; Principal B spoke 14 more times than her vice principal; Principal C spoke 17 more times than her vice principal, and Principal D spoke 21 more times than her vice principal. Additionally, with the exception of Case A, principals spoke for more time than their vice principals in every other case.

Table 5.3

Frequency and Mean Length of Participant Utterance During the Professional Learning Follow-Up Session

Participants	Frequency of Utterance Longer Than Two Seconds	Mean Length of Utterance in Seconds
Case A		
Principal A	19	17.1
Vice Principal A	7	39.0
Case B		
Principal B	41	10.2
Vice Principal B	27	9.81
Case C		
Principal C	20	22.2
Vice Principal C	3	13
Case D		
Principal D	44	12.2
Vice Principal D	23	8.4

Summary. Research question 1 asked, "To what extent was the intervention implemented with fidelity?" Research questions 1A and 1B were concerned with participant attendance at the professional learning workshop and the professional learning follow-up sessions. With three exceptions, participants attended all components of the planned intervention. Of the three participants that did not attend a portion of the intervention, two missed 2 hours each of the professional learning workshop. The one participant who missed part of the professional learning workshop missed approximately one-third of the session.

Research questions 1C and 1D were concerned with participant engagement. Participant engagement began high at the professional learning workshop and decreased over the course of the day, though only 11 of participants remained fully engaged throughout the professional learning workshop. Participant engagement during the professional learning follow-up sessions reveal two trends. First, principals spoke more frequently during the professional learning follow-up session. Second, with one exception, principals spoke for more time than vice principals. The outlier in this data is Vice Principal A. Vice Principal A was the participant who joined the follow-up session late.

Outcome Evaluation

The second and third research questions were interested in the outcome of the intervention. The second research question asked, "To what extent was the technology integration plan that was created during the professional learning session and follow-up session communicated in the site-based workshop?" The third research question asked, "What are school site administrators' technology-related beliefs? The second research question included three sub-questions that were concerned with the communication of the technology integration plan, the activities related to the technology integration plan, and the implementation of the technology integration plan. The third research question included two sub-questions that were concerned with the changes in the technology-related self-efficacy beliefs of participants, and the technology integration leadership of participants. The findings for research questions two and three are organized first by case, as this is a multiple case study (Baxter, 2008), and then sequentially by question within each case.

Case A. Both the principal and vice principal who made up this case had been in their respective roles for 3 years. The two school site administrators appeared to have a strong working relationship. The collegial nature of their partnership was apparent in the way they divided leadership of the site-based workshop equally and the collaborative nature of their planning process during the professional learning follow-up session that was noted in the researcher's journal.

Technology Integration Plan Implementation (RQ2). Research question 2A asked, "Did participants communicate the technology integration plan to their staff?" Based on field notes made during the site-based workshop, the technology site plan was neither presented nor discussed at the site-based workshop. Instead of presenting the technology integration plan, the SAMR framework for technology integration was presented.

Research question 2B asked, "Did participants incorporate activities that reinforced the technology integration plan?" The site-based workshop opened with a viewing of the Gravity video that was used at the professional learning workshop. Principal A then led a discussion of the way technology integration was presented within the video. Next, instead of a presentation of the technology site plan, Vice Principal A presented the SAMR framework (Puentedura, 2014) as a way to conceive of and organize technology integration practices. The final activity of the site-based workshop was a structured discussion. Principal A organized the teaching staff into groups of seven, that included a teacher from each grade level. Principal A and Vice Principal A then took turns presenting an instructional scenario to the staff and asked the groups to discuss ways in which technology could be integrated into the scenario. Principal A and Vice Principal A circulated through the room, monitoring group discussions.

Research question 2C asked, "How did participants describe their successes or barriers to implementing their site technology plan?" During her interview, Principal A discussed the barrier to technology integration she believed she had tried to address during the site-based workshop:

> …So there is an expectation that they're using their technology to plan [during site buy-back time] because I have to see them. So, I think just holding an expectation that I need to see some technology use and creative technology use in their lesson plans.

Principal A's statement identified the low engagement of technology integration occurring at her site and illustrated her attempts to hold staff members to her stated expectations. Vice Principal A elaborated further on this dynamic at the site: "Obviously, on that campus, you have a real mix of veteran teachers, and newbie teachers. The veterans are more of the holdouts. We needed a plan that would meet both ends of that spectrum for our staff." Principal A and Vice Principal A were in agreement that some staff members were resistant to technology integration, and Vice Principal A believed the most resistant staff members were the "veteran teachers."

Vice Principal A elaborated in the interview her concern about the uneven technology integration practices of her staff: "It's really about equity. If my veterans are not doing this, but my newbies are, well then, these kids are getting it and these kids aren't." She then tied her concerns over equity to the site-based workshop, saying, "We really wanted for our teachers to understand that SAMR model and realize that what they're doing in the classroom already meets a lot of that."

Technology-related self-efficacy (RQ3A). The adapted PSES was administered to each participant in early October and mid-December. The pretest and posttest survey results for Principal A and Vice Principal A are presented in Table 5.4.

Adapted PSES results showed that Principal A experienced an increase in technology-related self-efficacy beliefs. The self-efficacy beliefs of Vice Principal A also increased over the course of the intervention. Between the first administration and the second administration, Principal A's score increased by 0.08, and Vice Principal A's score increased 0.17. This change in scores between the initial administration and the final administration suggests that technology-related self-efficacy beliefs may have increased. Changes in the self-efficacy beliefs of the participants are also reflected in the language recorded by the participants to describe their thinking throughout the intervention.

Table 5.4

Adapted PSES Results for Case A

Participant	Pre-Intervention	*SD*	Post-Intervention	*SD*
Principal A	7.58	0.51	7.66	0.49
Vice Principal A	7.33	0.51	7.50	0.67

During the final interview, when asked how she saw herself as a technology integration leader, Principal A framed her growth around becoming more conversant with specific technologies:

> I'm always researching, or asking, or listening to those who are... like if somebody mentioned something and I'm always like, "What's that?" And then if I feel like it's something beneficial, then I try to figure out how to get it to my staff.

In describing her approach to learning more about technologies with which she is unfamiliar, Principal A expressed her discomfort in learning how to effectively use new technology on her own. Principal A went on to speak about her discomfort in learning new technologies and sharing them with their staff, "So just me being comfortable in teaching them new things, but I feel like I'm 100% willing. There's no factor that hinders my willingness except for my lack of knowledge, I guess." Principal A next addressed a concern she had long harbored when considering technology integration leadership:

> I do feel more confident, and my staff's understanding when I mess up there. I think they feel good. They're like, "Okay, well she's up here in front of everybody and she messes up too." So, I feel like I have to model that. I do feel more competent, but it's very much out of my comfort zone.

In confronting her own missteps when attempting to successfully demonstrate technology to her staff, instead of seeing this as a failure, Principal A framed this as an opportunity for her staff to grow when dealing with technical issues through the example Principal A had provided.

In addition to expressing increased comfort with technology integration, Principal A further reflected on her feelings regarding her ability to use technology in front of their staff, saying:

> I feel responsible. I want to be that. And so even when I'm not comfortable, I try to at least have some small part in it because it forces me to do it in front of everybody. And then I feel like, in turn, I'll become more confident because I'm doing it.

The phenomenon that Principal A is describing in this quote, and that was apparent during the participant-led workshop, is that she realized she had become more confident by successfully engaging with technology in front of her staff; this is the definition of a mastery experience, and as identified by Bandura (1977), is the most important source of self-efficacy development.

Technology integration leadership intent (RQ 3B). Before the professional learning workshop began, Case A participants completed the adapted PSES and responded to three open-ended questions. In response to a question that asked about personal management of technology integration, Principal A said, "I believe the reason I don't manage [technology] change is because it is a top down job." In making this statement, as the school principal, she appeared to be deferring responsibility for technology integration to a district office administrator.

In another open-ended question survey item, Principal A contradicted her assertion that technology integration leadership was a "top down job" by identifying her instructional coach as the responsible party on their site. She responded, "I use my mentor [instructional coach] and the [student early release] time on Wednesdays to introduce new apps or a new concept," clearly identifying her instructional coaches as the technology integration leader for her campus.

During the professional learning workshop, Principal A shared the belief that her role was to facilitate teacher sharing of technology integration practices, instead of leading technology integration work herself. She shared that she likes "to highlight other teachers use of technology. I feel it is more motivating than a mandate." Vice Principal A shared a similar strategy that she used with staff and technology integration:

> I try to provide opportunities for teachers to share or highlight ways in they use technology. As we go into classrooms and see great technology use by teachers, we ask them to present to the staff and then we look for implementation [in other classes].

In both statements Principal A and Vice Principal A are presenting strategies they employed to have other staff members act as the technology integration leaders at their site.

During the professional-learning follow-up session, Principal A made a statement that revealed preliminary changes in her conception of technology leadership when compared to statements made in the open-ended questions included with the adapted PSES administered before the intervention began:

> I see that maybe some focus has drifted from our technology plan. Have we become complacent? Are we pushing teachers to push students in innovative ways? I think I need to step back and reset what my goals are for my site and how I am pushing the tech vision to my teachers.

This is in contrast to her earlier written remarks during the professional learning workshop where she identified others as the technology integration leaders at her site. In this statement, Principal A is self-identifying as the technology integration leader at her site.

During the final interview, Principal A expanded upon her growing sense of responsibility for technology integration, “So I think I have a big responsibility as to what technology [integration] is going to look like in the classroom by how much I expose my staff to. I can’t expect them to just know it.” Her identification of the party responsible for technology had shifted from identifying the district office to herself.

After articulating her sense of responsibility for technology integration Principal A went on to further describe her changed sense of ownership over technology integration at her site:

> I think I have a huge responsibility for the way it goes. Right? You’re a leader. You’re it. You’re up there on Wednesdays and every day driving the way the school goes. If I’m not behind technology, everyone’s going to know that. And then they’re not going to be behind technology because I’m not pushing it. If I’m not holding them accountable in any way, then it’s just kind of flat line. So, I have to be willing to push it and expose it and model it and try new things. Otherwise they’re not going to do it either if I’m not.

In expressing her growing sense of responsibility for technology integration Principal A also reflected on how she could act as a technology integration leader for their campus. She began with self-modeling, “I believe it is motivated by modeling it to them in my own presentations and meetings.” She also discussed strategies for holding teachers accountable for integration technology into their teaching, “So there is an expectation that they’re using their technology physically to plan because I have to see them. So, I think just holding an expectation that I need to see some technology use … in their lesson plans.” Though she described the need to hold teachers accountable for following her lead, she also expressed the need to create an environment wherein technology integration was approachable:

> I believe the most integral piece of creating a positive technology learning environment is by creating a culture among staff that is accepting of taking risks and mistakes. I encourage teachers to try things without the fear that there may be a penalty for something going wrong.

Principal A had expressed that she relied on others to lead technology integration at the beginning of the intervention, but by the end she had begun to self-identify as the leader of technology integration on her campus.

Summary. Principal A did not begin the intervention with a strong sense of herself as a technology integration leader. She was explicit in assign responsibility to others, indicating that it was "top-down" work. Over the course of the intervention that seemed to change as she embraced being uncomfortable in front of her staff as she led the site-based workshop and discussed her intent to continue to lead technology integration with her staff.

Case B. Principal B was new to her position and school site, while Vice Principal B had previously served in the role at the site under a different principal. As such, the two school site administrators who made up this case were adjusting to their new roles and working relationship. Though Principal B would describe her reliance on her vice principal for technology integration knowledge during the final interview, the relationship was still developing during the intervention.

Technology Integration Plan Implementation (RQ 2). Research question 2A asked, "Did participants communicate the technology integration plan to their staff?" The field notes I recorded during the site-based workshop indicate the technology site plan developed at the professional learning workshop was not presented. Instead, the SAMR framework (Puentedura, 2014) was presented as the tool that Principal B wanted staff members to use to structure their approach to technology integration.

Research question 2B asked, "Did participants incorporate activities that reinforced the technology integration plan?" As with Case A, Case B's site-based workshop opened with a viewing of the *Gravity* video and was followed by a short discussion facilitated by Vice Principal B. Principal B then shared two documents with her staff. The first document was a representation of the SAMR model (Puentedura, 2014) of technology integration. The second document was a framework for technology integration that I had developed for the district several years ago but had intentionally not included in the professional learning workshop as it is not based on empirical research. After introducing these two documents to her staff, Principal B used them to have her staff work in grade-level teams and posed a series of hypothetical situations. In these situations, she asked her staff to come up with ways to integrate technology that aligned with SAMR or the internal framework for technology integration.

Research question 2C asked, "How did participants describe their successes or barriers to implementing their site technology plan?" Following the site-based workshop, at the final interview, Principal B was asked to describe the site-based workshop. Her response focused on the procedural elements she had used to implement the activity:

> We've given them [teachers] some tools, we gave them the opportunity to design a lesson, and plan it, that would be aligned with it [the internal framework], that would map whatever we modeled for them, and then they went ahead and started working on designing that for their classroom.

As Principal B limited her response to the procedural elements of planning the site-based workshop, no evidence of technology-related self-efficacy was communicated.

Vice Principal B's response to questions during the final interview about the site-based workshop did not focus on its structure. Instead she described the initial planning of the site-based workshop, saying "Well, it started with a district technology plan" and then she went on to describe the way the plan for the site-based workshop was developed, first noting that the primary concern held by Principal B was meeting the time requirement that I had communicated. Principal B said:

> The conversation progressed from what do we do for the hour and half, to what do we do for the technology vision, which then had us settle on using the [internal framework] with the understanding that that would be a framework for future or continual, but probably future, implementation and a way to frame conversations at grade levels of maybe what we as administrators would begin to look for.

Following this statement, however, she revised her thinking, indicating she had an issue with the idea of a "technology vision" saying, "I'm not sure what the district's current vision for technology is... I'm not sure it's a district vision. I think it's a vision that is shared by pockets of people in leadership." Vice Principal B continued to reflect on the purpose they had put the site-based workshop, specifically the professional workshop follow-up meeting we had discussed in the planning meeting. She said:

> My hope is that the preparation, [and] the conversation that we had in preparation for that day, were more about the vision going forward than they were about the day that you came and observed. I think right now the focus is on the day that you came to observe, and that we need[ed] to do a PD because Alex is here.

In making this statement Vice Principal B made clear that the purpose of the site-based workshop, as she saw it, was to comply with the requirements of the intervention.

Technology-related self-efficacy (RQ 3A). The pretest and posttest survey results of the adapted PSES that Principal B and Vice Principal B completed as part of the intervention are presented in Table 5.5.

Table 5.5

Adapted PSES Results for Case B

Participant	Pre-Intervention	*SD*	Post-Intervention	*SD*
Principal B	6.33	2.53	8.75	0.45
Vice Principal B	7.58	0.70	7.83	0.83

Survey results show that Principal B, among all participants ($N = 17$), experienced the most change in technology-related self-efficacy beliefs as measured by the adapted PSES. Principal B's score increased by 2.42 points. The self-efficacy beliefs of Vice Principal B also increased over the course of the intervention by 0.25 points. Though Vice Principal B's adapted PSES score increased over the intervention, the qualitative data collected from her did not reflect similar changes.

At the concluding interview, Principal B reflected on her understanding of herself as a technology integration leader during the final interview. She stated:

> Well, I have the will. I think I don't always have the knowledge. So, I think that really as a leader, I also need to continue to grow with technology, and to continue to expose myself to different opportunities, so that way I can get better at what I'm doing.

Principal B also identified a strategy for increasing her knowledge of technology resources, which she had connected to her sense of confidence when using technology, "I think that [asking others for help] can grow me as a leader in technology, because I haven't arrived yet."

Technology integration leadership intent (RQ 3B). Before the professional learning workshop began Principal B responded to three open-ended questions attached to the adapted PSES, writing, "I do not feel like I need to motivate my teachers to use technology." Instead of personally leading the work of technology integration, she assigned technology leadership to the teachers themselves. Principal B stated she successfully delegated this responsibility to teachers, "…by having teachers share new uses of technology during our staff meetings." In writing this response, Principal B made clear she saw her role as a technology integration leader as a facilitator, who made teacher-to-teacher learning possible.

During the professional learning workshop, Principal B had begun to communicate a changing sense of responsibility for technology integration leadership. After reviewing the *National Education Technology Plan Update* (U.S. Department of Education, Office of Educational Technology, 2016), Principal B shared a changed perspective on technology integration leadership, saying:

> The experience affects my role as a leader because I realize that I need to set the technology expectations for my staff, as well as give my staff permission to take risks with technology, so they can continually improve in their use of technology.

At the final interview, Principal B shared her changed sense of responsibility for technology integration leadership. She expressed her intent to support technology integration by, "…creating a positive environment by modeling, giving teachers the opportunity to model for their colleagues, and celebrating good things that I am seeing in the classroom that integrates technology." Further, Principal B, who had previously indicated that others were responsible for technology integration at her site, discussed the need to reclaim this role for herself:

> So, I know as a leader, I know that I will also need to continue to grow myself. So now that we're talking about this change that I could do, because I can have my mentor [instructional coach] train me, and then I could train the staff, or we can train them together. That way, I'm practicing too. And then we're doing it together as a team.

In making this statement, Principal B did not identify herself as wholly responsible for technology integration leadership in the future as she indicated that she would continue to look to her instructional coach for support.

Unlike Principal B, Vice Principal B did not communicate changes in her sense of responsibility for technology integration during the final interview. In attempting to understand why the intervention did not affect her sense of responsibility for technology integration, I asked Vice Principal B, "How do you see yourself as a school site technology leader?" Vice Principal B responded, "I don't." She went on to say:

> I'm tech support. I would call myself tech support. Maybe beyond, well, definitely beyond IT, who fixes broken things, using the technological pieces we already have, the specific apps we have. But in terms of applying technology to driving instruction or to taking our technology to further places, my entire role is as support staff. Yes, I'm a site leader, but I'm a site support leader.

Instead of sharing how she saw herself as a technology integration leader, Principal B described herself as technical support and emphasized ways she supported her teachers and principal.

Summary. Principal B experienced the greatest change in technology-related self-efficacy beliefs, as measured by the adapted PSES. That change was also reflected in the qualitative data collected throughout the intervention. At the start of the intervention Principal B shared an understanding of technology integration, and her place in it, that held others accountable. At the end of the study, her intent to act as a technology integration leader had grown. Vice Principal B, unlike her principal, did not exhibit increased intent to act as a technology integration leader. However, she indicated that this was the case because she does not see herself as a leader on campus, but as a support for her supervisor.

Case C. The participants who made up this case included two of the most veteran school site administrators in the organization. Principal C was one of the longest serving principals in the district and Vice Principal C was one of the longest serving vice principals in the district. Their site-based workshop was characterized by a specific structure that they had adopted and sought to use, regardless of content. That strategy was apparent in their site-based workshop, as it was structured very differently than the site-based workshops conducted by cases A and B.

Technology Integration Plan Implementation (RQ 2). Research question 2A asked, "Did participants communicate the technology integration plan to their staff?" According to the field notes I made while attending the site-based workshop, the technology integration plan was not discussed or referenced. Instead Principal C had decided to maintain a professional learning structure she had been using with her staff for the last two years.

Research question 2B asked, "Did participants incorporate activities that reinforced the technology integration plan?" The site-based workshop planned by Principal C included the *Gravity* video which opened the site-based workshop. Though it was not present, Principal C said that she had begun her planning process with the technology integration plan in mind:

> I looked through it [the technology integration plan] and I was trying to figure out, 'How can I expose them to this without it just being me talking, right?" Because of the structures set up within our Wednesdays [professional learning time], I wanted it to be in

> the format that we normally do, which is an open kind of conversation that can often lead to a back and forth debate or just open questioning of each other.

Following the *Gravity* video, Principal C continued with what she described as the "structures" of her regular professional learning time. This included, based on field notes, the introduction of a popular press article Principal C had found online, time for staff to read the article, and then a structured discussion of the article in a format the staff were familiar with. For the discussion, one teacher from each grade level team sat at a table in the middle of the room and discussed a question related to the article that was posed by Principal C. During this time the rest of the teachers, who were not actively participating in the discussion, took notes on what was said. Before the next new question was posed, the teachers at the central table returned to their teams, and a teacher who had not yet shared joined the middle table and discussed the question that Principal C posed.

Research question 2C asked, "How did participants describe their successes or barriers to implementing their site technology plan?" During the final interview, Principal C described the interactions that took place during the site-based workshop. She described what she heard her teachers saying about technology integration during the discussion. "I think what you saw there was people not afraid. They were pretty open to sharing their thoughts, which is what you want. You want them to do that." After explaining her thought process for structuring the site-based workshop the way she did, she continued on to evaluate the way her teacher's responses to the content that was presented:

> Do I feel like that they know a little bit better about what the district vision is? Do I feel like that's the end of that conversation? Absolutely not. That was the beginning of that

> conversation because it really opened up again just telling me where my staff is with this. Kind of scary, a little bit. But it's reality.

In this quotation, Principal C, explicitly states that she does not believe that her staff has a clear understanding of the technology integration plan. Instead, she has described the site-based workshop as an introductory discussion that broached the subject of technology integration with her staff and helped her understand their perspective on technology integration.

Vice Principal C did not actively participate during the site-based workshop. During the final interview when asked what she perceived as success or barriers to the implementation of the technology integration plan she discussed the plan in relation to her understanding of technology integration, "Just having that [technology integration plan] be in front of me and now when I do walkthroughs it's part of my thought process when I'm giving teachers feedback."

Technology-related self-efficacy (RQ 3A). Principal C and Vice Principal C completed the adapted PSES as a pretest and posttest for the intervention. Results are presented in Table 5.6.

Table 5.6

Adapted PSES Results for Case C

Participant	Pre-Intervention	*SD*	Post-Intervention	*SD*
Principal C	7.41	1.03	8.16	0.71
Vice Principal C	7.63	1.38	7.91	0.90

Survey results show that Principal C's score increased by 0.75 points. The self-efficacy beliefs of Vice Principal C also increased over the course of the intervention by 0.28 points.

During the final interview Principal C discussed how important she believed her attitude toward technology integration was, "I think it comes back to this, my mindset has been so critical for us in this conversation because it is the biggest obstacle." She equated the changes in her thinking to the approach to technology integration she had seen teachers take with students:

> The teachers do the same thing. In their own mindset, they think, 'Well, the kids don't need it [technology] for that [learning],' or 'This [technology] isn't going to make it more powerful for my students and give them another option,' because in their own mindset, they believe that.

After explaining that her thinking had changed regarding the value of technology integration practices, and the relationship between her comfort with technology integration and what she called for her staff to do with technology, she went on to make the connection explicit, "The question is, how do I show them [the teachers] how to integrate technology effectively within an effective lesson? I think I still have some way to go with that part."

During the final interview Vice Principal C described an increased sense of confidence in using technology, and the interaction she had with teachers around technology integration, saying:

> I think if you are using it yourself and you are confident and you talk highly about it, I think that rubs off. And I feel like as a leader if you're positive [about technology integration], the teachers are more willing to try something. Because if you're vulnerable as a leader and trying it yourself, then I think that that helps. If I'm expecting them to utilize technology, then they need to see me doing it right along with them.

Technology integration leadership intent (RQ 3B). As the technology-related self-efficacy beliefs of Principal C and Vice Principal C changed over the course of the intervention, the intent to act as technology integration leaders for their campus did as well. In the pre-intervention open-ended questions attached to the adapted PSES, Principal C shared an understanding of her role as a technology integration leader focused primarily around organizational and financial considerations. When asked "How do you manage technology-related change at your school site?" she wrote, "Supporting it [technology integration] financially. Providing the tools to successfully implement into the instructional pedagogy."

At the end of the intervention, Principal C was describing her role as a technology integration leader in different terms, she said, "I realized, through the process of doing that presentation [site-based workshop] for my team, that they're going to value what I value." She went on to describe how she thinks a leader should support technology integration for their site. She said, "I think this really should happen through modeling. It's something I feel fairly confident in doing in a way that embeds it via instructional practices and goals. I have to be more intentional with this."

Vice Principal C described her intent, or lack thereof, to act as a technology leader in the open-ended questions attached the adapted PSES writing, "I don't manage change because it is a top down facilitated job." Vice Principal C, whose technology-related self-efficacy beliefs experienced a lesser degree of change than Principal C, as measured by the adapted PSES, explained the changes in her intent to act as a technology integration leader in similar, personal, terms. She said, "I motivate teachers' use of technology by supporting them when they need help with apps." She followed this statement by saying, "I feel like I'm willing, which is huge, and I could learn or help a teacher facilitate a lesson or whatever they needed help in."

Summary. Principal C began the intervention with an understanding of technology integration leadership focused on financial and organization concerns. Over the course of the intervention, as her technology-related self-efficacy beliefs increased, her intent to act as a technology integration leader changed as well. The same is true for Vice Principal C, she too experienced an increased sense of technology-related self-efficacy and her expressions of intent to act as a technology integration leader changed as well. Though their site-based workshop did not incorporate the technology integration site plan created at the professional learning workshop, both participants demonstrated a changed sense of technology-related self-efficacy and technology integration leadership intent.

Case D. The two administrators in Case D had worked in their current roles and site for one year before the intervention began. Prior to assuming the role of principal, Principal D had been a long-serving vice principal in the district. Vice Principal D had served as vice principal for another elementary school in the district prior to moving to Site D. Though their working relationship most closely resembled the collegial working relationship between Principal A and Vice Principal A, the division of work at the site-based workshop was substantially different. Additionally, Site D participates in a program with unique qualification criteria and program specific mandates. The focus on that program consumed much of Principal D's attention and was apparent at the professional learning follow-up session and during the final interview.

Technology Integration Plan Implementation (RQ 2). Research question 2A asked, "Did participants communicate the technology integration plan to their staff?" A review of the field notes I made during the site-based workshop revealed that the site-based workshop presentation differed substantially from the site-based workshop planned at the follow-up. Case D was the first of the four cases to hold the professional learning follow-up session. Their original plan was to hold their site-based workshop on November 1, a district-wide professional learning day and a non-attendance day for students. However, between making the plan and November 1, the district office mandated a series of professional learning sessions that teachers were required to attend. This necessitated the rescheduling of the site-based workshop.

Case D's site-based workshop was not held until the final Wednesday in December, prior to winter break, during teacher early-release, professional development, time in the afternoon. According to the field notes, Principal D welcomed staff to the workshop, introduced the activity, and then handed responsibility for leading the site-based workshop to Vice Principal D. At no point during the site-based workshop was the technology site plan presented or discussed.

Research question 2B asked, "Did participants incorporate activities that reinforced the technology integration plan?" The activity that Principal D introduced was originally based upon the civilization artifact activity from the professional learning workshop. The civilization artifact activity was an open-ended activity where participants were asked to use their devices to create artifacts from an ancient, newly discovered civilization. However, instead of being asked to use their technology to create artifacts, they were asked to research Christmas traditions and present what they learned to the staff using a presentation application on their device.

Research question 2C asked, "How did participants describe their successes or barriers to implementing their site technology plan?" During the concluding interview I asked questions about the implementation of the site-based workshop. Principal D, however, did not answer them; instead, she diverted her response to discussion of the program in which her school site participates and how technology integration supports that program. I asked Vice Principal D the same question during the final interview, she said, "I was not really part of creating that [the site-based workshop], to be honest." Field notes made during the professional learning follow-up session, when the site-based workshop was originally planned, indicate that Vice Principal D was there. Her response, then, describes not the site-based workshop as planned, but the site-based workshop as implemented. I next asked Vice Principal D to describe the plan for presenting the technology integration plan to her school site; she said, "I don't think we really have one."

Technology-related self-efficacy (RQ 3A). Before the intervention began in early October of 2019, and after it concluded in mid-December of the same year, the adapted PSES was administered to each participant. The pretest and posttest survey results for Principal D and Vice Principal D are presented in Table 5.7.

Table 5.7

Adapted PSES Results for Case D

Participant	Pre-Intervention	*SD*	Post-Intervention	*SD*
Principal D	7.41	1.16	8.00	0.73
Vice Principal D	7.63	1.11	8.08	0.28

Both Principal D and Vice Principal D experienced an increase in technology-related self-efficacy over the course of the intervention. Principal D's technology-related self-efficacy increased by 0.59 and Vice Principal D's score increased by 0.45 points. Unlike the other cases, though the self-efficacy beliefs of both the principal and vice principal increased between the pretest and posttest administration of the adapted PSES, the qualitative data captured over the course of the intervention did not reflect this change.

During the final interview, when asked about her ability to lead a technology integration, Vice Principal D reported, "I feel like my playlist to pull from is becoming outdated a little and that's more on me just to do more research to seek help." In responding this way, she tied her facility with technology to her confidence with technology integration. When asked to define what she meant by playlist, Vice Principal D responded, "Keynote and Google Slides, apps like that."

Principal D, like all the participants, experienced an increase in her self-efficacy according to the results of the adapted PSES. However, when interviewed, it was evident from the conversation that she was having difficulty in articulating a sense of confidence in using or leading technology integration. When asked to discuss their understanding of technology, she discussed teacher use of technology instead:

> It goes back to the teachers having the skills and the confidence to do it and maybe it takes me or [Vice Principal D] going in and modeling how to do it. It just feels like when you do that, like okay, we got it, it's good, but then it never really happens again because they just don't have it. I can't do it for them every time.

The response to further probing questions were met with similar attempts to change the subject, for example:

> I don't know if anything hinders my willingness. It's just, I guess it's not, I don't even want to say "a priority" because it is a priority. I guess it's just prioritizing the priorities and deciding how to put everything in that's important.

Technology integration leadership intent (RQ 3B). In response to an open-ended question attached to the adapted PSES Principal D that asked how she managed technology related change at her site she responded, "Modeling, set expectations, provide opportunities for teacher practice." When asked about how she created a technology-enabled learning environment, she wrote, "Ensure that students and teachers have access, opportunities, and resources." Like Principal C, this initial set of responses was focused on the logistical and financial components of technology integration.

During the professional learning workshop, Principal D's responses focused on the specific applications that she encountered in her role or in making connections between technology integration and the site-specific instructional program. She wrote, for example, "This [a school-based program] is completely focused, as a summative project." Refocusing technology integration leadership work to be about meeting the goals of her site-specific program happened consistently throughout the intervention.

At the final interview, Principal D did not articulate a changed sense of responsibility for technology integration leadership though she indicated that she was proficient in the use of technology, both in her personal life and work. When asked about her understanding of the district's technology integration plan, in a statement she had participated in creating, she said,

> I feel like it reenergized the part [of our instructional program] that's so important—that creativity piece, the student agency like having a voice and having choice. That's a really big phrase for [our program] and it's also really how technology, the beauty of technology is that students have the opportunity to be creative and give their voice—let their voice be heard globally.

The statement, though generally aligned with the vision for technology integration, remained focused on her other instructional programs. When asked follow-up questions on technology integration, she continued to bring the conversation back to a discussion of the other programs in place at the school.

Summary. Unlike the other three cases examined, case D was unique in several ways. First, in the data collected from this site it was clear that Principal D was almost exclusively focused on specific programmatic needs of her site and viewed the needs of technology integration through the lens of that program. Further, she was not engaged in the site-based workshop, letting Vice Principal D run the workshop in its entirety.

Cross-Case Analysis

The use of multiple cases allows the researcher to analyze results within and across several different contexts (Baxter & Jack, 2008). As such the multiple-case study requires the examination of the multiple cases in concert to identify similarities and differences (Baxter & Jack, 2008). Those findings are presented here, as a cross-case analysis.

The findings from cases A, B, and C were broadly similar. Cases A and B integrated common components from the professional learning workshop, included similar activities taken from the professional learning workshop, and utilized the SAMR framework to orient their discussion. The site-based workshop conducted by case C was structurally similar to Cases A and B, but Principal C used an organizational structure that was endemic to her leadership style. Case D, however, was very different in its implementation of the site-based workshop, providing contrasts that will be discussed further in this cross-case analysis. Across the four cases two themes emerged. The first theme to emerge was an understanding of technology integration rooted in the technology tools instead of student-led practices. The other theme to emerge in the cross-case analysis was a shifting sense of responsibility for technology integration.

Technology-focused integration versus student-led learning. A commonality across all four cases was that the district technology integration plan was not presented at any site-based workshop. This finding is made more interesting because of the frequency with which participants discussed their desire for student-led uses of technology during the final interview. During the coding process a number of codes emerged that seemed to indicate a preference for student-led uses of technology, but that preference was not communicated to school site staff during the site-based workshop (see Table 5.8).

Table 5.8

Student-Led Uses of Technology

Sample	Code	Theme
I would like to see it without it, and then have them grade themselves on a rubric, and see where they land, like as far as how they could show they're learning, because I think if it's open ended for them, then they're going to be free to be more creative.	Creative	Student-led uses of technology
In looking back at the activity, it made me realize that if teachers give students an opportunity to create using technology in the classroom, students will have an opportunity to productively struggle.	Mindset	
I saw the importance of giving parameters to a project, but not giving too many, or it limits the creativity. I saw the importance of productive struggle and giving enough time for each aspect of a project.	Open-ended	

The mismatch between participants stated desire for student-led technology use and technology integration focused on specific technological tools appeared during the professional learning workshop and at the final interview. At the professional learning workshop, the final activity was the creation of a district technology integration plan. The technology integration plan was intended to function as a common frame for understanding technology integration across the district that could be adapted by each school site based upon their need (see Table 5.9). The intent of the participants when they created this statement, according to notes made in the researcher's journal, was to convey their desire that student-led uses of technology should be the approach to technology integration pursued by teachers. This intent was not communicated to site staff at any of the site-based workshops. What was communicated instead, was a focus on technology as the component of most focused upon when integrating technology.

Table 5.9

District Technology Integration Statement

	Statement
Why we use technology	Technology provides opportunities to improve and enhance learning and all learners should have engaging and empowering learning experiences that extend beyond the classroom.
How we use technology	Technology is used to provide authentic opportunities for students to engage with content that supports meaningful and diverse learning.
What we do with technology	
As school leaders	School leaders use technology to organize, personalize, and support effective classroom instruction.
As teachers	Teachers use technology to support, create, and guide learning.
As students	Students use technology to collaborate, demonstrate, and connect learning with the wider world.

As noted in the findings section, this statement was not referenced at any of the site-based workshops. Further, two of the sites, Case A and Case B, presented the SAMR framework for technology integration at their site-based workshop, instead of referencing this technology integration plan. The use of SAMR conflicts with student-led learning as the SAMR framework is focused on using technology to re-envision the kind of work students complete. In their critical review of SAMR Hamilton, Rosenberg, and Akcaoglu (2016) identify several concerns and argue that the focus on the technology “minimizes the more important focus on using technology in ways that emphasize shifting pedagogy or classroom practice to enhance teaching and learning” (p. 437).

Principal C did not present the district technology integration statement to her staff, nor did she present the SAMR framework. Instead she presented an article that discussed ways that technology could make the logistical burden of teaching easier. The labor-saving nature of technology is often a reason that people integrate technology, but it was not mentioned in the district technology integration statement. Though she did not present SAMR, she did not make clear to her staff that student-led use of technology was the desired end-goal.

Case D did not present a coherent message related to technology integration during the site-based workshop. Though Principal and Vice Principal D had developed a site-based workshop that included a discussion of student-led technology integration practices, and an activity meant to support student-led practices, they did not implement it. Across all four cases, though they had collaboratively created a plan that called for student-led technology practices, they did not share that understanding with their staff, whether because they presented a different understanding of technology integration, or because they did not present a coherent message.

Sense of responsibility for technology integration. The second major theme to emerge from the cross-case analysis was "sense of responsibility for technology integration." At the beginning of the intervention responses to the open-ended questions attached to the adapted PSES indicated that someone else was responsible for technology integration. That "someone else" was most often identified as their vice principal, their instructional coach, or a district office administrator (See Table 5.10).

As an example, codes that contributed to the "my responsibility" sub-theme included statements the participants made about their responsibility to do something with technology. Similarly, the "your responsibility" sub-theme included codes that were applied to statements wherein participants assigned the responsibility for technology integration to another person or persons. These were some of the first codes to emerge when I began a review of the data and brought to light a shifting understanding of responsibility for technology integration leadership that emerged over the course of the intervention.

Table 5.10

Responsibility for Technology Integration

Sample	Code	Sub-theme
This has been a function of the district and really is pushed by principals on any technology-related change.	District	Your responsibility
I relay the message to the teacher that it is a vital communication tool in our profession, and we must be up to date on the programs being utilized at school and home.	Messenger	
I motivate by modeling the use of technology during professional development and the way this modeling can be used in the classroom.	Motivate	My responsibility
What I do need to do is to continue to provide professional development around technology from a teacher's point of view.	Providing support	

This view that technology integration leadership was someone else's responsibility was stated by several principals. Principal A wrote, early in the intervention, that "I believe the reason I don't manage [technology] change is because it is a top down job." Principal B shared a similar view, stating "I do not feel like I need to motivate my teachers to use technology." Principal C did not identify others as responsible for technology integration, but she did frame her responsibility around logistical and financial responsibilities instead of pedagogically focused responsibilities. Vice principals, too, did not see themselves as responsible for technology integration. Vice Principal B offered the clearest example of this in her response to the question, "How do you see yourself as a school site technology leader?" She responded, "I don't." Though others were less explicit, they too shared that they believed their principal, or their instructional coach was responsible for the leadership.

Over the course of the intervention, though, the perception that they were not responsible for technology integration shifted among Cases A, B, and C. Principal A became more comfortable taking risks with technology in front of her staff, based upon statements she made during the final interview. Principal B, too, shared her plans to engage with technology integration at staff meetings, though she indicated that she would continue to seek help from her vice principal and instructional coach. Principal C also indicated that she was going to continue to seek ways to lead technology integration at her site. She was the participant who most clearly articulated her understanding that she had to lead technology integration, because if she did not do it, her staff would not value technology. Principal D, though, did not articulate a changed sense of responsibility for technology integration.

Conclusion

The findings describe how school site administrators understand technology integration, how the technology-related self-efficacy of school site administrators changed over the course of the intervention, and how school site administrators understand their role as technology integration leaders.

Over the course of the intervention, the participants' conception of technology integration leadership underwent a change. At the start of the intervention, several of the administrators, when asked about how they viewed their role as technology leaders, focused on structural and financial responsibilities or reported that they were not responsible for technology integration at their site. During the intervention, many of the participants began to report changed understandings of technology integration leadership.

Participant understanding of technology integration was the construct addressed by the second research question. Based on the results presented in the findings section, and addressed in the cross-case analysis, participants understanding of technology integration did change as a result of this intervention, though their intent to act did not. Though the participants collectively created a technology integration statement that was focused on student-led practice with technology, it was not communicated with school site staff. The understanding of technology integration communicated by Phase 2 participants during the site-based workshops was based on an understanding of technology integration participants constructed outside of the intervention.

The third research question addressed the constructs of technology-related self-efficacy beliefs (Knoblauch & Woolfolk Hoy, 2008; Tschannen-Moran & McMaster, 2009) and technology integration leadership (Larosiliere et al., 2016; Stuart et al., 2009). Throughout the qualitative analysis process, data related to the technology-related self-efficacy and technology integration leadership often appeared together. Technology-related self-efficacy beliefs changed over the intervention as participants sense of responsibility for technology integration leadership shifted from being someone else's responsibility to becoming their responsibility. Additionally, though self-efficacy scores increased for all participants on the adapted PSES, those who participated in Phase 1 and Phase 2 experienced more growth than those who only participated in Phase 1.

Discussion

The conceptual framework developed in Chapter 1 identified professional learning as a possible means of affecting the proximal outcome, increased technology-related self-efficacy for school site administrators, as the way to affect the long-term outcome, technology integration leadership. In this section, I discuss the findings and how they relate to the conceptual framework, prior research, limitations of the study, recommendation for practice and recommendations for future research. Specifically, I will address the relationship between the professional learning workshop and technology integration, Bandura's (1977) theory of self-efficacy development, and the relationship between technology-related self-efficacy and the intent to act as a technology integration leader.

Implementation of Technology Integration

The conceptual framework for this intervention identified the technology-related self-efficacy beliefs of school site administrators as a likely proximal variable on which to act in order to increase the participants intent to act as technology integration leaders. The method of affecting change in participants technology-related self-efficacy beliefs was through a professional learning workshop and a follow-up planning session. This structure was based on Tschannen-Moran and Garesis (2004) study on self-efficacy development conducted with reading teachers.

Though the self-efficacy beliefs of the participants in the current study did change over the course of the intervention, the technology integration plan that was developed at the professional learning workshop, with the expectation that its implementation would be part of the site-based workshop, was not used at any of the site-based workshops. Instead of using the district technology integration plan, the four cases that participated in Phase 2 relied on other understandings of technology integration or did not present a coherent understanding of technology integration to their staff at all.

The intervention did not yield a common understanding of technology integration implementation in all four cases, as was hoped. That the technology integration plan was missing from all four site-based workshops may have been caused by insufficient professional learning and professional learning follow-up. Dusenbury et al. (2003) identify a number of criteria for judging implementation fidelity; among them is dose, which is the degree to which participants received a sufficient amount of the intervention. Though this study successfully met the process evaluation requirements established in Research Question 1, it may be the case that the established criteria was insufficient.

Technology-Related Self-Efficacy

The theoretical framework adopted to structure the intervention, Bandura's (1986) social cognitive theory, identified four sources of self-efficacy development. Three were used to guide the intervention: mastery experiences, vicarious experiences, and verbal persuasion. The quantitative and qualitative data presented in this study showed that technology-related self-efficacy increased over the course of this intervention. Of the three sources of self-efficacy development, mastery experiences and vicarious experiences were the most often referenced, and most often visible, sources of the participants' self-efficacy development. Verbal persuasion, though present in every step of the intervention, was more difficult to quantify and measure with the instruments used in this study.

Mastery experiences have been identified by researchers (Bandura, 1977; Knoblauch & Woolfolk Hoy, 2007; Tschannen-Moran & McMaster, 2009) as the most effective source of self-efficacy development. Mastery experiences occur when a participant successfully completes an activity (Bandura, 1977). Several mastery experiences were built into the intervention, including the civilization artifact activity and the site-based workshop. The civilization artifact activity, took place during the professional learning workshop, was designed as a protected mastery experience (Tschannen-Moran & McMaster, 2009), a form of a mastery experience presented in such a way as to limit risk to the participant. Participants responded to the civilization artifact activity; several of the Phase 2 participants discussed how useful they had found it during the professional learning follow- In addition, Case D attempted to recreate the civilization builder activity for their site-based workshop.

Though useful, protected mastery experiences result in less self-efficacy growth than authentic mastery experiences (Tschannen-Moran & McMaster, 2009), which are mastery experiences that have no way to ensure participant success like a protected mastery experience. Authentic mastery experiences, then, are more a more powerful strategy for increasing self-efficacy beliefs, but also more dangerous, because when participants fail to experience mastery, the attendant drop in self-efficacy belief is greater. In this intervention, the authentic mastery experience was operationalized as the site-based workshop. In three of the four cases, this mastery experience was successfully completed. Principal A and Vice Principal A both felt they led successful workshops. Because this intervention was designed to increase the technology-related self-efficacy of its participants, success or failure is defined by the participants' expectations. Principal B felt she had successfully completed her workshop because she had led a productive discussion with her staff. Vice Principal B was less clear in her assessment of the event's success, possibly because she was less involved in the event and did not get as much time to interact with the staff as she would have liked. Principal C felt she had successfully completed her workshop, though Vice Principal C was not actively involved during the process and did not express strong feelings about the mastery experience. The changes in self-efficacy are consistent with Tschannen-Moran and McMaster's (2009) research findings as Tschannen-Moran and McMaster found that self-efficacy increased as a consequence of successfully completing mastery experiences. Neither Principal D nor Vice Principal D, unlike their colleagues, shared data that would indicate whether they had successfully completed their authentic mastery experience. Principal D, similar to Vice Principal C, appeared to be disengaged from the site-based workshop and had little to say about the experience. Vice Principal D was more positive, though noncommittal, about the success of the event.

Vicarious experiences, the second most powerful source of self-efficacy development after mastery experiences (Bandura, 1977), were also used in the intervention. Vicarious experiences occur when participants view others, with whom they identify, complete a mastery experience. This source of self-efficacy development was most apparent during the professional learning workshop and the site-based workshop. Data collected throughout the professional learning workshop conveyed the impact the open-ended discussions, following each activity, as a source of increased confidence. Hearing their colleagues' thinking helped them understand and feel more comfortable with technology integration.

Vicarious experiences were also a visible part of the site-based workshop. All four of the cases utilized vicarious experiences to support the self-efficacy development for their teachers. Cases A, B, and C all showed the *Gravity* video, which was used during the professional learning workshop, and served as a vicarious experience of successful technology integration. Case D did not show the video but did have groups share the outcome of their protected mastery experience; Vice Principal D communicated to the whole group that each grade-level group had successfully complete their tasks. A second source of vicarious experiences, identified in the literature, occurs through the viewing of video clips with which the participants could relate (Beisiegel et al., 2018). This was incorporated into the professional learning workshop, and participants' comments reflected changing understandings of their technology-related self-efficacy as a result of viewing the video vignettes of technology integration by other educators.

The third component of self-efficacy development used in this intervention was verbal persuasion. According to Bandura (1977), this is the weakest source of self-efficacy development. However, verbal persuasion is also pervasive throughout professional learning events as it includes nearly all speech that occurs between the facilitator and participants, or between participants themselves. For this reason, it was included in the intervention as a source of self-efficacy development. An example of this was the discussion that followed the *Gravity* video as the group discussed student-led uses of technology as an examples of successful technology integration.

In summary, the use of Bandura's (1977) sources of self-efficacy were successful in increasing the technology-related self-efficacy of the participants. This finding, supported in the literature (Knoblauch & Woolfolk Hoy, 2008; Tschannen-Moran & McMaster, 2009), indicated that mastery experiences and vicarious experiences are the most powerful sources of self-efficacy development. All participants ($N = 17$) made technology-related self-efficacy gains according to the results from the adapted PSES and supported by the qualitative data.

Technology Integration Leadership

Technology integration leadership, as introduced in Chapter 1 and investigated in the needs assessment in Chapter 2, was the identified target of the intervention. The conceptual framework, based on the literature review presented in Chapter 1, identified the development of increased technology-related self-efficacy beliefs as a possible proximal outcome with which to affect an increase in the technology leadership ability of participants. The logic model developed for this intervention hypothesized that increases in technology-related self-efficacy among participants would lead to increases in the technology-related leadership demonstrated by participants.

Though a strong relationship cannot be established as a consequence of this study, there is a seeming alignment between the results of the adapted PSES and the frequency of codes related to the theme I identified as "sense of responsibility for technology integration," which had two sub-themes: "your responsibility" and "my responsibility." Early in the study when technology-related self-efficacy beliefs were lower, the incidence of "your responsibility" was high. At the conclusion of the intervention, after technology-related self-efficacy beliefs rose, codes related to "your responsibility" occurred very infrequently, and codes related to the "my responsibility" theme were more common.

Cases A, B, and C all experienced increased technology-related self-efficacy beliefs as measured by the adapted PSES. The participants at each site, with the exception of Vice Principal B, also shared an increased sense of responsibility for technology integration leadership. Case D, however, experienced increases in self-efficacy but did not share a sense of increased technology integration leadership. Principal D's responses to many of the final interview questions de-emphasized technology integration and focused instead on her assessment of the specific needs of a site-based program being conducted at her school.

Principals who do not act as technology integration leaders have teachers who do not value technology integration (Stuart et al., 2009). The likely outcome for the progress of technology integration at Case D, based on the low engagement with technology integration leadership at that site, suggests that teachers may not integrate technology in a manner that improves student outcomes. Though Anderson and Dexter's (2005) and Larosiliere et al.'s (2016) findings may not portray a positive picture of technology integration for Principal D's school site, they present a hopeful vision for the progress of technology integration for the teachers and students in Principals A, B, and C's schools. Because of the increased sense of self-efficacy developed through the intervention and their increased sense of technology integration leadership, it is likely that technology integration will happen more rapidly (Larosiliere et al., 2016), produce better outcomes (Anderson & Dexter, 2005), and lead to an increase in meaningful use (Berrett et al., 2012) at their school sites.

Limitations

There are several limitations to this study, including researcher bias, sample size, length and structure of intervention, instrumentation, and sample composition. Limitations are evident in any research study and it is necessary to acknowledge their existence and how they might affect the study. Some of these limitations are the result of the requirement to address a problem of practice within the context in which I work.

Researcher bias, which is the tendency that "… 'insider' investigators may limit their curiosities, so they only discover what they think they don't know, rather than opening up inquiries to encompass also what they don't know they don't know" (Chenail, 2011). As a researcher investigating their own professional context, researcher bias is a clear limitation of this study as I have worked with each of the participants in a number of different ways over the last 10 years. The many interactions I had with the participants in the past cannot help but affect my work with them during this intervention.

Of concern for this study are the claims that can be made using the quantitative data. The external validity of this research is threatened because the participant group ($N = 17$) is too small to calculate the effect size reliably. The low statistical power of the quantitative component of this mixed-methods study limits the statistical validity of tests conducted to ascertain the validity of the measurement (Shadish et al., 2002).

The intervention was conducted over 3 months, and while some change in technology-related self-efficacy was reported, a longer intervention may be warranted. In addition to a longer duration, this intervention included only one professional learning event. More professional learning opportunities may have also increased the strength of the findings. Darling-Hammond et al. (2017) identify professional learning events with sustained follow-up and support as the most effective system for creating change, perhaps warranting a longer intervention with multiple professional learning events, additional coaching, and sustained follow-up. Future research should extend the length of the intervention and include more opportunities for professional learning and follow-up.

There are two limitations related to instrumentation. First, I was unable to locate a validated instrument to measure the technology-related self-efficacy beliefs of school site administrators and adapted a preexisting instrument, the PSES, instead. Though I adapted the PSES with the guidance of experts, the version I used was not validated. The creation of an instrument that is intended to measure the technology-related self-efficacy beliefs of school site administrators would improve the ability to measure the impact of self-efficacy focused intervention on the leadership intention of school site administrators in future studies, the proximal and long-term outcome for this study.

The second limitation related to instrumentation was the difficulty of measuring verbal persuasion as a factor of self-efficacy development. Though this is a known limitation (Howardson & Behrend, 2015), I was unable to locate an appropriate measure to capture the amount of verbal persuasion that occurred during the intervention. The creation of an instrument focused on verbal persuasion would benefit future studies.

The last limitation of this study was the sample composition. I included both principals and vice principals as participants in this study. However, during the final interview several vice principals shared that they did not feel like technology integration leaders because they did not see themselves as leaders on the campus. They reported that they saw themselves as support personnel who helped enact their principal's direction. This understanding of their role may have led them to interpret components of the intervention in a way that I did not anticipate. A study that included solely principals or solely vice principals may provide more consistent results.

Implications for Research

There are three implications for research resulting from this study. They include the selection or construction of appropriate instruments, the use of a sample size with sufficient power to establish statistically valid conclusions, and further investigation into the connection between technology-related self-efficacy beliefs and the intent to act as a technology integration leader.

This study identified a possible connection between technology-related self-efficacy beliefs and the intent to act as a technology integration leader. However, no clear causal connection can be established for several reasons. One of the necessary components future research into the connection between technology-related self-efficacy beliefs and the intent to act as a technology integration leader would require is a valid and reliable instrument to measure the technology-related self-efficacy beliefs of school site administrators. As I could not locate an instrument that had been designed for such a purpose, I modified an existing instrument. Claims resulting from future research would be stronger if such an instrument could be located or created.

The second implication for future research into this topic that would make findings stronger is the use of a larger sample. This study was embedded within the context where I work, limiting the number of participants available. Future research should broaden its participant pool so that the results of statistical analysis would be more authoritative.

The final implication for future research is related to the length and structure of the intervention. Though both technology-related self-efficacy beliefs and the intent to act as a technology integration leader changed over the course of the intervention, it is not clear that the intervention was of sufficient length. The implementation of the district technology plan, for instance, did not occur. That component of the intervention may have been more successful if the intervention included additional professional learning opportunities and additional follow-up sessions.

Implications for Practice

There are three implication for practice that resulted from this research study. First, over the course of the intervention it became clear that principals and vice principals, though both school site administrators, understood their roles differently. Principals, as expected, saw themselves as school site leaders whereas vice principals did not always see themselves as site leaders. In the future, the particular needs of principals and vice principals need to be attended to in future attempts to engage them in the work of technology integration.

The second implication for practice results from the clear finding that the technology integration plan was not implemented. Future initiatives need more support than the limited professional learning and follow-up work that was conducted in this research. Creating a site plan was a good first step, but it went unused and participants fell back on familiar tools with which they had more extensive previous experience.

The final implication for practice is the possible connection between self-efficacy beliefs and leadership intent. As I continue the work of technology integration, I will use the data gathered for this study to inform my future endeavors. As school site administrators became more conversant with technology and spent time considering its use, for example, their intent to lead the technology integration process increased. In the future, I will increase the amount of time I spend helping school site administrators understand technology so that they are more confident technology integration leaders. The goal of this study was to find a way to increase meaningful technology integration for all students. Though these results do not definitively establish a connection between technology-related self-efficacy belief growth and technology leadership intent, these preliminary results should lead to a larger study.

References

Abusham, J. (2018). Do something that scares you each day: The role of self-efficacy in preparing school leaders. *Educational Leadership Administration: Teaching and Program Development, 29*(1)*,* 64–75.

Aesaert, K., Vanderline, R., Tondeur, J., & von Braak, J. (2013). The content of educational technology curricula: A cross-curricular state of the art. *Educational Technology Research and Development, 61,* 131–151. doi:10.1007/sl 1423-012-9279-9

Anderson, R. E., & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly, 41*, 49–82. doi:10.1177/0013161X04269517

Angrist, J., & Lavy, V. (2002). New evidence on classroom computers and pupil learning. *The Economic Journal*, *112*, 735–765. doi:10.3386/w7424

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*, 191–215. Retrieved from http://psycnet.apa.org/

Bandura, A. (1984). Recycling misconceptions of perceived self-efficacy. *Cognitive Therapy and Research, 8*, 231–255. doi:10.1007/bf01172995

Bandura, A. (1985). Model of causality in social learning theory. In M. J. Mahoney & A. Freeman (Eds.), *Cognition and Psychotherapy* (81-100). New York, NY: Plenum Press

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York, NY: W.H. Freeman & Company.

Bandura, A. (2012). On the functional properties of perceived self-efficacy revisited. *Journal of Management, 38*, 9–44. doi:10.1177/0149206311410606

Bautista, N. U. (2011). Investigating the use of vicarious and mastery experiences in influencing early childhood education majors' self-efficacy beliefs. *Journal of Science Teacher Education, 22,* 333–349. doi:10.1007/s10972-011-9232-5

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report, 13,* 544–559. Retrieved from https://nsuworks.nova.edu/tqr/

Bebell, D., & Kay, R. (2009). One to one computing: A summary of the quantitative results from the Berkshire wireless learning initiative. *The Journal of Technology, Learning, and Assessment, 9*(2), 1–60. Retrieved from http://www.jtla.org

Becker, H. J. (2000). Findings from the teaching, learning, and computing survey: Is Larry Cuban right? *Education Policy Analysis Archives, 8*(51), 1–31. doi:10.14507/epaa.v8n51.2000

Beisiegel, M., Mitchell, R., & Hill, H. C. (2018). The design of video-based professional development: An exploratory experiment intended to identify effective features. *Journal of Teacher Education*, *69*, 69–89. doi:10.1177/0022487117705096

Berrett, B., Murphy, J., & Sullivan, J. (2012). Administrator insights and reflections: Technology integration in schools. *The Qualitative Report, 17,* 200–221. Retrieved from https://nsuworks.nova.edu/tqr/

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*, 77–101. doi:10.1191/1478088706qp063oa

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.

Bronfenbrenner, U. (1994). Ecology models of human development. In T. Husen & T. N. Postlewaite (Eds.), *International encyclopedia of education* (2nd ed., Vol. 3, pp. 1643–1647). Oxford, England: Elsevier.

Buckenmeyer, J. A. (2010). Beyond computers in the classroom: Factors related to technology adoption to enhance teaching and learning. *Contemporary Issues in Education Research, 3*, 27–35. doi:10.19030/cier.v3i4.194

Chang, I.-H. (2012). The effect of principals' technological leadership on teachers' technological literacy and teaching effectiveness in Taiwanese elementary schools. *Journal of Educational Technology & Society*, *15*(2), 328–340. Retrieved from https://www.j-ets.net/

Chen, C.-H. (2008). Why do teachers not practice what they believe regarding technology integration? *The Journal of Educational Research, 102*, 65–75. doi:10.3200/joer.102.1.65-75

Chen, J., & Usher, E. (2013). Profiles of the sources of science self-efficacy. *Learning and Individual Differences, 24,* 11–21. doi:10.1016/j.lindif.2012.11.002

Chenail, R. J. (2011). Interview the investigator: Strategies for addressing instrumentation and researcher bias concerns in qualitative research. *The Qualitative Report, 16,* 255-262. Retrieved from https://nsuworks.nova.edu/tqr/

Cherian, M. (2009). *From PLATO to podcasts: Fifty years of federal involvement in educational technology.* Retrieved from the Center on Education Policy website: https://www.cep-dc.org

Claro, M., Nussbaum, M., Lopez, X., & Contardo, V. (2017). Differences in views of school principals and teachers regarding technology integration. *Journal of Educational Technology and Society, 20(3)*, 42–53.

Creswell, J. W., & Plano-Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). Thousand Oaks, CA: SAGE.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory Into Practice, 39,* 124-130. doi:10.1207/s15430421tip3903_2

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

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal, 38*, 813–834. doi:10.3102/00028312038004813

Culp, K. M., Honey, M., & Mandinach, E. (2003). *A retrospective on twenty years of education technology policy* (Contract No. ED-01-CO-0026/0017). Retrieved from https://www2.ed.gov/rschstat/eval/tech/20years.pdf

Daniels, J. S., Jacobsen, M., Varnhagen, S., & Friesen, S. (2014). Barriers to systemic, effective, and sustainable technology use in high school classrooms / Obstacles à l'utilisation systémique, efficace et durable de la technologie dans les salles de classe des écoles secondaires. *Canadian Journal of Learning and Technology / La Revue Canadienne de L'apprentissage et de La Technologie, 39*(4)*,* 1–14. doi:10.21432/t2sg67

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (with Espinoza, D.). (2017). *Effective teacher professional development*. Retrieved from Learning Policy Institute website: https://learningpolicyinstitute.org/product/effective-teacher-professional-development-report

Desimone, L. M., & Garet, M. S. (2015). Best practices in teachers' professional development in the United States. *Psychology, Society, & Education*, *7*, 252–263. doi:10.25115/psye.v7i3.515

Donovan, L., Hartley, K., & Strudler, N. (2007). Teacher concerns during initial implementation of a one-to-one laptop initiative at the middle school level. *Journal of Research on Technology in Education, 39*, 263–286. doi:10.1080/15391523.2007.10782483

Downes, J. M., & Bishop, P. A. (2015). The intersection between 1:1 laptop implementation and the characteristics of effective middle level schools. *RMLE Online*, *38*(7), 1–16. doi:10.1080/19404476.2015.11462120

Drayton, B., Falk, J. K., Stroud, R., Hobbs, K., & Hammerman, J. (2010). After installation: Ubiquitous computing and high school science in three experienced, high-technology schools. *The Journal of Technology, Learning, and Assessment*, *9*(3), 1–57. Retrieved from http://www.jtla.org

Dusenbury, L., Brannigan, R., Falco, M., & Hansen, W. B. (2003). A review of research on fidelity of implementation: Implications for drug abuse prevention in school settings. *Health Education Research, 18*, 237–256. doi:10.1093/her/18.2.237

Ertmer, P.A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*, 47–61. doi:10.1007/BF02299597

Ertmer, P., Ottenbreit-Leftwich, A., & York, C. (2006). Exemplary technology-using teachers: Perceptions of factors influencing success. *Journal of Computing in Teacher Education*, *23*, 55–61. doi:10.1080/10402454.2006.10784561

Fiske, S. T. (1992). Thinking is for doing: Portraits of social cognition from daguerreotype to laserphoto. *Journal of Personality and Social Psychology, 63,* 877–889. doi:10.1037/0022-3514.63.6.877

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. *American Psychologist, 34*, 906–911. doi:10.1037/0003-066X.34.10.906

Flick, U. (2009). *An introduction to qualitative research* (4th ed.). Thousand Oaks, CA: SAGE.

Fong, C. J., & Krause, J. M. (2014). Lost confidence and potential: A mixed methods study of underachieving college students' sources of self-efficacy. *Social Psychology of Education*, *17*, 249–268. doi:10.1007/s11218-013-9239-1

Fredricks, J. A., Blumenfeld, P. C., & Paris, A, H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74,* 59-109. doi: 10.3102/00346543074001059

Garvis, S., Twigg, D., & Pendergast, D. (2011). Breaking the negative cycle: The formation of self-efficacy beliefs in the arts. A focus on professional experience in pre-service teacher education. *Australasian Journal of Early Childhood*, *36*(2)*,* 36–41. doi:10.1177/183693911103600206

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report, 8,* 597-606. Retrieved from http://nsuworks.nova.edu/

Gregoire, M. (2003). Is it a challenge or a threat? A dual-process model of teachers' cognition and appraisal processes during conceptual change. *Educational Psychology Review, 15,* 147–179. doi:1040-726X/03/0600-0147/0

Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Technology Research and Development, 29*, 75–91. doi:10.1007/BF02766777

Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching*, *8*, 381–391. doi:10.1080/135406002100000512

Guskey, T. R. (2014). Measuring the effectiveness of educators' professional development. In L. E. Martin, S. Kragler, D. J. Quatroche, & K. L. Basuerman (Eds.), *Handbook of professional development in education: Successful models and practices, preK–12* (pp. 447–466). New York, NY: The Guilford Press.

Harper, B., & Milman, N. B. (2016). One-to-one technology in K–12 classrooms: A review of the literature from 2004 through 2014. *Journal of Research on Technology in Education, 48,* 129–142. doi:10.1080/15391523.2016.1146564

Havard, B., Nguyen, G.-N., & Otto, B. (2018). The impact of technology use and teacher professional development on U.S. national assessment of educational progress (NAEP) mathematics achievement. *Education and Information Technologies, 23,* 1897–1918. doi:10.1007/s10639-018-9696-4

Hechter, R. P., & Vernette, L. A. (2013). Technology integration in K–12 science classrooms: An analysis of barriers and implications. *Themes in Science and Technology Education, 6,* 73–90. Retrieved from https://www.learntechlib.org/j/THESTE/

Howardson, G. N., & Behrend, T. S. (2015). The relative importance of specific self-efficacy sources in pretraining self-efficacy beliefs. *International Journal of Training and Development, 19,* 233–252. doi:10.1111/ijtd.12060

Hsu, P.-S. (2016). Examining current beliefs, practices and barriers about technology integration: A case study. *TechTrends, 60,* 30–40. doi:10.1007/s11528-015-0014-3

Inan, F. A., & Lowther, D. L. (2009). Factors affecting technology integration in K–12 classrooms: A path model. *Educational Technology Research and Development, 58*, 137–154. doi:10.1007/s11423-009-9132-y

International Society of Technology Educators. (2009). *ISTE standards for administrators*. Retrieved from https://www.iste.org/standards

Kirkpatrick, L., Brown, H. M., Searle, M., Smyth, R. E., Ready, E. A., & Kennedy, K. (2018). Impact of a one-to-one iPad initiative on grade 7 students' achievement in language arts, mathematics, and learning skills. *Computers in the Schools, 35,* 171–185. doi:10.1080/07380569.2018.1491771

Kirschner, P. A., Sweller, A., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist 41(2)*, 75-86. doi:10.1207/s15326985ep4102_1

Knapp, L. (1989). *ACOT classroom networks: Today and tomorrow* (ACOT Report No. 5). Retrieved from https://files.eric.ed.gov/fulltext/ED316203.pdf

Knoblauch, D., & Woolfolk Hoy, A. (2008). "Maybe I can teach *those* kids." The influence of contextual factors on student teachers' efficacy beliefs. *Teaching and Teacher Education, 24,* 166–179. doi:10.1016/j.tate.2007.05.005

Larosiliere, G. D., McHaney, R., & Kobelsky, K. (2016). The effects of IT management on technology process integration. *Journal of Computer Information Systems, 56*, 341–351. doi:10.1080/08874417.2016.1164494

Lee, G. M., & Lind, M. L. (2011). Information technology diffusion: Impact on student achievement. *Information Systems Education Journal, 9*(3)*,* 35–49. Retrieved from www.aitp-edsig.org

Lochmiller, C. R., & Lester, J. N. (2017). *An introduction to educational research: Connecting methods to practice.* Thousand Oaks, CA: SAGE.

LoTi Connection. (2009). Retrieved from http://www.loticonnection.com

Lowther, D. L., Inan, F. A., Strahl, J. D., & Ross, S. M. (2008). Does technology integration "work" when key barriers are removed? *Educational Media International, 45*, 195–213. doi:10.1080/09523980802284317

Machado, L. J., & Chung, C.-J. (2015). Integrating technology: The principals' role and effect. *International Education Studies*, *8*(5), 43–53. doi:10.5539/ies.v8n5p43

Machin, S., McNally, S., & Silva, O. (2007). New technology in schools: Is there a payoff? *The Economic Journal*, *117*, 1145–1167. doi:10.1111/j.1468-0297.2007.02070.x

McLeod, S. (2005). Principals technology leadership assessment [Survey instrument and directions]. Center for the Advanced Study of Technology Leadership in Education. Retrieved from http://dangerouslyirrelevant.org/resources/ptla

Mehta, V., & Hull, D. M. (2013). Structural validity of the professional development profile of the LoTi digital-age survey. *Journal of Psychoeducational Assessment 31,* 61–71. doi:10.1177/0734282912454992

Metcalf, W., & LaFrance, J. (2013). Technology leadership preparedness: Principals' perceptions. *Journal of Research in Education*, *23*, 58–75. Retrieved from https://journals.sagepub.com/home/rie

Mintzes, J. J., Marcum, B., Messerschmidt-Yates, C., & Mark, A. (2013). Enhancing self-efficacy in elementary science teaching with professional learning communities. *Journal of Science Teacher Education*, *24*, 1201–1218. doi:10.1007/s10972-012-9320-1

Miranda, H. P., & Russell, M. (2011). Understanding factors associated with teacher-directed student use of technology in elementary classrooms: A structural equation modeling approach. *British Journal of Educational Technology, 43*, 652–666. doi:10.1111/j.1467-8535.2011.01228.x

Moersch, C. (1995). Levels of technology implementation (LoTi): A framework for measuring classroom technology use [Supplement material]. *Learning and Leading With Technology, 23*, 40–42. Retrieved from http://loticonnection.com/

Mohamadi, F. S., & Asadzadeh, H. (2012). Testing the mediating role of teachers' self-efficacy beliefs in the relationship between sources of efficacy information and students achievement. *Asia Pacific Education Review*, *13*, 427–433. doi:10.1007/s12564-011-9203-8

Mueller, J., Wood, E., Willoughby, T., Ross, C., & Specht, J. (2008). Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. *Computers & Education, 51*, 1523–1537. doi:10.1016/j.compedu.2008.02.003

Neal, J. W., & Neal, Z. P., (2013). Nested or networked? Future directions for ecological systems theory. *Social Development, 22(4)*, 722–737. doi: 10.1111/sode.12018

Nelson, M. C., Cordray, D. S., Hulleman, C. S., Darrow, C. L., & Sommer, E. C. (2012). A procedure for assessing intervention fidelity in experiments testing educational and behavioral interventions. *The Journal of Behavioral Health Services & Research*, *39*, 374–396. doi:10.1007/s11414-012-9295-x

No Child Left Behind Act of 2001, P.L. 107-110, 20 U.S.C. § 6319 (2002).

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, *62*, 307–322. doi:10.3102/00346543062003307

Palmer, D. (2011). Sources of efficacy information in an in-service program for elementary teachers. *Science Education, 95*, 577–600. doi:10.1002/sce.20434

Park, E.-A., Sinha, H., & Chong, J. (2007). Beyond access: An analysis of the influence of the E-Rate program in bridging the digital divide in American schools. *Journal of Information Technology Education: Research, 6,* 387–406. doi:10.28945/223

Park, S., Hironaka, S., Carver, P., & Nordstrum, L. (2013). *Continuous improvement in education.* Retrieved from Carnegie Foundation for the Advancement of Teaching website: https://www.carnegiefoundation.org/wp-content/uploads/2014/09/carnegie-foundation_continuous-improvement_2013.05.pdf

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd). Thousand Oaks, CA: SAGE.

Phillippi, J., & Lauderdale, J. (2018). A guide to field notes for qualitative research: Context and conversation. *Qualitative Health Research, 28,* 381–388. doi:10.1177/1049732317697102

Pittman, T., & Gaines, T. (2015). Technology integration in third, fourth and fifth-grade classrooms in a Florida school district. *Educational Technology Research and Development, 63*, 539–554. doi:10.1007/s11423-015-9391-8

Puentedura, R. R. (2014). *SAMR: A contextualized introduction.* Retrieved from http://www.hippasus.com/

Putwain, D. W., Remedios, R., & Symes, W. (2015). Experiencing fear appeals as a challenge or a threat influences attainment value and academic self-efficacy. *Learning and Instruction*, *40*, 21–28. doi:10.1016/j.learninstruc.2015.07.007

Rakes, G. C., Fields, V. S., & Cox, K. E. (2006). The influence of teachers' technology use on instructional practices. *Journal of Research on Technology in Education, 38,* 411–426. doi:10.1080/15391523.2006.10782467

Roberts, C., Kennedy, M., Kinard, E., DeKlotz, P., Stack, K., Truesdale, V., …Danner, J. (2017). *Role of federal funding and research findings on adoption and implementation of technology-based products and tools*. Retrieved from https://symposium.curry.virginia.edu/wp-content/uploads/2017/07/The-Goals-and-Roles-of-Federal-Funding-for-EdTech-Research_FINAL-1.pdf

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York, NY: Free Press.

Schunk, D. H. (1987). Peer models and children's behavioral change. *Review of Educational Research, 57,* 149–174. doi:10.2307/1170234

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston, MA: Houghton Mifflin.

Shapley, K. S., Sheehan, D., Maloney, C., & Caranikas-Walker, F. (2009). Evaluating the implementation fidelity of technology immersion and its relationship with student achievement. *The Journal of Technology, Learning, and Assessment, 9*, 1–69. Retrieved from https://www.learntechlib.org/j/ISSN-1540-2525/

Shapley, K. S., Sheehan, D., Maloney, C., & Caranikas-Walker, F. (2011). Effects of technology immersion on middle school students' learning opportunities and achievement. *The Journal of Educational Research, 104*, 299–315. doi:10.1080/00220671003767615

Smarter Balanced Assessment Consortium. (2017). *The smarter balanced guide to technology readiness*. Retrieved from https://portal.smarterbalanced.org/library/en/guide-to-technology-readiness.pdf

Stewart, T., Allen, K. W., & Bai, H. (2011). The effects of service-learning participation on pre-internship educators' teachers' sense of efficacy. *Alberta Journal of Educational Research, 57,* 298–316. Retrieved from http://www.ajer.ca

Stuart, L. H., Mills, A. M., & Remus, U. (2009). School leaders, ICT competence and championing innovations. *Computers & Education*, *53*, 733–741. doi:10.1016/j.compedu.2009.04.013

Tilton, J., & Hartnett, M. (2016). What are the influences on teacher mobile technology self-efficacy in secondary school classrooms? *Journal of Open, Flexible and Distance Learning, 20*(2), 79–93. Retrieved from http://www.jofdl.nz

Topper, A., & Lancaster, S. (2013). Common challenges and experiences of school districts that are implementing one-to-one computing initiatives. *Computers in the Schools, 30*, 346–358. doi:10.1080/07380569.2013.844640

Tschannen-Moran, M., & Gareis, C. R. (2004). Principals' sense of efficacy. *Journal of Educational Administration*, *42*, 573–585. doi:10.1108/09578230410554070

Tschannen-Moran, M., & Johnson, D. (2011). Exploring literacy teachers' self-efficacy beliefs: Potential sources at play. *Teaching and Teacher Education, 27,* 751–761. doi:10.1016/j.tate.2010.12.005

Tschannen-Moran, M., & McMaster, P. (2009). Sources of self-efficacy: Four professional development formats and their relationship to self-efficacy and implementation of a new teaching strategy. *The Elementary School Journal, 110,* 228–245. doi:10.1086/605771

Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing an elusive construct. *Teacher and Teacher Education, 17,* 483–804. doi:10.1016/s0742-051x(01)00036-1

National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for educational reform: A report to the nation and the secretary of education, United States Department of Education by The National Commission on Excellence in Education*. Retrieved from https://www.edreform.com/wp-content/uploads/2013/02/A_Nation_At_Risk_1983.pdf

U.S. Department of Education, Office of the Under Secretary. (2003). *A snapshot of Title I schools, 2000–1* (Contract No. EA 97010001). Retrieved from https://www2.ed.gov/rschstat/eval/disadv/nlss2000/nlss-snapshot.pdf

U.S. Department of Education, Office of Educational Technology. (2016). *Reimagining the role of technology in education: 2017 national education technology plan update*. Retrieved from https://tech.ed.gov/files/2017/01/NETP17.pdf

Usher, E. L., & Pajares, F. (2008). Sources of self-efficacy in schools: Critical review of the literature and future directions. *Review of Educational Research, 78*, 751–796. doi:10.3102/0034654308321456

Usher, E. L., & Pajares, F. (2009). Sources of self-efficacy in mathematics: A validation study. *Contemporary Educational Psychology, 34,* 89–101. doi:10.1016/j.cedpsych.2008.09.002

Versland T. M., & Erickson, J. L. (2017). Leading by example: A case study of the influence of principal self-efficacy on collective efficacy. *Educational Leadership & Management, 4*, 1–17. doi:10.1080/2331186X.2017.1286765

Villano, M. (2008). What are we protecting them from? *THE Journal, 35*(5), 48–54. Retrieved from http://www.thejournal.com

Webster, M. D. (2017). Philosophy of technology assumptions in educational technology leadership. *Journal of Educational Technology & Society, 20*(1), 25–36. Retrieved from https://www.j-ets.net/

Windschitl, M., & Sahl, K. (2002). Tracing teachers' use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics, and institutional culture. *American Educational Research Journal, 39*, 162–205. doi:10.3102//00028312039001165

Winner, D. G. (2012). *The self-efficacy of the elementary teacher toward technology use* (Doctoral dissertation). Retrieved from https://www.proquest.com

Wright, B. J., O'Halloran, P. D., & Stukas, A. A. (2016). Enhancing self-efficacy and performance: An experimental comparison of psychological techniques. *Research Quarterly for Exercise and Sport, 87*, 36–46. doi:10.1080/02701367.2015.1093072

Appendix A

Principal Technology Leadership Assessment

I. Leadership & Vision

1. To what extent did you participate in your district's or school's most recent technology planning process?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you communicate information about your district's or school's technology planning and implementation efforts to your school's stakeholders?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent did you promote participation of your school's stakeholders in the technology planning process of your school or district?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent did you compare and align your district or school technology plan with other plans, including district strategic plans, your school improvement plan, or other instructional plans?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you advocate for inclusion of research-based technology practices in your school improvement plan?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6. To what extent did you engage in activities to identify best practices in the use of technology (e.g. reviews of literature, attendance at relevant conferences, or meetings of professional organizations)?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

II. Learning and Teaching

1. To what extent did you provide or make available assistance to teachers to use technology for interpreting and analyzing student assessment data?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you provide or make available assistance to teachers for using student assessment data to modify instruction?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent did you disseminate or model best practices in learning and teaching with technology to faculty and staff?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent did you provide support (e.g., release time, budget allowance) to teachers or staff who were attempting to share information about technology practices, issues, and concerns?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you organize or conduct assessments of staff needs related to professional development on the use of technology?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6. To what extent did you facilitate or ensure the delivery of professional development on the use of technology to faculty and staff?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

III. Productivity & Professional Practice

1. To what extent did you participate in professional development activities meant to improve or expand your use of technology?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you use technology to help complete your day-to-day tasks (e.g., developing budgets, communicating with others, gathering information)?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent did you use technology-based management systems to access staff/faculty personnel records?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent did you use technology-based management systems to access student records?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you encourage and use technology (e.g., e-mail, blogs, videoconferences) as a means of communicating with education stakeholders, including peers, experts, students, parents/guardians, and the community?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

IV. Support, Management, & Operations

1. Support faculty and staff in connecting to and using district- and building-level technology systems for management and operations (e.g., student information system, electronic grade book, curriculum management system)?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you allocate campus discretionary funds to help meet the school's technology needs?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent did you pursue supplemental funding to help meet the technology needs of your school?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent did you ensure that hardware and software replacement/upgrades were incorporated into school technology plans?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you advocate at the district level for adequate, timely, and high-quality technology support services?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6. To what extent did you investigate how satisfied faculty and staff were with the technology support services provided by your district/school?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

V. Assessment & Evaluation

1. To what extent did you promote or model technology-based systems to collect student assessment data?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you promote the evaluation of instructional practices, including technology-based practices, to assess their effectiveness?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent did you assess and evaluate existing technology-based administrative and operations systems for modification or upgrade?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent did you evaluate the effectiveness of professional development offerings in your school to meet the needs of teachers and their use of technology?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you include the effective use of technology as a criterion for assessing the performance of faculty?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

VI. Social, Legal, & Ethical Issues

1. To what extent did you work to ensure equity of technology access and use in your school?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

2. To what extent did you implement policies or programs meant to raise awareness of technology-related social, ethical, and legal issues for staff and students?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

3. To what extent were you in involved in enforcing policies related to copyright and intellectual property?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

4. To what extent were you involved in addressing issues related to privacy and online safety?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

5. To what extent did you support the use of technology to help meet the needs of special education students?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

6. To what extent did you support the use of technology to assist in the delivery of individualized education programs for all students?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

7. To what extent did you disseminate information about health concerns related to technology and computer usage in classrooms and offices?

Not at all	Minimally	Somewhat	Significantly	Fully
1	2	3	4	5

Appendix B

Levels of Technology Integration Survey

LoTi Digital Age Survey for Teachers

LoTi Digital Age Survey: Digital Landscape
Select the response for each question below that best represents the digital landscape in your classroom.

1. How many years of teaching experience do you have in education?
q *Less than Five Years*
q *Five to Nine Years* q *Ten to Twenty Years*
q *More than Twenty Years*

2. Which statement best describes your classroom's digital infrastructure?
q *No access to digital resources*
q *Teacher workstation only*
q *Classroom laptop/mobile device station(s)*
q *Access to laptop/mobile device cart(s)*
q *One-to-one laptop/mobile devices*
q *BYOD (Bring Your Own Device)*
q *Other*

3. Which model best describes your approach to blended or hybrid learning in the classroom? Blended learning models include Flipped Classroom, Rotation, Online Lab, Flex, Self-Blend, Supplemental, Face-to-Face Driver, and Online Driver.
q *No Blended Learning Model*
q *Blended Learning using a Flipped Classroom Model*
q *Blended Learning using a Rotation Model*
q *Blended Learning using an Online Lab Model*
q *Blended Learning using a Flex Model*
q *Blended Learning using a Self-Blend Model*
q *Blended Learning using a Supplemental Model*
q *Blended Learning using a Face-to-Face Driver Model*
q *Blended Learning using an Online Driver Model*

4. From which source do you most frequently seek guidance, information, inspiration, and/or direction relating to your classroom use of digital resources in the classroom?
q *Students*
q *Building Administrators*
q *School/District Specialists (e.g., Media/Technology Specialist, Instructional Specialist)*
q *Classroom Teachers (e.g., Other Colleagues, Mentors, Peer Coaches)*
q *Specific websites (e.g., Teaching Channel, YouTube, Kahn Academy, Online Subscriptions)*
q *Other (e.g., College Professor, Conference Presenter, Business/Community Member, Vendor)*

5. What do you perceive as the greatest obstacle to advancing your use of digital resources in your instructional setting?
q *None*
q *Lack of Access to Digital Resources*
q *Time to Learn, Practice, and Plan*
q *Required Instructional Priorities (e.g., Statewide Testing, New Textbook Adoptions)*
q *Lack of Staff Development Opportunities*
q *Other*

LoTi Digital Age Survey: Teacher Perceptions
Select the response for each statement below that best represents your perceptions about the use of digital resources in your classroom.

6. I believe the use of digital resources in my classroom can positively impact student learning and achievement.
q *Strongly Agree*
q *Agree*
q *No opinion*
q *Disagree*
q *Strongly Disagree*

7. I have the necessary capabilities and skills to integrate digital resources successfully into my classroom instruction.
q *Strongly Agree*
q *Agree*
q *No opinion*
q *Disagree*
q *Strongly Disagree*

8. I know where (e.g., Teaching Channel, YouTube, Kahn Academy) or who (e.g., campus technology specialist, academic coach, grade level teacher, curriculum coordinator) to go towhen I need support for using digital resources in my classroom.
q *Strongly Agree*
q *Agree*
q *No opinion*
q *Disagree*
q *Strongly Disagree*

LoTi Digital Age Survey for Teachers

9. I receive useful feedback on the integration of digital resources into my instruction from my administrator(s).
- q *Strongly Agree*
- q *Agree*
- q *No opinion*
- q *Disagree*
- q *Strongly Disagree*

10. I am able to maximize student learning best when I complement my whole group approach with learning stations/centers, cooperative grouping, and/or individualized instruction.
- q *Strongly Agree*
- q *Agree*
- q *No opinion*
- q *Disagree*
- q *Strongly Disagree*

LoTi Digital Age Survey: School Climate
Select the response for each statement below that best represents your perceptions about the educational climate at your school.

11. I am treated as a respected educational professional on my campus.
- q *Strongly Agree*
- q *Agree*
- q *No opinion*
- q *Disagree*
- q *Strongly Disagree*

12. I engage in a two-way cycle of communication and feedback with my school administrators.
- q *Strongly Agree*
- q *Agree*
- q *No opinion*
- q *Disagree*
- q *Strongly Disagree*

13. I feel that I am listened to, represented, and feel I have a voice on campus.
- q *Strongly Agree*
- q *Agree*
- q *No opinion*
- q *Disagree*
- q *Strongly Disagree*

14. I understand and support the shared vision for our school's use of digital resources along with other key stakeholders.
- q *Strongly Agree*
- q *Agree*
- q *No opinion*
- q *Disagree*
- q *Strongly Disagree*

LoTi Digital Age Survey: Use of Resources
Select the response for each question below that best represents how often digital and/or environmental resources are being used during instruction.

15. How often are your students using digital tools and/or environmental resources during the instructional day?
- q *Never*
- q *At least once a year* q *At least once a month*
- q *At least once a week* q *At least once a day*
- q *Multiple times each day*

16. How often are you (the teacher) using digital tools and/or environmental resources during the instructional day?
- q *Never*
- q *At least once a year*
- q *At least once a month*
- q *At least once a week*
- q *At least once a day*
- q *Multiple times each day*

LoTi Digital Age Survey: Standards-Based Learning
Select the response that best represents how often standards drive student learning experiences.

17. How often are your students involved in standards-based learning experiences during the instructional day?
- q *Never*
- q *At least once a year*
- q *At least once a month*
- q *At least once a week*
- q *At least once a day*
- q *Multiple times each day*

LoTi Digital Age Survey for Teachers

LoTi Digital Age Survey: Teacher Statements
Select the response that best represents how often the statement mirrors the instructional practices in your learning environment.

0	1	2	3	4	5	6	7
Never	*At least once a year*	*At least once a semester*	*At least once a month*	*A few times a month*	*At least once a week*	*A few times a week*	*Daily*

1. My students work together using digital tools and/or environmental resources that require them to analyze information and ask questions based on a teacher-provided prompt.
2. My students work alone or in groups to create traditional reports with web-based or multimedia presentations (e.g., Prezi, PowerPoint, Google Slides) that showcase information on topics that I assign in class.
3. I assign my students tasks that emphasize teacher-directed investigations with a known outcome (e.g., science experiments, mathematical problem solving, literary analysis) using the available digital tools and/or environmental resources.
4. I provide different formative and summative assessments that encourage students to demonstrate their content understanding in nontraditional ways.
5. My students use digital tools and/or environmental resources to participate in teacher-directed activities that require them to transfer their learning to a new situation.
6. My students use collaborative digital tools (e.g., Google Docs, social media, wikis) and/or environmental resources beyond the school building (e.g., community action groups, parents, elected officials) to create solutions for real world problems (e.g., bully-ing, health awareness, election apathy, global warming).
7. I promote, monitor, and model the ethical use of digital tools in my classroom (e.g., appropriate citing of resources, respecting copyright permissions).
8. I use digital tools to expand my communication opportunities with students, parents, and peers.
9. My students find innovative ways to use our school's advanced digital tools (e.g., 1:1 mobile devices, digital media authoring tools, probeware with GPS systems) for inquiry-based learning opportunities that use social media.
10. I model and facilitate the effective use of current and emerging digital tools to support teaching and learning in my classroom.
11. I use digital tools to support my instruction (e.g., multimedia, online tutorials, online simulations, videos) so that students can better understand the content that I teach.
12. I alone use the classroom digital tools during instruction due to the amount of content that I have to cover by the end of each marking period.
13. My students use a variety of digital tools that support the evolving nature of my grade level content and promote student academic success.
14. My students readily self-select the most appropriate digital tool to aid them in completing any given task.
15. I employ learner-centered strategies (e.g., communities of inquiry, learning contracts) to address the diverse needs of my students using developmentally-appropriate digital tools.
16. My students use digital tools and/or environmental resources to participate in problem-solving activities with others beyond the classroom.
17. My students use digital tools and/or environmental resources for (1) collaboration, (2) publishing, and (3) research to tackle real world questions, themes, and/or challenges within our community.
18. I model for my students the safe and legal use of digital tools while I am delivering content and/or confirming student

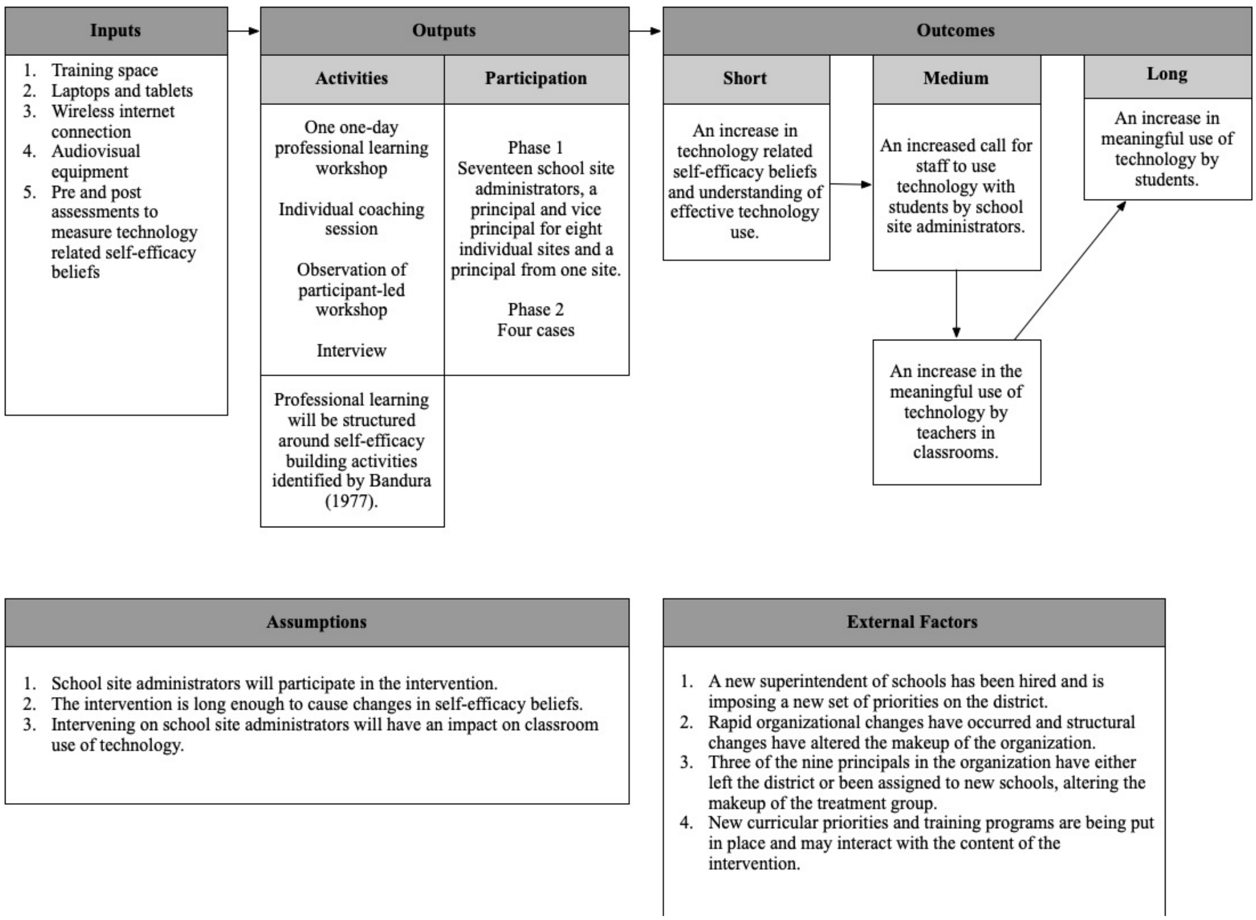
LoTi Digital Age Survey for Teachers

0	1	2	3	4	5	6	7
Never	*At least once a year*	*At least once a semester*	*At least once a month*	*A few times a month*	*At least once a week*	*A few times a week*	*Daily*

19. My students model the "correct and careful" use of digital tools (e.g., ethical usage, proper digital etiquette, protecting their personal information) and are aware of the consequences regarding their misuse.
20. I collaborate with others (e.g., students, faculty members, business experts) to explore creative applications of digital tools that improve student learning.
21. My students use digital tools and/or environmental resources to define real life problems and then find solutions that are grade level appropriate.
22. My students engage in standards-based applied learning projects that emphasize student investigations using digital tools.
23. I use student-centered performance assessments that involve students transferring what they have learned to a real world context using the available digital tools and/or environmental resources.
24. My students' questions, interests, and readiness levels directly impact how I design learning activities that address the content standards.
25. My students use the classroom digital tools and/or environmental resources to engage in relevant, challenging, self-directed learning experiences that address the content standards.
26. My students complete online tasks that emphasize high level cognitive skills (e.g., Bloom—analyzing, evaluating, creating; Webb—strategic and extended thinking).
27. My students use digital tools and/or environmental resources to confirm their content understanding or to improve their basic math and literacy skills.
28. My students use digital tools and/or environmental resources to explore deeper content connections (e.g., analyzing data from surveys and experiments, making inferences from text passages) that require them to draw conclusions.
29. My students collaborate with me in setting both group and individual academic goals that provide opportunities for them to direct their own learning aligned to the content standards.
30. I promote global awareness in my classroom by providing students with digital opportunities to collaborate with others beyond the classroom.
31. My students apply their classroom content learning to real world situations within the local or global community using the digital tools at our disposal.
32. I reinforce specific content standards and confirm student learning using digital tools (e.g., discussion forums, digital student response system, wikis, blogs) and/or environmental resources (e.g., manipulatives, graphic organizers, dioramas).
33. My students self-select digital tools and/or environmental resources for higher-order thinking and personal inquiry related to project-based learning (PBL) experiences.
34. My students use all forms of the most advanced digital tools to pursue collaborative problem-solving opportunities of personal and/or social importance.
35. I use digital tools and resources to differentiate the content, process, and/or product of learning experiences.
36. I promote the effective use of digital tools on my campus and within my professional community.
37. I consider how my students will apply what they have learned in class to the world they live in when planning group projects.

Appendix C

Logic Model



Appendix D

Research Summary Matrix

RQ1: To what extent was the intervention implemented with fidelity?

RQ1B: To what extent did all nine principal and all eight vice principals attend the entire professional learning workshop?

RQ1C: To what extent did all four principals and all four vice principals selected to participate in Phase 2 of the intervention attend the entire follow-up session?

RQ1D: To what extent were participants engaged with the professional learning workshop?

RQ1E: To what extent were participants engaged with the professional learning follow-up session?

Construct	Instrumentation	Data Collection		Data Analysis
		Source(s)	Frequency	
Attendance	Sign-in and sign-out sheet	Participant	Twice, once before the professional learning workshop began and once after it concluded	Frequency table
	Researcher's Journal	Researcher	After the professional learning workshop and the professional learning follow-up session	Review of the researcher's journal and noted when participants left and returned.
Participant engagement	Researcher's Journal	Researcher	After the professional learning workshop	Percentage of participants fully engaged with activities as noted in researcher's journal
	Transcripts	Participants	During the professional learning follow-up session	Frequency, length, and quality of utterances

RQ2: To what extent was the technology integration plan that was created during the professional learning session and follow-up session communicated in the site-based workshop?

RQ2B: Did participants communicate the technology integration plan to their staff?

RQ2C: Did participants incorporate activities that reinforced the technology integration plan?

RQ2D: How did participants describe their successes or barriers to implementing their site technology plan?

Construct	Instrumentation	Data Collection		Data Analysis
		Source(s)	Frequency	
Communication of technology integration plan	Field notes	Researcher	During the site-based workshop for each case	Emergent coding and thematic analysis of qualitative data (Braun & Clark, 2006) using NVivo 12 software package
Technology integration activities	Field notes	Researcher	During the site-based workshop for each case	Emergent coding and thematic analysis of qualitative data (Braun & Clark, 2006) using NVivo 12 software package
Implementation of technology integration plan	Transcribed audio recording of participant interview (Appendix G)	Participants	Once, during the final interview	Emergent coding and thematic analysis of qualitative data (Braun & Clark, 2006) using NVivo 12 software package

RQ3: What are school site administrators' technology-related beliefs?

RQ3A: To what extent did school site administrators' sense of technology-related self-efficacy, as measured by the adapted Principal Sense of Efficacy Scale and interviews, change during the course of the study?

RQ3B: How do school site administrators describe their role as technology integration leader?

Construct	Instrumentation	Data Collection		Data Analysis
		Source(s)	Frequency	
Technology-related self-efficacy	Adapted PSES (Appendix E)	Participants	Twice, as a pretest and as a posttest	Descriptive statistics calculated using SPSS, specifically the mean and range of scores for the pretest and posttest
	Adapted PSES (Appendix E)	Participants	Twice, as a pretest and as a posttest	Related-Samples Sign Test
	Adapted PSES (Appendix E)	Participants	Twice, as a pretest and as a posttest	Paired T-Test
	Transcribed audio recording of participant interview (Appendix G)	Participants	Once, during the final interview	Emergent coding and thematic analysis of qualitative data (Braun & Clark, 2006) using NVivo 12 software package
Technology integration leadership	Open-ended questions attached to adapted PSES (Appendix F)	Participants	Twice, as a pretest and as a posttest	Emergent coding and thematic analysis of qualitative data (Braun & Clark, 2006) using NVivo 12
	Transcribed audio recording of participant interview (Appendix G)	Participants	Once, during the final interview	Emergent coding and thematic analysis of qualitative data (Braun & Clark, 2006) using NVivo 12 software package

Appendix E

Adapted Principal Sense of Efficacy Scale

This questionnaire is designed to help us gain a better understanding of the kinds of things that create challenges for principals in their school activities.

Directions: Please indicate your opinion about each of the questions below by marking one of the nine responses in the columns on the right side. The scale of responses ranges from *None at All* (1) to *A Great Deal* (9), with *Some Degree* (5) representing the midpoint between these low and high extremes. You may choose any of the nine possible responses since each represents a degree on the continuum. Your answers are confidential.

Please respond to each of the questions by considering the combination of your *current* ability, resources, and opportunity to do each of the following in your present position.

"In your current role as principal, to what extent can you …"

1. Facilitate student learning with technology in your school?
2. Generate enthusiasm for a shared vision for technology integration in the school?
3. Handle the time demands of the job related to schoolwide technology integration?
4. Manage change in your school related to the use of technology?
5. Promote school spirit regarding technology integration among a large majority of the student population?
6. Create a positive technology-enabled learning environment in your school?
7. Incorporate technology integration in order to raise student achievement on standardized tests?
8. Promote a positive image of technology integration in your school with the media?
9. Motivate teachers' use of technology?
10. Promote the prevailing technology-related values of the community in your school?
11. Maintain control of technology integration in your own daily schedule?

12. Shape the operational policies and procedures that are necessary to manage technology integration in your school?

Appendix F

Pretest and Posttest Open-Ended Survey Questions

Please respond to these questions.

1. How do you manage technology-related change at your school site? If you do not manage technology-related change at your school, why do you think that is?
2. How do you motivate teachers' use of technology? If you do not motivate your teachers to use technology, why do you think that is?
3. How do you create a positive technology-enabled learning environment in your school? If you do not create a positive technology-enabled learning environment in your school, why do you think that is?

Appendix G

Interview Protocol

The following interview questions have been adapted from studies into principal technology leadership conducted by Berrett et al. (2012) and Winner (2012). The intent of these questions is to investigate how the school site administrators view their ability to lead technology integration initiatives and how their sense of technology self-efficacy is related to their ability to lead technology integration at their school sites. The responses to these questions will be used to help answer research questions one, two, and three.

1. Please tell me your name and the name of your school.
2. Effective Use of Technology
   a) Describe how you use technology in your personal life.
   b) Describe how you use technology in your professional life.
   c) Share some examples of students' and teachers' effective integration of technology in your school.
   d) Give an example of what you would see if all students were using technology effectively.
   e) Ideally, how would you like to see teachers integrate technology in the classroom?
   f) What is keeping this ideal situation from occurring?
3. Technology-Related Self-Efficacy
   a) How do you see yourself as a school site technology leader?
   b) How do you feel your leadership impacts teachers' willingness to integrate technology during instruction, if at all?
   c) What factors do you believe limit your ability to support teachers to integrate technology in the classroom?
4. School Site Plan
   a) To what extent did your participation in past district technology-focused professional learning help or hinder your ability to implement technology integration at your site?
   b) How has your understanding of the district vision for technology integration affected, or not affected, what you want to see at your school?
   c) Describe the process you took to implement your site technology plan.
   d) What has helped the implementation of your site's technology plan?
   e) What has hindered the implementation of your site's technology plan?

Appendix H

Consent Form

Johns Hopkins University

Homewood Institutional Review Board (HIRB)

Informed Consent Form

Title: The Effects of Technology-Related Self-Efficacy Beliefs on the Ability of School Site Administrators to Lead Technology Integration.

Principal Investigator: Dr. Elizabeth Todd Brown, Visiting Professor Senior Education Advisor JHU EdD Program

Date: July 6, 2019

PURPOSE OF RESEARCH STUDY:

The purpose of this research study is to investigate the relationship between technology-related self-efficacy beliefs of school site administrators and their ability to effectively lead a technology integration at their school site which may increase the equitable and meaningful use of technology by students. We anticipate that approximately 17 people will participate in this study.

PROCEDURES:

Phase 1:

In Phase 1 of this study, participants will participate in a 1-day professional learning workshop. During this workshop, they will engage in activities intended to increase their technology-related self-efficacy beliefs and their ability to lead effective technology integration at their school site. This workshop will include the viewing of several video clips, group discussions, and the creation of a common technology vision for the school district in which they work.

At the start of the professional learning workshop, participants will complete a short, 27-question survey. They will complete this survey again following the conclusion of the professional learning workshop.

Phase 2:

Four of the participants from Phase 1 will participate in Phase 2 of the research study. They will participate in three activities. First, a one-on-one follow-up meeting (lasting approximately 1 hour) with the student researcher will take place to help the participant plan a workshop for their site staff. This workshop will be focused on the creation of a site-based technology integration plan, based on the district technology vision created at the professional learning workshop.

The second activity in Phase 2 is the participant-led workshop. The four participants selected for Phase 2 will lead a workshop at their school site where they develop a site-based plan for implementing the technology vision. The student researcher will observe the workshop and take notes. This activity will last approximately 2 hours.

The final activity in Phase 2 is an interview. The participant and the student researcher will meet for 1 hour. The interview will be recorded on a digital recorder and transcribed. The interview will take approximately 1 hour.

Phase 1 of the intervention will take six and a half hours. Phase 2 of the intervention will take approximately 4 hours. The first hour of Phase 2 will be the one-on-one follow-up meeting. The next 2 hours will be the participant-led workshop. The final hour will be the concluding interview.

RISKS/DISCOMFORTS:

The risks associated with participation in this study are no greater than those encountered in daily life.

BENEFITS:

There are no direct benefits to you from participating in this study.

This study may benefit society if the results lead to a better understanding of the development of technology-related self-efficacy beliefs and technology leadership in school site administrators.

VOLUNTARY PARTICIPATION AND RIGHT TO WITHDRAW:

Your participation in this study is entirely voluntary; you choose whether to participate. If you decide not to participate, there are no penalties, and you will not lose any benefits to which you would otherwise be entitled.

If you choose to participate in the study, you can stop your participation at any time without any penalty or loss of benefits. If you want to withdraw from the study, please send an email to Elizabeth Todd Brown, the principal investigator, at ebrow21@jhu.edu that includes the subject line "Withdraw from study."

If we learn any new information during the study that could affect whether you want to continue participating, we will discuss this information with you.

CIRCUMSTANCES THAT COULD LEAD US TO END YOUR PARTICIPATION:

Under certain circumstances we may decide to end your participation before you have completed the study. Specifically, we may stop your participation if you are no longer employed as a school site administrator in the context (school district) in which this study is taking place.

ALTERNATIVES TO PARTICIPATION:

Phase 2 of this study includes face-to-face follow-up to develop a site technology plan. If you are not selected to participate in Phase 2 but would like to receive face-to-face follow-up, please contact the student researcher, Alex Tietjen, at atietje1@jhu.edu. Your request will be accommodated.

CONFIDENTIALITY:

Any study records that identify you will be kept confidential to the extent possible by law. The records from your participation may be reviewed by people responsible for making sure that research is done properly, including members of the Johns Hopkins University Homewood Institutional Review Board and officials from government agencies such as the National Institutes of Health and the Office for Human Research Protections. (All of these people are required to keep your identity confidential.) Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records.

Records will be kept in several ways. First, responses to electronic surveys will be kept in documents that are password protected. Second, electronic recordings of the interviews in Phase 2 will be made on a digital recorder and then transferred onto a password protected folder on the student researcher's personal computing device. Finally, personal notes created by the student researcher will be kept in a password protected file.

All personal information collected for this research will be anonymized. Each participant will be assigned a number so that any information they provide is kept confidential. A physical codebook that connects the participant's name to their number will be kept in a locked cabinet. No electronic copy of the connection between code number and name will be maintained. All records will be destroyed 5 years from the date of collection.

COSTS:

There are no costs to participate in this research.

COMPENSATION:

You will not receive any payment or other compensation for participating in this study.

IF YOU HAVE QUESTIONS OR CONCERNS:

You can ask questions about this research study now or at any time during the study, by talking to the researcher(s) working with you or by calling Dr. Elizabeth Todd Brown, Visiting Professor Senior Education Advisor, JHU EdD Program.

If you have questions about your rights as a research participant or feel that you have not been treated fairly, please call the Homewood Institutional Review Board at Johns Hopkins University.

SIGNATURES

WHAT YOUR SIGNATURE MEANS:

Your signature below means that you understand the information in this consent form. Your signature also means that you agree to participate in the study.

By signing this consent form, you have not waived any legal rights you otherwise would have as a participant in a research study.

Participant's Signature **Date**

Signature of Person Obtaining Consent **Date**
(Investigator or HIRB Approved Designee)

Appendix I

Workshop Outline

Learner Objectives:
Participants will…

- Be able to discuss what kind of learning technology integration best supports.
- Be able to define what meaningful technology integration looks like in the classroom.
- Be able to identify when technology is being used meaningfully and when it is not.
- Understand the importance of using technology to support student learning.
- Understand why teachers and students need to be able to use technology in the classroom.
- Understand their role in making classroom technology integration successful.

Agenda

1. **Data Collection** **15 minutes**
    - **a.** Welcome participants
    - **b.** Present the consent form, gather signatures
    - **c.** Objective
    - **d.** Agenda
2. **"Homework, Oh Homework…"** **20 minutes**
    - **a.** Show video clip
        - **i.** The purpose of this video is to provide a vicarious experience to the participants that also serves as a reform message and implicates their practice (Gregoire, 2003).
        - **ii.** The video clip presents a vision of technology integration that is not currently present in the context in which the participants work.
    - **b.** Notice and wonder activity
        - i. After the initial viewing of the video clip, the clip will be played again. Participants will be asked to take notes during the second viewing, where they record what they noticed about the vision of technology integration presented in the video, and what they wonder about the vision of technology integration presented in the video. These notes will then be shared uncritically with the group to initiate the next phase of the discussion.
        - **ii.** This activity will employ both verbal persuasion and vicarious experiences for technology-related self-efficacy development.
    - **c.** Constructivist pedagogy discussion
        - **i.** Researchers have found a clear connection between constructivist styles of instruction and technology integration (Becker, 2000; Ertmer et al., 2012; Hsu, 2016). The vision of technology integration presented in the video clip represents a highly constructivist pedagogical approach that is supported through the use of technology. This discussion of the video clip is intended to help participants understand the connection between constructivist pedagogy and effective technology integration (Sawyer, 2014).

ii. This activity will employ both verbal persuasion and vicarious experiences for technology-related self-efficacy development.

3. **Education Technology Report** **20 minutes**
   a. Jigsaw reading of report
      i. The *2017 National Education Technology Plan Update* (U.S. Department of Education, 2016) outlines a vision for technology integrations that is integral to the desired final outcome, equitable use of technology to complete meaningful work. The report is presented to provide grounding for the work of this workshop. Participants will be assigned a short section of the report and will then report on the portion they read to others who read a different section so as to engage them in the work and decrease the amount of time needed to effectively engage with the text.
   b. Socratic discussion
      i. Next, a structured discussion will take place. Participants will be assigned roles so as to facilitate the discussion and increase engagement. The discussion will be framed so that a clear connection between the constructivist use of technology identified in the previous activity and the requirements of the *2017 National Education Technology Plan Update* (U.S. Department of Education, 2016) are clear.
      ii. This activity will employ both verbal persuasion and vicarious experiences for technology-related self-efficacy development.
4. **Civilization Builders** **100 minutes**
   a. Activity
      i. Participants will be formed into three groups of three and will use digital devices to research the components of civilization, devise the basic components of a civilization, and then create specific artifacts related to their imagined civilization.
      ii. This activity is structured as a technology-embedded constructivist learning opportunity. The intent is to demonstrate the value of technology when employing constructivist pedagogical approaches so that at the end of the workshop when participants are designing a vision for technology integration, it includes constructivist uses of technology that are supported in the literature regarding effective technology integration (Becker, 2000; Ertmer et al., 2012; Hsu, 2016; Sawyer, 2014).
      iii. This activity will serve as a protected mastery experience to promote technology-related self-efficacy growth.
5. **Working Lunch** **60 minutes**
   a. Presentation of civilization artifacts
   b. Debrief of experience, and the way the technology informed what they are able to learn, create, or accomplish.
   c. This activity will employ both verbal persuasion and vicarious experiences for technology-related self-efficacy development.
6. **Video Vignettes** **30 minutes**

a. Participants will watch video vignettes of technology integration occurring in a classroom.
b. This activity will employ both verbal persuasion and vicarious experiences for technology-related self-efficacy development.
c. Socratic discussion of effective uses of technology and ineffective uses of technology in the videos.
d. Participant responses will be collected electronically during the discussion to further demonstrate the possible uses of technology in effective instruction.

7. **Break** **10 minutes**
8. **Defining Effective Technology integration** **30 minutes**
   a. Participants will be split into an elementary and secondary group and will synthesize their experiences, as a small group, to collaboratively discuss and define effective technology integration at each level. The two groups will then present the definition they arrived at to the other group.
9. **Developing a Technology Vision** **90 minutes**
   a. Participants will extend their definition of effective technology integration into creating a coherent vision for technology integration in the district, that incorporates what effective technology integration is for administrators, teachers, and students.
10. **Conclusion and Explanation of Phase 2** **15 minutes**
    a. Phase 2 of the intervention will be explained to the participants before the end of the workshop.
       i. Individual Coaching Session
          1. The individual coaching session, which is the first follow-up activity, will be explained to the participants as a 1-hour meeting with the facilitator to plan the participant-led workshop they will lead at their site.
       ii. Participant-Led Workshop
          1. The participant-led workshop will be the second follow-up activity of the intervention. The participants from this workshop will lead a workshop at their school site with their staff to create a plan for implementing the jointly created district-wide technology vision.
       iii. Interview
          1. The final follow-up activity, the interview, will be described to the participants.
    b. Before leaving the workshop, participants will schedule all three follow-up activities with the facilitator.

Total Time: 6.5 hours

Curriculum Vitae

Alexander S. Tietjen

1410 W. Beverly Drive, Visalia CA 93277 ■ atietjen@gmail.com

Education

the Johns Hopkins University Graduate School of Education, Baltimore MD 2020
Ed. D.
Course Specialization: Technology Integration in K16 Education
Dissertation Focus: Technology integration leadership through technology-related self-efficacy development

California State University Fullerton, Fullerton CA 2016
M.S. Education
Course focus: Educational Technology

California State University Fresno, Fresno CA 2010
Teaching Credential
Specialization: Single-subject, History

University of California, Santa Barbara, Santa Barbara CA 2006
B.A. History

Professional Experience

Burton School District, Porterville CA
- *Director of Educational Technology* (2018-2020)
- *Academic Technology Coordinator* (2015-2018)
- *Academic Technology Coach* (2014-2015)
- *History Teacher* (2011-2014)

SCICON Outdoor School of Science and Conservation, Springville CA
- *Outdoor Education Intern* (2006-2007)

Conference Presentations

Curriculum and Instruction Steering Committee Symposium, Monterey CA
- *Adapt, adopt, abandon: Insight and resources from a district-wide NIC implementation K-12* (February 20, 2020)

EdTechTeacher, Palm Springs CA
- *Planning for serendipity: Making technology integration successful* (January 30, 2018)