

Running head: A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

AN EVALUATION FOR HOW THE INNOVATOR, INNOVATION, AND CONTEXT
AFFECT TECHNOLOGY INNOVATIONS IN A K-5 SETTING
BY

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ABSTRACT OF THE DISSERTATION

An Evaluation for How the Innovator, Innovation, and Context Affect Technology Innovations
In a K-5 Setting

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There are a variety of factors that can facilitate or constrain technology use in classrooms (Hew & Brush, 2006). Using a modified version of the framework for Conditions for Classroom Technology Innovations (Zhao et al., 2002), this study explored how the innovator, innovation, and context impact technology use in four K-5 elementary schools. The TPACK framework was used to analyze teacher knowledge and support structures (Mishra & Koehler, 2006). Research has called for more contextualized studies in schools, that include stakeholders like teachers and administrators, and that focus on supports like vision, access to technology, training, collaboration, and technical support. Of particular importance is not just the availability of these supports but how well they flexibly and responsively meet the needs of teachers (Granger et al., 2002; Rutkowski et al., 2011).

Therefore, the purpose of this study was to conduct a program evaluation to determine the needs of teachers using the framework so the district could improve context supports to better meet teacher needs and improve teaching practices. Study participants included fifty-eight teachers who participated in a survey—twenty of whom also participated in focus groups. Other relevant stakeholders included technology coaches, principals, tech support personnel, and central office administrators who participated in interviews or focus groups.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

The findings established a wide variety of needs that could benefit from greater responsiveness from the supports the district has established. The innovators demonstrated a need for more ongoing, detailed training for basic technical knowledge before widespread integration at the level of TPACK could be established. With increased access to a variety of technologies, “easy and efficient” use is needed if teachers are going to be able to properly integrate the number of tools that are becoming available to them due to decreased costs for new technology. Also important were underlying beliefs that were hindering greater technology integration, particularly with decentralizing the classroom for more student-centered practices. Teachers had a variety of “distances” between themselves and technology, and between the desired technology practices and their current practices.

The implications call for the district to more purposely use teachers’ needs to drive the flexible supports it already has in place. This includes articulating a short-term vision and improving the coordination of support structures to help all teachers meet the vision. Those supports would involve ongoing discussions about teacher pedagogical beliefs, increased coaching during the school day, structured collaboration to meet the vision, and more ongoing training for basic technical knowledge. This study shows the importance of using all relevant stakeholders to evaluate a program for improved practices and to use teacher needs to coordinate improved context supports.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

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A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

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A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Dedication

To Emily, Paige, Cameron and Charlie- You bring meaning to this and everything else.
To my parents, Tom and Barbara, and my brother Mark, dedicated teachers both inside and
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A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Table of Contents

Abstract.....	ii
Acknowledgements.....	iv
Dedication.....	vi
List of Tables.....	ix
List of Figures.....	x
Chapter 1: Introduction.....	1
Problem of Practice.....	4
Evaluation Purpose.....	10
Chapter 2: Literature Review and Conceptual Framework.....	12
Literature Review.....	12
The Innovators.....	12
The Innovation.....	24
The Context.....	26
Conceptual Framework.....	37
Chapter 3: Methodology.....	39
Evaluation Design.....	39
Data Collection Procedures.....	43
Data Analysis.....	48
Validity.....	49
Chapter 4: Findings.....	51
Analysis Framework.....	51
The Innovator.....	51

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Basic Technical Knowledge.....	52
Technological Content Knowledge (TPACK)	62
Technology and Teacher Pedagogy Compatibility.....	73
The Innovation.....	84
Vision.....	85
Distance from Current Practices.....	88
Distance from Technology.....	96
The Context.....	105
Responsive Technical Staff.....	105
Knowledgeable Group of Translators.....	110
Professional Development.....	123
Social Infrastructure.....	138
Chapter 5: Discussion of Findings.....	148
Discussion.....	148
Implications.....	157
Future Research.....	168
Limitations.....	168
References.....	170
Appendix A.....	177
Appendix B.....	178
Appendix C.....	183
Appendix D.....	191
Appendix E.....	192

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

List of Tables

Table 1. Stages of Instructional Evolution in Technology Rich Classroom.....	15
Table 2. Research Questions, Data Sources, and Data Analysis.....	40
Table 3. Data Collection and Analysis Timeline.....	41
Table 4. Survey Results: Technology Knowledge, Time to Plan, and PD.....	52
Table 5. Survey Results: Teacher Beliefs About Technology.....	73
Table 6: Survey Results: Teacher Beliefs About Professional Development.....	124

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

List of Figures

Figure 1. Pedagogical Content Knowledge and Technology as Separate.....	18
Figure 2. Technological Pedagogical Content Knowledge (TPACK) as Integrated.....	19
Figure 3. Context Supports.....	33
Figure 4. Concept Map.....	38
Figure 5. Sources Used to Assess Teacher Needs.....	161
Figure 6. District Integration PLC.....	163
Figure 7. Goals for Support Structures.....	163
Figure 8. Timeline for Roll Out and Training.....	166

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Chapter 1: Introduction

Fulfilling the promise of a technologically integrated classroom has been elusive (Cuban, 2001; Cuban, Kirkpatrick, Peck, 2001; Gray, Thomas, & Lewis, 2010). In 1995, over a decade after computers started to make their way into schools (Sandholtz, Ringstaff, & Dwyer, 1997), Tyack and Cuban succinctly summarized the lack of successful technology integration as, “Computers meet classrooms, classrooms win.” At that time, there was serious doubt that computers would become successfully integrated by teachers in transformative ways (Cuban, 2001; Cuban et al., 2001). These skeptical arguments concluded that computers would follow the fate of other innovations, that they would be used as peripheral extras whose promise would fade (Cuban, 2001; Cuban et al., 2001; Tyack & Cuban, 1995). However, even skeptical forecasts came with the caveat that computers did appear to have more potential, and could have greater lasting effects, than the innovations that came before them like radio, film, or the video projector, but that the conditions for integrating them were not ideal (Tyack & Cuban, 1995).

Like previous innovations, computers have been thrust into schools by well-meaning administrators and those outside of education, “techno-reformers” (Cuban, 1996). Historically, teachers have not been asked whether they wanted the machines nor have they typically had input as to the types of machines or software they might find useful. When teachers haven’t used computers as others have intended, they have often been labeled technophobes—despite the fact that teachers have historically taken up innovations that help them solve the myriad of challenges posed by classroom life (Cuban, 1986; Cuban, 2001). When deciding what technologies to implement, teachers often weigh the amount of time needed to learn to use the technology compared to the payoff for themselves and their students (Cuban, 1986; Cuban, 2001; Sandholtz et al., 1997). It has also been noted that the very structure of their work-life in schools, and how

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

professional development typically is conducted, hinders their ability to make complex and time-consuming changes (Elmore, 2002), that technology can require (Mishra & Koehler, 2006).

However, despite a history of limited success for many technology innovations in classrooms, the seemingly enormous potential of computer technology to improve, and possibly transform education on a wide scale, has compelled many schools to invest great sums of money to provide greater access to teachers and students (Cuban, 2001; Gray, et al., 2010). Student to computer ratios on average were 125:1 in 1981, 18:1 in 1991 and between 5:1 or 2:1, depending on the definition, in 2010 (Cuban, 2001; Gray, et al., 2010). The rationale for increasing access to technology has been that teachers can't integrate computers that they don't have access to, and there was evidence that teachers who did have greater access, were more likely to integrate computers more consistently (Becker & Ravitz, 2001). While improved access is certainly part of the solution, it has proven to be an insufficiently small part of the solution (Ertmer, & Ottenbreit-Leftwich, 2010; Hew & Brush, 2007; Mishra & Koehler, 2006; Zhao, Pugh, Sheldon & Byers, 2002). As greater resources have been provided, still with lackluster results, there has been concerted focus on other factors involved with technology integration (Ertmer, & Ottenbreit-Leftwich, 2010; Hew and Brush, 2007; Zhao et al., 2002).

In an analysis of empirical studies about technology integration in schools from 1995 to 2006, 123 total barriers to technology integration were found (Hew & Brush, 2007). This substantial documentation of barriers undermines common assumptions that teachers simply need to possess basic skills and a good attitude to integrate technology effectively (Zhao et al., 2002). While improving access to resources was the most widely cited factor, buying technology wasn't a sufficient answer to solving the problem of resources (Hew & Brush, 2007). Providing technology support that includes time for teachers to plan the use of technology, and the degree

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

to which the technology was considered “easily accessible” were major factors (Hew & Brush, 2007; Zhao et al., 2002). In addition to increased access to resources, many of the other barriers can be largely categorized into three main factors for successful technology innovations, the innovator, innovation, and context, which will help structure this study.

First, the innovator includes the technology knowledge that the teacher has, as well as how well aligned the innovator’s pedagogical beliefs are with the capability of the technology. Second, the innovation includes the relative distance between the teacher and the available resources as well as the relative distance between the desired technology practices and the teacher’s current practices. Particular focus will be on how technology moves teachers from the center of the classroom and how some students might know more about technology than their teachers do (Bennett & Maton, 2010). Third, the context includes the technological infrastructure, the human infrastructure, as well as the organizational culture of collaboration. These three factors interact to impact the degree to which technology innovations are successful (Zhao et al., 2002) and will inform the theoretical structure for this study.

Fortunately, the identification of the barriers can help lead to discoveries about how schools can improve their technology integration. Research has documented ways in which some teachers and schools have been able to overcome many of these barriers (Granger, Lotherington, Owston, & Wideman, 2002; Hughes, 2005; Sandholtz & Reilly, 2004; Teo & Wei, 2001). However, there is no simple recipe for success and the changes required of teachers and schools are substantial. Making the transition to a more technology-rich classroom, and the possibility of transforming teaching and learning by utilizing technology, will likely be a slow and carefully cultivated process (Sandholtz & Reilly, 2004; Zhao et al., 2002).

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Problem of Practice

Warren Township School District was the setting for this study because it was where the researcher worked. It was an appropriate place to study because Warren's path to greater technology integration mirrored the unfulfilled promise that has been documented in many schools from the research literature. Warren had been providing teachers with greater access to technology in the hope that improved access would lead to increased use. This increased use could then lead to uses that would promote two outcomes. First, it can provide students with technology skills and knowledge for a 21st Century world that they will inhabit as adults. Second, it could be part of transforming teaching and learning in ways that improve educational outcomes. This transformation was understandably in its early stages and could benefit from a baseline assessment. Over the last few years, technology use had become expected in classrooms, but a coherent technology program with clear goals and training had not yet been established. Therefore, this study was a formative program evaluation that would provide feedback to Warren on how it can begin to create a more comprehensive technology program.

The gap between the desired technology use and actual technology use was officially articulated as part of the district's strategic planning process that took place during the 2012-2013 school year. At that time, a team of district parents, teachers and administrators met with the purpose of assessing the current state of the district's technology use and writing goals for desired future use that included strategies to help accomplish the goals. The goal was centered on creating a technologically innovative classroom experience (see Appendix A) and many of the strategies were focused on supporting teachers to help them meet this newly articulated goal. The problem of practice will be further detailed using the framework, the innovator, innovation and the context.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

The Innovators

Warren's population of teachers, the innovators, were like many found in the research literature (Ertmer, & Ottenbreit-Leftwich, 2010; Hew & Brush, 2007). There existed a spectrum of beliefs about the exact role technology should play in schools. Some teachers held the belief that technology was simply one more objective for them to accomplish, or that time with technology would take away from time that was needed for other, more pressing, needs—both in regards to teacher planning time and classroom learning time. There were also a range of beliefs about if, and how, the technology actually improves student learning. However, what was unclear was the exact nature and scale of the problem with teacher beliefs. For example, one problem with teacher belief was that some teachers didn't believe technology could be useful to them or they questioned their own ability to enact quality use.

Of particular importance in Warren was the compatibility between a teacher's pedagogical beliefs and the technology's intended use in the class—considering the decentralizing nature of technology that might be at odds with a more traditional teacher-centered classroom (Cuban, Kirkpatrick, Peck, 2001). The district had previously attempted balanced literacy reforms that were differentiated and child centered, and there were lingering doubts amongst teachers about the efficacy of those ideas. If a technology is purchased to assist in differentiated instruction, and a teacher has resisted that in the past, the technology use will not align with the teacher's pedagogical beliefs and the teacher is likely to resist the technology, or try to use it in a more teacher-centered way.

Another conflict between technology and pedagogical beliefs that can arise is who in the classroom is the source of information. Students have been called “digital natives” because technology has been a part of their world for their entire lives. Their teachers are more likely to

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

be considered “digital immigrants” since many have come to live in our new technologically infused landscape (Bennett & Maton, 2010). There is debate about the value and accuracy of the digital native theory. Digital natives might possess a range of knowledge, that includes some students knowing more than their digital immigrant teachers. However, there is at least the perception, and the possible reality, depending on the ability and knowledge of the individual teacher or student, that some of the students have more skills and knowledge than their teachers (Bennett & Matton, 2010). This power shift, or the threat of a power shift, would exacerbate the decentralizing tendencies that many of the technologies already have.

Rarely in school do students have the potential to possess greater knowledge and power than their teachers and this fact could place even the most student-centered teachers at unease. The implications for the classroom are that this new technology could easily come into conflict with the current beliefs of teachers, thus hindering the success of classroom innovations. In addition to the problems associated with teacher beliefs, there were substantial limitations with basic technical knowledge and technology integration knowledge amongst the faculty.

Skills and Knowledge

Similar to belief, there was a spectrum of knowledge and skills across the faculty that hindered the district’s ability to implement technology at uniformly high levels. Knowledge for this study focused on basic technical knowledge and knowledge required to integrate technology effectively, known as Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006). The basic technical knowledge that teachers need included how to fully operate the technology available to them and how to troubleshoot common technical problems. An important guide, in this study, for how much teachers needed to know in terms of basic skills was whether they could use their technology “easily”. Some teachers had good technology

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

knowledge but didn't know how to make the technology part of their daily routine while others did not have the skills to enact the technology at all. Developing complex knowledge of integrating technologies that promote improved learning was an area that all teachers needed to improve upon. Part of this knowledge involved understanding the different types of technology uses, like how each technology might offer replacement, amplification, transformative uses, or a combination of these uses (Hughes, 2005; Pea, 1985). These uses, and TPACK, will be discussed in greater detail later in the Literature Review (Mishra & Koehler, 2006).

As noted when discussing beliefs, some students could know more about technology than their teachers and this lack of knowledge could prevent teachers from leading classroom change if they don't know how to let their students take the lead in productive ways. This problem could lead some teachers to believe that they couldn't start their technology use until they knew more than their students, especially if their belief was that they are the center of the knowledge, or they think they should have greater knowledge about the technology in order to plan effective instruction.

The Innovation

Warren's innovation was its technology vision statement and the tools it had purchased to help teachers achieve the vision. To highlight what Warren wanted to accomplish with its technology, a brief look at part of the strategic planning document is needed. The stated goal is below.

We will strive to provide a cutting-edge, technology-rich environment conducive to our students becoming creators, collaborators, upstanding digital citizens, critical consumers, and innovators.

While Warren wanted to provide a "cutting edge" and "technology-rich" environment, it also wanted to incorporate goals from its 21st Century learning initiative like collaboration and

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

creativity, which envision a more student-centered, open-ended, real-life problem solving environment with integrated subject matter that promotes student ownership of learning. Included in this vision would be to use technology as an integral tool that could improve engagement, help integrate subject matter, greatly expand access to resources, differentiate learning, and promote a more seamless home and school connection—all while using these learning activities to promote students' technology skills and knowledge.

This study focused on K-5 classroom teachers and the technologies that were available to teachers in this setting. These technologies included interactive whiteboards (SMART Boards), computers (including laptops and desktops with access to the internet), Chromebooks, iPads and a variety of websites for spelling, reading and writing instruction (which will be referred to as the “digital tools”) and will be explained in greater detail in Chapter 4, the Findings section.

An important factor for the innovation was the relative “distance” these technologies were from the teachers, particularly how “easy” their access was (Zhao et al., 20002). Also important was the relative distance between the desired practices and the teachers' current practices. Within the district there were varying levels of access that created differing distances and thus made access easier for some more than others. There were also varying levels of distance between teaching practices of some teachers and the desired practices. These were mostly about the basic structure of a teacher's classroom, particularly the level of teacher or student centeredness the teacher's classroom was.

Context

Within Warren's vision statement was the desire to provide more training and support so teachers could feel “competent”, “confident”, and “inspired” with their technology use. The district was striving for ubiquitous use, not just pockets of excellence. This vision would require

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

a planned and coordinated approach to the introduction, adoption, and sustainability of the changes teachers needed to make. The three main elements of the context section are the technological infrastructure, the human infrastructure, and the organizational culture that together can create a context with a pervasive IT culture (Teo & Wei, 2001, p. 404; Zhao et al., 2002).

Part of a robust context for technology integration is a strong professional development program (PD) to train and support teachers (Sandholtz & Reilly, 2004; Teo & Wei, 2001; Zhao et al., 2002; Valcke, Rots, Verbeke, & van Braak, 2007). Warren offered training over the summer and throughout the school year. Teachers also had access to supports like coaches and other local experts, but it was unclear how effective the training and support was. One problem was that in the past, many training sessions had been optional and attracted the teachers who were more inclined to use technology. Training was also not coordinated by specific teacher needs, sustained over a long enough period of time to effectively support teachers, or focused on a particular vision. How coaches were utilized was also a problem since they were the local experts that were needed to improve classroom practices. Coaches were full time teachers who could offer help, either before or after school, or on their prep period. Another important factor was the social infrastructure, which involved the collaborative environment for teachers and the culture of teacher professionalism—specifically on the topic of teachers taking responsibility for their own learning.

The strategic planning process articulated the need for more training and support. However, in order to make the right changes, this study was intended to determine how teachers, administrators, and district coaches thought the training was meeting teacher needs and what else they felt was needed to improve supports for technology integration across the district. Gaps

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

between what was taking place in Warren and what the research says is ideal were also identified and used to make suggestions for improvements.

While Warren knew it had areas for improvement with the innovators, the innovation, and the context, this study provided more detail about the scale and nature of the problem. These three factors were used to help inform the structure of the theoretical framework, the methodology, the findings, and the suggested solutions that arose from this study.

Evaluation Purpose

A utilization-focused developmental program evaluation was used to help clearly define Warren's needs for improved technology integration. An evaluation can help inform why gaps exist between the envisioned practices, and actual technology use (Patton, 2008). The questions that guided this evaluation were focused on the major factors involved with the integration of technology. For the innovators, the focus was on teacher pedagogical beliefs, teacher basic technical knowledge, and technology integration knowledge. For the innovation, the focus was on the stated vision for technology, and the access to technology in terms of the relative distance between teachers and the technology. Also important for the innovation was the relative distance between current teacher practices and desired practices. For the context, the technical infrastructure was explored to see if it was dependably working. The human infrastructure depended on a pervasive IT culture that included training and support that met teachers' needs as well as a culture of collaboration that could help teachers make the changes they need to make. These factors can act to enable improved technology uses or act as barriers to uses that include replacement, amplification and transformative uses (Ertmer & Ottenbreit-Leftwich, 2010; Hew & Brush, 2007; Hughes, 2005; Pea, 1985).

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Utilization focused evaluation is done for the people who will use the evaluation (Patton, 2008)—in this case, district stakeholders such as the teachers, administrators and the trainers for technology. To encourage their use of the findings, they were included in developing the evaluation. Once the evaluation began, the users were kept aware of preliminary findings and were included in decisions that were made throughout the evaluation. By including them in the evaluation process, it is more likely they will use the findings. Evaluation is about finding out; if what the organization wants to happen, is actually happening—it is “a form of reality testing” (Patton, 2008, p. 43).

Questions Guiding This Evaluation

Central Question

What is current state of technology integration in the district and how does this relate to the technology integration envisioned in the strategic plan?

Research Questions

1. What are teacher pedagogical beliefs, skills, and technology integration knowledge for K-5 classrooms? (Innovators)
2. What is the distance between the teachers and the tools, and between the envisioned teacher practices and their current practices? (Innovation)
3. How are training, vision, coaching, teacher professionalism, and collaboration impacting use? (Context)

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Chapter 2: Literature Review

Research on the innovators, the innovation, and the context (Zhao et al., 2002), will be reviewed to help provide a framework for the methods and analysis. How teachers are trained to use technology was an essential part of this evaluation. They need time to acquire skills and knowledge by having, a chance to experiment with the technology, successful experiences, the chance to work with knowledgeable peers and role models, as well as a professional development program within the context of their work (Ertmer & Ottenbreit-Leftwich, 2010; Hew and Brush, 2007; Teo & Wei, 2001). In order to help change their pedagogical beliefs, teachers need to think technology can help them achieve their instructional goals (Hughes, 2005). School context is the final key element in the integration of technology. Schools that are well equipped, have a vision for use, are supportive of technology integration, and allow for collaborative peer interactions to help explore technology solutions over time are successful in creating a context that improves technology integration (Sandholtz & Reilly, 2004; Zhao, et al., 2002).

The Innovators

The innovators, were the starting point for this study because they are the ones who need to incorporate technology effectively. In that sense, their high quality uses are part of the desired outcome of Warren's technology plan. Students won't be exposed to high quality, technologically integrated classrooms that can improve learning, without teachers knowing what is needed to create those situations, nor will students develop their own skills and knowledge through effective classroom activities. For Warren to achieve its plan, teacher knowledge and belief are critical and a review of the literature in these areas will shed light on the major issues for these factors.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Basic Technical Skills and Integration Knowledge (TPACK)

Technical knowledge plays an important role in technology use (Ertmer & Ottenbreit-Leftwich, 2010; Mishra & Koehler, 2002; Sandholtz et al., 1997; Sandholtz & Reilly, 2004). Providing teachers with the skills and knowledge they need in order to use technology effectively can begin to change their beliefs about their technical abilities and improve their uses of technology (Teo & Wei, 2001). What teachers need to know can range from the simple to the complex. Technology skills can seem like a long, and constantly changing, list of hardware and software items that teachers need to learn to use effectively. In general, teachers need to know how to fully operate the technologies they are expected to use (Teo & Wei, 2001). The need for basic skills should not be overlooked because without them, the more complex integration will have trouble becoming routine (Hew & Brush, 2007; Mishra & Koehler, 2002; Zhao et al., 2002).

This basic operational knowledge includes how to fully operate hardware and software. It also includes how to install and operate any device that needs to be connected to the technology and how the underlying systems, like wireless systems, interact to help the technology function. Along with how to operate the technology, teachers need to know how to use it effectively and anticipate student technology skill and knowledge needs in their specific context to promote learning. This involves understanding the complex interplay of content, pedagogies, and technology (Mishra & Koehler, 2006). In addition to having their own learning needs, teachers are also confronted with the fact their students have learning needs in terms of skills and knowledge, and that some of their students might know more than they do about how to use certain technologies (Bennet & Maton, 2010). Finally, technology tends to disrupt the typical classroom structure, and can lead to more unpredictability, so some teachers need to learn how to

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

restructure their classroom management strategies for technology use to be effective (Sandholtz et al., 1997).

Early studies of teachers, who integrated technology well, focused on how those teachers had more skills and knowledge than the teachers who didn't use technology well (Becker, 2000). State and national standards for technology were, and still are, mainly focused on the need for teachers to learn technology skills so they can use the technology effectively (Sandholtz & Reilly, 2004). While basic technology skills are needed, focusing solely on skills might slow the process of integration and could focus teachers on technical aspects of using technology as opposed to integration in their classroom. The following two bodies of research elaborate on integration and the complex knowledge that it requires.

Teachers, Not Technicians

Research from the Apple Classrooms of Tomorrow studies (ACOT) shows that teachers in technology rich classrooms with sufficient access to technology and collegial support went through an instructional evolution over time (Sandholtz et al., 1997). When certain supports are in place, teachers can move through this evolution more quickly (Sandholtz & Reilly, 2004). Progress can occur more quickly when technology is purchased to accomplish specific learning outcomes and training is tailored to these uses. These findings come from a longitudinal study that took place over a five-year period in a K-8 public school district where all teachers had access to equivalent equipment, training and support. Data was collected from documents, surveys, teacher journals, interviews and classroom observations. In this program, teachers integrated technology more frequently and moved through the instructional evolution process more quickly than in the ACOT studies. Researchers classified these stages of development, which included skills and knowledge, but focused on the application of those skills for more

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

“dynamic learning experiences for students” which is one of Warren’s long-terms goals (Sandholtz & Reilly, 2004, p. 2). These stages recognize that skills are needed but place the emphasis more on the desired results of those skills and knowledge—changed teaching practices. See Table 1 below for the stages of evolution with technology from the ACOT studies.

Table 1. Stages of Instructional Evolution in Technology Rich Classroom

Stage	Definition
Entry	Learning the basics of using technology; technical issues dominate
Adoption	Move beyond struggling with the technology to successfully using technology on a basic level in ways consistent with existing teaching and learning practices
Adaptation	Move from basic use to using technology for increased productivity; More frequent and purposeful use of technology, but little change in existing teaching and learning practices
Appropriation	Use technology "effortlessly" as a tool to accomplish instructional and management goals
Invention	Use technology as a flexible tool in the classroom. Learning is more collaborative, interactive and customized; new teaching and learning practices emerge

These stages are mentioned here because part of the technology knowledge that teachers need to know about is the range of technology possibilities that research has documented. For example, the third stage of development, adaptation, describes a teacher who is very competent with her technology but is using it in ways that have not substantially changed her teaching practices. This teacher might feel she has mastered her technology but is actually at the point where she could begin to develop more sophisticated uses. Understanding, and knowing the possibilities of

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

technology, as documented by researchers, could help her start innovating further. There will be more about the conditions for changing teacher knowledge from the ACOT studies in the Context section because the context in which the ACOT teachers improved their instruction can inform how Warren's supports are evaluated.

Technologies can offer enhancements to current pedagogies, create efficiencies, and even cause teachers to rethink current teaching practices (Mishra & Koehler, 2006). Similar to the importance of understanding the stages of development is understanding different types of technology use. Technology uses can be categorized as 1) **replacement** uses that simply replace an existing strategy with a new technology strategy, 2) **amplification** that makes accomplishing a current task more efficient or effective, and 3) **transformation** which can change the way teachers and students interact, their learning routines, and methods for problem solving (Hughes, 2005; Pea, 1985). Warren Township teachers and administrators can utilize these three types of uses to begin to reflect on their current practices as well as begin to think about more complex technology integration practices that are desired. Therefore, these categories of technology use should become part of the knowledge base for teachers.

While schools need to focus on helping teachers learn the skills that are necessary to use the technologies at their disposal, those technologies change over time—creating new skills and knowledge for teachers to learn (Sandholtz et al., 1997). Because skills and knowledge change over time, it is helpful to have a broader framework to think about technology integration knowledge and its relation to teaching and learning in classrooms. A framework can help analyze teaching practices and create relevant professional development (Mishra & Koehler, 2002).

A Framework for Skills and Knowledge

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

In addition to the need for teachers to develop basic technology skills, there is a need for teachers to develop an understanding of the interplay between technology, the content they need to teach, and the pedagogies they use to teach that content (Mishra & Koehler, 2006, p. 1017). Within a framework that integrates these three components, training teachers to simply operate new hardware and software is insufficient because the training will fall short of the essential aspect about how the technologies can interact to promote greater learning. Therefore, in addition to the question of what teachers need to know about operating the technology, is the question of how teachers should incorporate them into their teaching practices (Mishra & Koehler, 2002). New teaching methods that technologies offer can challenge teacher belief systems, and possibly hinder commonly used pedagogies. Not only is this interplay of content, pedagogy, and technology the most complex part of the integration task for teachers, it is also an area that is often not addressed in training (Hew & Brush, 2007).

Teachers benefit from training that is focused on context-specific uses that improve learning (Hughes, 2005), so they can use this knowledge for integrating technology. There is a need for more contextualized professional development to help support teachers over the long term so they can begin negotiating the impact that technology has on content and pedagogies (Mishra & Koehler, 2002). Consequently, teachers often do not use the suggestions provided to them at training because they are not specific enough to meet their grade level or subject matter needs (Hughes, 2005).

Situated training that connects specific technology uses with specific content and curricular goals is critical (Hughes, 2005). The more specific the link between the technology and the learning outcomes, the more likely it will be that teachers understand how the technology helps students learn, which in turn, increases the likelihood that they will not only use the

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

technology, but use it effectively (Hughes, 2005). This interplay between the content that needs to be taught, the pedagogies that teachers use in their contexts, and the capabilities of the technology, create a new knowledge that combines all three, known as Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006).

The knowledge of how content and pedagogy interact is known as “Pedagogical Content Knowledge” (PCK) (Mishra & Koehler, 2006). Technology is often seen as a separate part of this knowledge as shown below (Figure 1). Mishra and Koehler (2006) argue that when technology is added to the classroom learning experience, its effective use requires a new type of knowledge, TPACK (Figure 2).

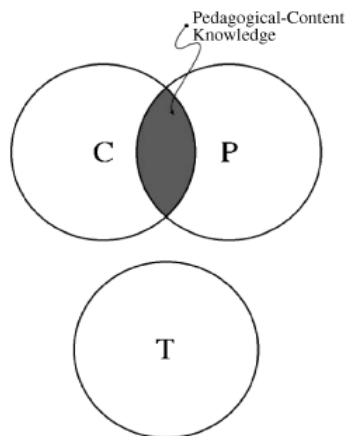


Figure 1. Pedagogical Content Knowledge and Technology as Separate.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

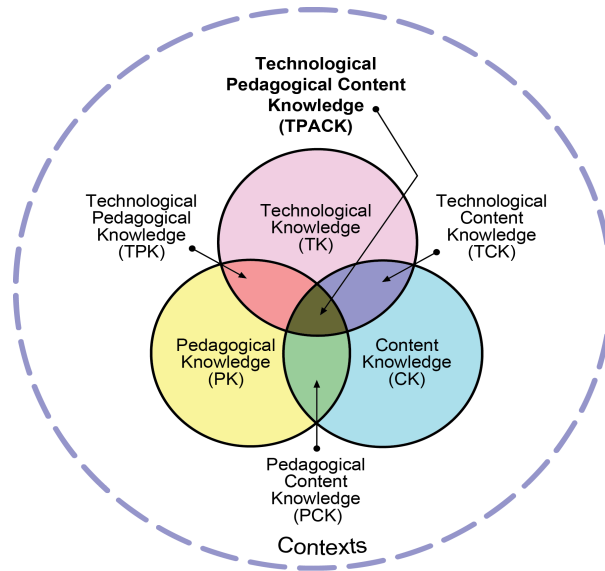


Figure 2. Technological Pedagogical Content Knowledge (TPACK) as Integrated. (TPACK.org, 2012).

“TPACK represents a class of knowledge that is central to teachers’ work with technology. This knowledge would not typically be held by technologically proficient subject matter experts, or by technologists who know little of the subject or of pedagogy, or by teachers who know little of that subject or about technology (p. 1029)”.

There is “no single technology solution that applies to every teacher, every course, or every view of teaching”, and that “quality teaching requires developing a nuanced understanding of the complex relationships between technology, content, and pedagogy, and using this understanding to develop appropriate, context-specific strategies and representations” (Mishra & Koehler, 2006, p. 1029).

Since TPACK’s introduction in 2006, it has been used most simply as a way to bring attention to the idea that technology use in schools, and therefore the training and support, should be thought of as a new type of knowledge that exists at the intersection of technology, content, and pedagogy (Mishra & Koehler, 2006). Thought of another way, TPACK represents the “unique knowledge” teachers need to have about technology and how “it enables or constrains”

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

their efforts to help learners master specific subject matter (Brantley-Dias & Ertmer, 2013, p. 120). For teachers, when thinking about a specific content goal, they should be able to decide which technology use would be best at helping them accomplish their goals for learning.

Having TPACK knowledge enables teachers to create learning activities than can, not only integrate technology with Common Core objectives, but also help students build their own skills and knowledge. If teachers can properly integrate these varied goals, technology becomes less of an add-on objective and more of an effective way to accomplish needed objectives while giving students the skills that are desired. Therefore, technology integration knowledge, TPACK, is an integral goal for teachers. In addition to knowledge, beliefs play an important role in how teachers will change their practices.

Belief

Belief is widely considered to be an important indicator of how people, in general, will behave (Bandura, 1986; Rokeach, 1968). Specifically, the best predictor of behavior and motivation is the belief in one's ability to competently complete a task (Bandura, 1986). Technology use is no different. If teachers believe that they are capable of successfully using the technology, that technology is an important part of instruction, and a worthy skill and knowledge for students they are more likely to increase their use (Ertmer, Addison, Lane, Ross & Woods, 1999; Prestridge, 2012). This is especially important because understanding what people believe is needed to inform how they should be taught or trained (Nespor, 1987; Pajares, 1992), which has implications for the Context section of this framework. While there is some debate about whether knowledge or beliefs are the most important factor in technology integration, belief has been shown to be an important factor to include in a study of technology integration (Ertmer,

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

1999; Granger et al., 2002; Hew & Brush, 2007; Hughes, 2005; Sandholtz & Reilly, 2004; Teo & Wei, 2001)

In their analysis of the broad base of research about technology integration, Hew and Brush (2007) framed the conditions in which teachers' beliefs about technology integration changed. There needed to be 1) a clear vision for technology use, 2) provision of necessary resources, 3) ongoing professional development, and 4) encouragement for teachers. These conditions will be addressed further in the Innovation section when discussing access to tools and in the Context section when discussing vision and context supports for better practices. However, the vision for technology in particular has implications in terms of beliefs.

Having a clear link between the technology and its use in the classroom is an important factor when teachers decide if they are going to use the technology (Hughes, 2005). Using case study methods, Hughes followed four teachers over the course of a year as they tried to implement technology that they had been exposed to through general workshop training and graduate coursework. Hughes found that teachers integrated technology more readily when they saw a direct link between the technology and their teaching goals. These four teachers, who volunteered to participate in the study, and had experience levels that ranged from three to twenty-six years of teaching, could be described as technology oriented. All had previously sought out technology training on their own and had implemented technology independently—not within a structured school implementation plan. These teachers do not represent the typical spectrum of teachers who might not believe technology can be effective, who might be fearful of technology, or who are less skilled with technology. In this sense, the findings speak to the best technology users. It can be inferred that less tech-oriented teachers may follow less successful paths when integrating technology.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Even these four “technology oriented” teachers, when training and support were general, didn’t always see the link between the technology and its use in the classroom, which hindered their belief in the technology’s utility (Hughes, 2005). When one teacher didn’t see the connection, he didn’t use the technology. He reported that he was waiting to figure out a use in his classroom—despite his past history of learning technology on his own and implementing it in his classroom. Another teacher reported he was not willing to dedicate the time needed to learn the technology until he was convinced it would produce classroom results that he wanted—again despite having shown a previous ability and interest in implementing technology in his class. A third teacher, who firmly believed in the usefulness of word processing software for helping students with the writing process, integrated it consistently and effectively. For this third teacher, she believed it would be hard to “truly practice the writing process without the computer because of the ease of revising” (Hughes, 2005, p. 285). While this is not the most sophisticated technology use, it shows that creating a match between what the desired teaching practices and the technology’s capability is an important motivator. It speaks to the need to invest time and energy to select technology that accomplishes certain goals and then train teachers with that goal in mind. Training that provides this knowledge can help change belief (Sandholtz & Reilly, 2004).

If Warren wants replacement or enhancement uses, then working to match the technology with those more straightforward goals would help create a direct link for teachers between the technology and the desired uses. If it wants to transform teaching and learning by integrating subject matter and creating 21st Century real life learning opportunities, a goal that Warren is seeking, it will need to work toward developing effective matches between technologies and this transformational goal. In that sense, the ultimate goal in Warren is not to match technology with

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

the curriculum they have, but to create a new curriculum with the full knowledge of how technology can transform teaching and learning—a profound undertaking.

Hughes (2005) demonstrated possible outcomes when four teachers were implementing technology without substantial supports. When training and support is more coordinated by the district, teachers have been shown to embrace the technology more quickly and effectively, partly because they can develop the needed skills and knowledge that can also change their beliefs (Sandholtz & Reilly, 2004). This training and support will be further addressed in the Context section.

Openly discussing beliefs should be part of ongoing professional development. Professional development that doesn't actively engage teachers in discussions about their current beliefs won't be able to change those beliefs because teachers are likely to keep them private. Once those beliefs are revealed, they can then be challenged. Ample experiences and time are needed in order for teachers to revise their beliefs (Kagan, 1992). Public conversations, through common planning times and other teacher meetings, about beliefs on how students learn, how best to teach them, what is worth learning, and how the technology can help accomplish the goals of the classroom, are necessary to change beliefs in terms of technology integration (Windschitl & Sahl, 2002). This means that typical technology training that gives teachers an overview about how to operate the technology and a few ideas for implementation is not likely to be effective—it needs to be connected to an ongoing conversation about the teachers' basic beliefs about teaching and learning. This conversation, should involve all relevant stakeholders, teachers, trainers, coaches, and administrators, and make explicit their beliefs about what constitutes effective teaching, and technology's role in effective teaching (Mishra & Koehler, 2006).

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Forming a basis for these conversation should be the technologies that teachers have access to, and more important, the capabilities of these technologies. Discussing capabilities, like how a technology can help provide a teacher with immediate assessment data than can be used to inform differentiated instruction or other learning activities, is an opportunity to talk about how those capabilities align with teachers' current beliefs. These capabilities might conflict with some basic teacher beliefs, like their own role in assessing students, or about the value of differentiated instruction. Therefore, the alignment between the technology and teachers' beliefs is an important factor for technology use (Zhao et al., 2002).

The Innovation

Warren's innovation is its vision and the tools it gives to teachers. Vision is often mentioned as a vital element to a comprehensive set of context supports that can help improve teacher knowledge, beliefs, and thus their uses. Because it is so connected to the supports, more about the vision will be discussed in the Context section. For the purposes of this section, the vision, as mentioned in the problem of practice section, has two main parts. The first part is a tech-rich replacement and enhancement vision, and the second is a 21st Century transformational vision. This basic characterization will help discuss the distance between current teaching practices and desired teaching practices.

Teaching: Distance from Current Practices

The distance between the current teaching practices and the desired practices of the innovation are important because the farther the desired practices are from the teacher's current practices, the less likely the innovation will be successfully implemented (Zhao et al., 2002). One example from Zhao et al., (2002), explained how a teacher in the study did not enact the task because it was too far from her current teaching practices. The number and types of changes she

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

needed to make in her teaching practices, to use the technology as intended, created too great a distance for her to travel to accomplish the desired use (Zhao et al., 2002). The importance of this will become more evident in the Findings section. This is important to this study because Warren has two main visions, a replacement and amplification vision that is closer, or less distant from current practices, than its more complex transformative vision. More about this study will be discussed in the Context section because the greater the distance that needs to be traveled the more supportive the context will need to be.

Technology can create many changes to teachers' current practices (Hew & Brush 2006). The amount of change to current practices should be considered when training—underlying changes need to be addressed before technology use will become more manageable for teachers (Ertmer & Ottenbreit-Leftwich, 2010). As Zhao et al., (2002) noted, changing teachers' practices should be seen in more evolutionary terms than revolutionary terms. As noted in the Innovator section, discussing and reflecting on current teaching practices would benefit from including the progression in technology uses from the ACOT studies (Sandholtz et al., 1997), and the types of technology uses, replacement, amplification, and transformation (Hughes, 2005, Pea, 1985). Considering the link between beliefs and knowledge, and a teacher's practices, ongoing conversations about beliefs are vital. Along with training that starts with teachers' existing practices and moves slowly, these conversations would be important contextual supports that can promote meaningful change (Ertmer 1999; Hew & Brush, 2006; Sandholtz et al., 1997, Sandholtz & Reilly, 2004; Zhao et al., 2002).

Access: Distance from tools

Providing teachers with adequate access to technology is frequently mentioned as an essential prerequisite for improved technology practices (Ertmer, 1999; Hew & Brush, 2006;

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Sandholtz et al., 1997; Sandholtz & Reilly, 2004; Zhao et al., 2002). In the ACOT studies, it was noted that when teachers had sufficient access to technology, their skills, knowledge, beliefs, and practices improved over time (Sandholtz et al., 1999). Zhao et al., (2002) further clarified the need for adequate access as “easy” access. If the access was not easy, it hindered teachers’ use. They described the relative “distance” there was between the teacher and the technology tools. This included having a sufficient number of devices to meet the needs of the project being enacted as well as how easily teachers could gain access to those technologies. The closer the distance, the easier the access, the more successful the technology use was likely to be.

The Context

Creating a context that supports technology integration is a multifaceted process. It includes effective leadership, adequate resources, a shared vision, and a comprehensive professional development program that nurtures teachers as professionals and life long learners (Ertmer & Ottenbriet-Leftwich, 2010). In their analysis of the broad base of research about technology integration, Hew and Brush (2007) framed the conditions in which teachers’ beliefs about technology integration changed. There needed to be 1) a clear vision for technology use, 2) provision of necessary resources, 3) ongoing professional development, and 4) encouragement for teachers. Variations of these supports have been documented as being effective in improving teachers’ knowledge and technology practices (Sandholtz et al., 1997; Dexter, 2011; Granger, 2002; Teo & Wei, 2001; Valcke, Rots, Verbeke, & van Braak, 2007). For this study, I’ve modified the framework from Zhao et al., (2002). Schools need to build their institutional supports, which include 1) human infrastructure, 2) technological infrastructure, and 3) social support networks for teachers as well as cultivate the productive working of all three to effectively implement technology (Zhao et al., 2002). First, I will discuss teachers trying to

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

innovate without coordinated institutional supports (Zhao et al., 2002). Then, a series of studies that elaborate on a variety of supports will be explored.

Context Without Coordinated Support

In their study, Zhao et al. (2002) tried to identify factors that were related to the success or failure of teachers to innovate when given access to computers. They used surveys, interviews, and observations to collect data on ten teachers who had been awarded grants for projects that integrated technology. Their teaching colleagues and their students were also interviewed for this study. Criteria for the grant winners included teachers who had previously demonstrated innovative technology practices or more general innovations in teaching. There were 118 grant winners in all who were also surveyed to support data analysis of the 10 case studies, although it was unclear how the survey data was used in the analysis.

Without comprehensive supports, teachers had to confront obstacles on their own (Zhao et al., 2002). Overall themes used for analysis and categorization for how well teachers navigated those obstacles included the “distance” and “dependency” the technology project was from either the teacher’s current teaching practices, the teacher’s technology capability, or the school context, particularly in regards to grade-level or subject-area teams (Zhao et al., 2002, p. 496). Technology innovations that were a greater distance from the teacher’s existing technology knowledge and teaching practices, struggled to be implemented; some technology projects failed to be implemented at all, while others had mixed success.

Using the findings in Zhao et al. (2002) as a guideline, innovations that were more distant from the prevailing context, which included the distance from the pedagogical beliefs and teaching practices of the teacher’s peer group, also had trouble if these projects included the peer group. Projects that were both distant from the teacher’s typical teaching practices as well as

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

those of the peer group, and were dependent on that group, also had trouble succeeding. If technology uses were distant from the teaching practices or culture of the peers, the teacher was more successful if he or she worked alone. On the other hand, a teacher who was weaker with her technology skills, was helped by a strong peer support network—her technology use was distant from her capability but was not distant from that of her peers and she had a supportive technology teacher, known as a “translator” or coach (Zhao et al., 2002), who helped her succeed. Projects that were small variations of the teacher’s previous teaching or technology use were the most successful. This was also true for the projects that were aligned with the peer group’s culture, which included its pedagogical beliefs and current teaching practices. These findings point to the importance of the current teaching practices at the school and how the context can support or constrain use.

Teachers in this study were attempting to integrate technology on their own, were not part of a coordinated technology plan, and depended on their school’s technological infrastructure, human infrastructure, and culture. Unlike in other studies that showed how teachers could progress in their use of technology when technological constraints were minimized and collegial support was actively fostered (Dexter, 2011; Sandholtz & Reilly, 2004), teachers who tried to integrate technology without these supports, had a mixed level of success.

Context with Coordinated Support

Having certain conditions in place, over time, can improve teachers’ knowledge, their ability to use technology, and can change their beliefs (Sandholtz et al., 1997; Sandholtz & Reilly, 2004). In technology-rich classrooms with substantial access to professional development, collegial support, and technology training, teachers begin to use technology more frequently and more purposefully as their beliefs in the technology’s usefulness change

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(Sandholtz et al., 1997). In these supportive environments, teachers begin to see how the technology is useful for their students, and start to believe in their own ability to use the technology. As this happens, they begin to integrate the technologies more often and more effectively (Sandholtz et al., 1997).

In an extension of the ACOT studies, Sandholtz & Reilly (2004) studied a district that created a vision and provided support for innovation. The focus of the school district's support on classroom integration and less on giving teachers broad technology skills helped teachers improve their practice more quickly (Sandholtz & Reilly, 2004). Key aspects of this initiative were the district determining the learning goals they had for technology (vision), buying specific technologies to meet those goals, and providing the technical training needed so teachers could focus on the instructional purposes of the technology. The four main components of the training and support were 1) classroom visits, 2) hands-on technology training geared toward integration, 3) group discussions, and 4) participant observations.

Teachers reported that the hands-on training, and structured opportunities for exploring the technology, gave them the time they needed to collaborate with peers, which improved their technological skills and therefore their classroom practices. Group discussions allowed teachers to reflect on how to use the technology for instruction and share accomplishments. The formal and informal networks of teacher sharing were considered important for teachers. These networks were formed around grade-level and subject-matter teaching teams, which teachers reported as being "very meaningful" (p. 505). Teachers also reported that these networks supported their implementation by giving them confidence and comfort with the technology. The topics discussed in the informal and formal networks often became the subject of district professional development.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

When teachers try to integrate technology on their own, without these supports, they are likely to encounter barriers. As noted in Sandholtz and Reilly (2004), a comprehensive approach to professional development and technology support can help teachers integrate technology successfully. Zhao et al. (2002) demonstrate what happens when teachers attempt to integrate technology without these systematic supports. When a district provides more comprehensive and targeted supports, including the necessary resources like computers, tech support, and collegial support, teachers have been shown to progress more quickly to complex forms of technology use (Sandholtz & Reilly, 2004). The district in this study trained teachers to use the technology for specific purposes, provided time to experiment, and time for ongoing opportunities to collaborate with peers, and teachers improved their practices. Teachers reported that having a support network of peers increased their comfort level and allowed them to try new teaching methods with the technology, which changed their beliefs about the role of technology and their ability to enact it in their classrooms. Having a context with social and resource supports can shift teachers' beliefs and their use of technology in classrooms (Sandholtz & Reilly, 2004).

Expert Help: Coaches and Translators

Using Mishra and Koehler's (2006) framework as a guide for part of her study, Dexter (2011) found a direct relationship between the degree of instructional support, as opposed to more basic technology support, that was tailored to the individual needs of teachers and the number of instructional support personnel for technology on staff. The more people the schools had, who could provide technology integration assistance for the specific needs of teachers, the more they supported technology use that aligned with content and pedagogy (Dexter, 2011).

In this study, schools that focused their efforts on technology's role in student learning, more often created support structures like interactions between technology experts and teachers

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

that were focused on student learning. At two of the schools, the technology personnel helped teachers find tech resources that aligned with their specific content and curriculum needs. This context specific support is an example of the convergence of content, technology, and pedagogy that the TPACK framework intends. The interactions at these schools were able to help meet teachers' direct instructional needs more than at schools that didn't focus technology goals on student learning. Those schools that focused less on student learning outcomes, for example simply providing better student access to technology, created structures that were less centered on student learning.

What also seemed to be particularly important was having teachers be a part of either a school-based technology committee, or having direct input into the committees that drove the content of professional development, and having a team-based administrative approach to meeting the substantial demands of fully supporting teachers with technology integration (Dexter, 2011). Together, these characteristics helped make teacher needs, in relation to teaching and learning as conceptualized in TPACK, the focus of the school's technology support efforts (Dexter, 2011).

Culture, Collaboration, and Peer Support

Beyond having a plan for buying, training, and supporting technology use, it is important to have a context with a "pervasive IT culture" of support for technology integration (Teo & Wei, 2001, p. 404). It can be hard to pinpoint the exact interplay of how beliefs and skills and knowledge affect each other because they are highly correlated—skills and knowledge impact belief and vice versa (Teo & Wei, 2001). With a strong context with a variety of supports for technology integration, teachers gain the knowledge and skills they need, which helps their beliefs about technology in ways that improve integration. Further supporting this need for a

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

pervasive culture, teachers have been found to need adequate professional development and collegial interactions in order to sufficiently judge if a certain technology use will be beneficial in their classroom (Zhao & Frank, 2003). Part of a supportive context is having technology support and school leaders who promote technology use.

Specific aspects of support have been shown to be helpful for changing teacher beliefs and improving technology implementation (Granger et al., 2002). Having an environment that promotes “just-in-time” collaborative learning that focuses on what teachers need-to-know improves implementation. A supportive web of relations between teachers, administrators, and technical support personnel allows for teachers to explore the technology and take risks in the classroom. By simply providing encouragement to improve, principals play a role in changing teacher beliefs about technology integration. While it is difficult to pinpoint which support structure influences belief, having a context with a pervasive IT culture matters in changing beliefs (Granger et al., 2002). Figure 3 below provides a diagram of a supportive context. The important role of school leaders, will be addressed more in the Context section.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

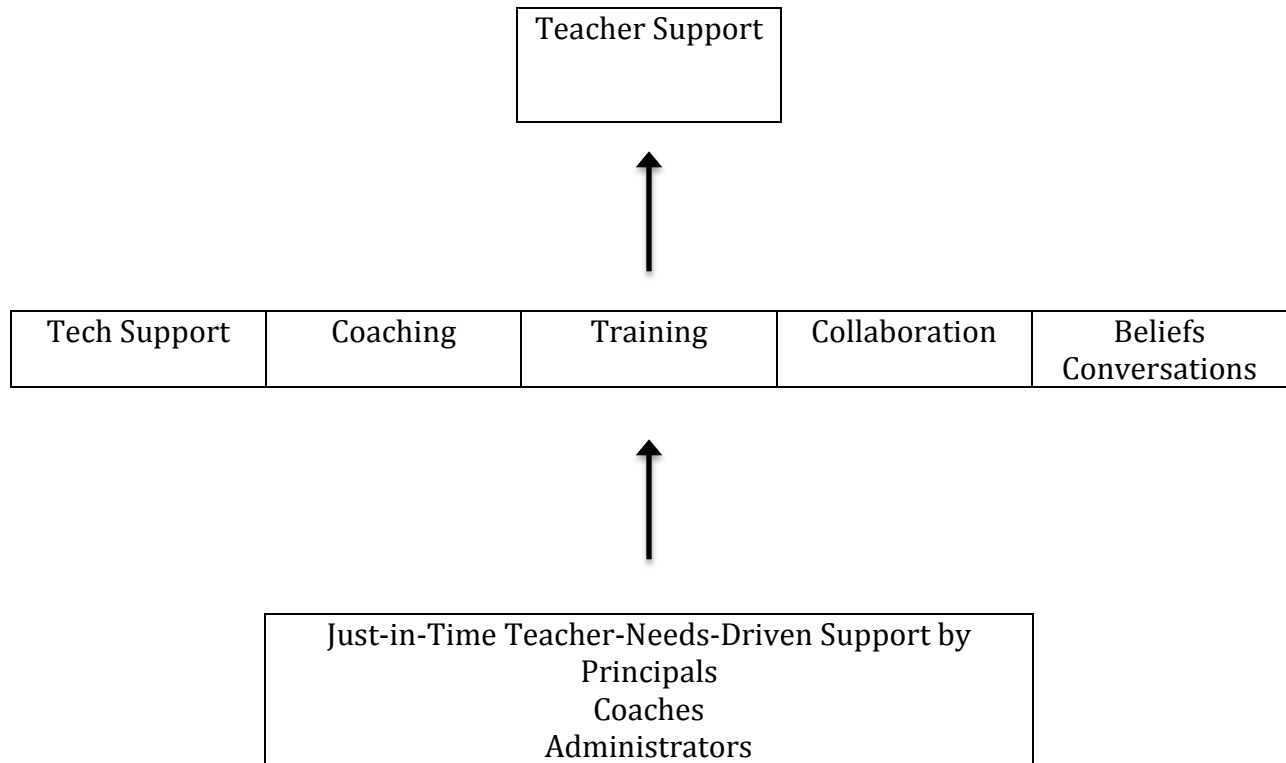


Figure 3. Context Supports

Coaches and Translators

Effective support will require prolonged access to experts with knowledge of technology, content, and pedagogy as well as the context in which these converge (Mishra & Koehler, 2006). Technology depends on an infrastructure that is out of the teacher's control. Anything that is out of teacher control can hinder use (Zhao et al., 2002). "Translators" have been described as "someone who could help the teacher understand and use the technologies for her own needs" (Zhao et al., 2002, p.502). These translators could be considered coaches in Warren's setting, or experts as described by Mishra and Koehler, who could help teachers align the technology, content and pedagogy. Similarly, having people in these roles was important in other studies that were previously discussed (Dexter, 2011; Sandholtz & Reilly, 2004).

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

The more qualitative nature of some of this research points to a need for a contextualized approach to technology support (Dexter, 2011; Sandholtz & Reilly, 2004; Zhao et al., 2002). The need for contextualized school supports is further demonstrated in an international quantitative study that sought to answer the question about whether the general availability of school-level support predicted technology integration (Rutkowski, Rutkowski, & Sparks, 2011). In trying to determine whether technical support and/or collegial supports were the factors that lead to improved technology practice, Rutkowski et al. (2011), cited both Granger et al., (2002) and Zhao et al., (2002) about the need for a web of flexible and responsive supports for teachers.

When studied through the use of an international survey, institutional supports for technology integration were not predictive of increased integration. The authors describe these findings as a paradox because they note that institutional support has been shown to increase desired integration but that there is not yet a broad understanding of support, or generalizable types, that automatically led to better integration. How those supports are instituted is crucial—delivering them is very much dependent on the context and meeting teacher needs (Rutkowski et al., 2011).

In some countries, increased technology support reduced the likelihood of teachers integrating technology, while in others it increased it. Colleague support was positively associated in some countries, while not in others. The authors conclude that, in this survey data, institutional support was not predictive of technology uses. They note that despite the complexity of the problem, and no easy solutions, schools are able to accomplish technology integration. They called for more qualitative research focused on a “bottom-up approach” (Rutkowski et al., 2011, p. 208) to these institutional factors like effective collaboration of key school leaders, teachers, and technology support staff, to meet teacher needs (Granger et al., 2002).

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

It is not that the institutional factors (technology support and collegial support) aren't important; they are. They are necessary, but they might not be sufficient for widespread success (Rutkowski et al., 2011). It is more likely, given the varying complexities of every school setting, that knowing what teachers need exactly must be determined by a flexible and responsive support staff (Zhao et al., 2002). Institutional support might be less about increased or better training and more about improving the responsive supports teachers need to foster an environment that promotes high quality use (Rutkowski et al., 2011). They suggest more qualitative study about the complex interactions of these supports, which is a focus of this evaluation study in Warren.

For Warren's study, the survey and teacher focus groups helped define the needs of teachers. The focus groups and interviews of all stakeholders helped determine how the supports impacted technology integration.

Technology Professional Development

Professional development plays an important role in how a school prepares teachers to integrate technology (Valcke, Rots, Verbeke, & van Braak, 2007). In a policy evaluation of the validity and suitability of technology training in Flemish schools, the authors used semi-structured in-depth interviews of 185 school technology leaders from 100 schools. The researchers explicitly state that the current Flemish professional development model of buying technology and providing general training is not promoting uses that improve teaching and learning. While this is a very specific context for this study, that might not appear to be related to Warren Township Schools, the authors note that using an approach that focuses on access to technology and broad skill development is a common mode of attempting to increase technology

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

use. It also aligns, to a degree, with Warren Township's current model of focusing on providing access to technology and introductory training.

Without a comprehensive vision and support for improved teaching practices in the studied schools, computer use was considered sporadic—only 10% of schools reported that teachers in their elementary schools “constantly” used technology as a tool. Teaching practices were not considered innovative. Fifty-three percent reported that teachers use technology to vary their teaching techniques and 43% use them to make learning more fun. No respondents reported using technology as a tool to innovate teaching and learning beyond current practices. These results should not be surprising because 71% of K-12 schools reported having no systematic approach to school-level professional development, and 72% reported that attending training was up to the individual teacher. In elementary schools, 62% reported that technology use was largely up to the individual teacher as well.

The conclusions of the study called for more specific school policies and training that are flexible, have follow-up activities, and that are driven by the needs of teachers. These supports can help teachers progress through different stages of improved technology use. More than half of the respondents in the study reported that their schools needed more coaching and school-based training; training that is aligned with a specific vision and consisted of detailed technology practices that are aimed at improved teaching and learning. As a result of the study, Flemish schools began more school-based and teacher-team based training in order to effectively meet teacher needs. The biggest shortfall of this research is that it was solely based on responses from school leaders, not teachers, and there were no classroom observations to validate findings.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

This review of the literature supports the conceptual framework for improved technology innovations by focusing on the innovators, the innovation, and the context in order to create a system of supports that can improve technology integration.

Conceptual Framework

The starting point for creating a comprehensive program that supports teachers for better technology practices begins with the needs of teachers in relation to the conceptual framework which utilized the Conditions for Classroom Technology Innovations framework, the Innovators, the Innovation, and the Context (Zhao et al., 2002). Within in this framework, I included the TPACK knowledge framework to help explain and analyze teacher knowledge as well as supports for that knowledge. This is conceptualized below, in Figure 4 the Concept Map of this study, and will be used to guide the methodology.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

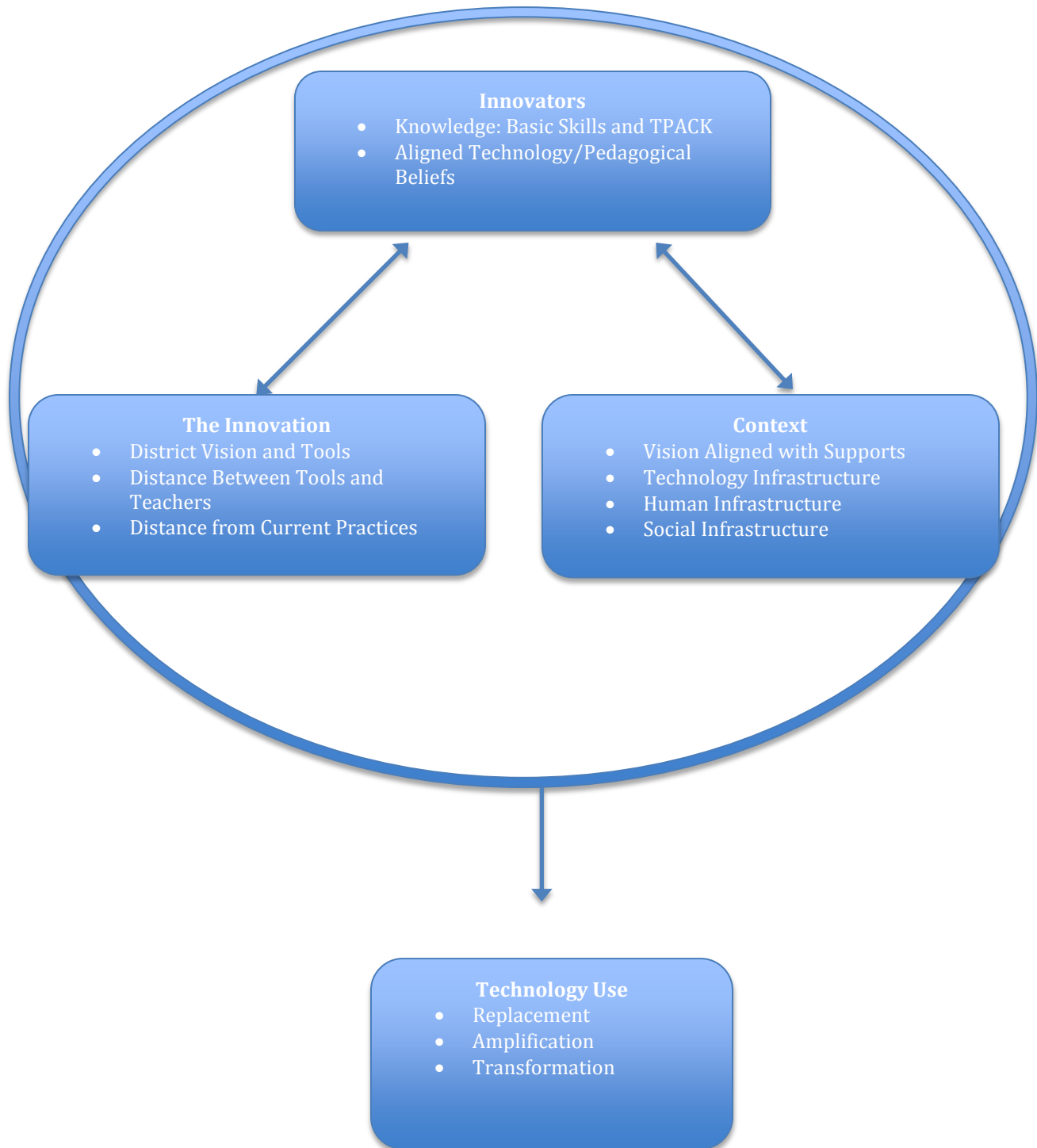


Figure 4. Concept Map

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Chapter 3: Methodology

Evaluation Design

To answer the research questions, using the conceptual framework, I utilized a sequential exploratory mixed-methods program evaluation (Creswell, 2009). The evaluation was a formative assessment since it was meant to inform changes to Warren Township's technology policies and professional development (Patton, 2008). A mixed-methods design was well suited for this evaluation because these methods helped collect data that provided broad trends in the district population that were then verified, built upon, interpreted, and contextualized with focus groups and interviews (Creswell, 2009). The research questions of this study were quantitative and qualitative in nature. An online survey using Qualtrics software was first used to collect information about the scope of the issues surrounding technology, particularly about knowledge and belief but also about training, collaboration, and tech support. The survey was then analyzed and teachers were placed into groups based on their aggregate knowledge and belief scores. Next, teachers were selected from these groups to be in focus groups. This selected teachers from the full range of knowledge and belief scores. The focus groups were used to collect qualitative data from teachers. Finally, more focus groups and interviews were used to collect qualitative data from school leaders and technology support staff. These were then analyzed to identify detailed information needed to inform training and support changes (Morgan, 1996; Creswell, 2009). Together, the qualitative and quantitative analysis helped provide a complete evaluation that the district can now use to make changes. Below is Table 2, detailing the alignment between the research questions, the data sources, and the analysis. There is also a timeline for these activities that follows, Table 3.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Table 2. Research Questions, Data Sources, and Data Analysis

Research Question	Data Source	Data Analysis
1. What are the needs of innovators? What are teacher pedagogical beliefs, skills, and technology integration knowledge integration for K-5 classrooms?	<ol style="list-style-type: none"> 1. Teacher survey Questions # 1-9, 21-35 2. Teacher focus groups 3. Tech Coach focus group 4. Administrator focus groups 5. Principal interviews 	<ol style="list-style-type: none"> 1. Survey: Descriptive statistics 2. Teacher Focus Groups: Interpretation, Code for Beliefs and Skills and Knowledge. Used to validate survey and provide greater detail. 3. Tech Coach, Administrator focus groups, and Principal interview: Used to validate teacher focus groups and survey.
2. What is the innovation, including what is the vision and what are the tools? What is the distance between the teachers and the tools, and between the envisioned teacher practices and their current practices.	<ol style="list-style-type: none"> 1. Teacher survey Question # 10-20 2. Teacher focus groups 3. Tech Coach focus groups 4. Administrator focus groups 5. Principal interviews 6. Document Review 	<ol style="list-style-type: none"> 1. Survey: Descriptive statistics 2. Teacher Focus Groups: Interpretation: Code for context conditions, training, collaboration, administration support. Used to validate survey and provide greater detail. 3. Tech Coach and Administrator focus groups, and Principal interview: Used to validate teacher focus groups and survey.
3. How are the contextual factors impacting use? How are training, coaching, culture and teacher professionalism, and collaboration impacting use?	<ol style="list-style-type: none"> 1. Teacher survey #1-36 2. Teacher focus groups 3. Tech Coach focus groups 4. Administrator focus groups 5. Principal interviews 	<ol style="list-style-type: none"> 1. Survey: Descriptive statistics 2. Teacher Focus Groups: Interpretation: Code for training (belief and skills and knowledge), peer and administrator support. Used to validate survey and provide greater detail.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

		3. Tech Coach and Administrator focus groups, and Principal interview: Used to validate teacher focus groups and survey. Interpretation: Code for training (belief and skills and knowledge), peer and administrator support. Used to identify Tech Coach/Administrator needs.
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The primary user of this evaluation was the superintendent and the two curriculum directors since they have the greatest influence over policy, training, and resources in the district. Other intended users of this evaluation were the relevant stakeholders: information technology (IT) director, technology support personnel, technology trainers and coaches, principals and Teachers. From the start of this evaluation, I was in contact with the superintendent. She reviewed all protocols before the data collection began to avoid any surprises and to make sure that her ideas were included in the interviews, focus groups, and the survey (Patton, 2008). Feedback was also given to the two curriculum directors. Below is Table 3, the Data Collection and Analysis Timeline.

Table 3. Data Collection and Analysis Timeline

Activity	Time Period
Survey	June 2014
Survey Analysis	Summer 2014
Teacher Focus Groups	October/November 2014
Analyzed Survey and Teacher Focus Group Data	Began November 2014
Stakeholder Focus groups And Interviews	November/December 2014
Analyzed Stakeholder data	January 2015
Interpretation and Analysis of all Data	January- May 2015

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Setting

Warren Township School District is a K-8 suburban school district serving 1,876 students in Somerset County, New Jersey (New Jersey Department of Education School Report Card, 2012-2013). Warren has one middle school consisting of grades 6-8 and four elementary schools consisting of grades K-5. New Jersey classifies its districts, known as District Factor Groups (DFGs), based on socio-economic factors like education level and income level of the town's population. Warren is rated as a relatively well educated and affluent "I" district, which is one level below the highest level of "J". Its student population is largely white (73%), with smaller populations of Asian (17%), Hispanic (6%), and African American students (1%). Less than 1% of the students receive free lunch and about 2% are Limited English Proficient (LEP) (New Jersey Department of Education, 2012-2013). The district ranks in the highest category of schools with a "Very High Performance" rating in both "Academic Achievement" and "College Readiness", (New Jersey Department of Education School Report Card, 2012-2013).

Research Participants

All K-5 general education classroom teachers were asked to participate in a survey. Purposeful sampling was then used to select participants from relevant stakeholder groups for interviews and focus groups (Creswell, 2009)—there will be more detail about selection in the Data Collection section. Relevant stakeholders were included in the sample because they could validate findings made from the teacher survey and focus groups and offer their perspective on needed changes to the available supports.

It is important to mention that teachers who either don't like technology, or who are afraid of it, might not want to participate in this evaluation process. These people can be "low interest" and "low power" stakeholders (Patton, 2008, p.80)—teachers who might benefit from

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

better training and support but who could easily be overlooked in the evaluation process. Every effort was made to seek out their voices and their participation in order to include them in the process. Steps were also taken to ensure their needs, ideas, and criticisms remain confidential so they don't have to fear being exposed. Including these stakeholders made the evaluation more thorough and the findings more likely to be useful for all stakeholders.

Data Collection Procedures

A self-administered electronic survey was used to collect data about the three factors in the framework: 1) innovators, 2) innovation, and 3) context, as well as demographic and grade level information (Creswell, 2009), from all K-5 teachers who were currently teaching in general education classrooms (see Appendix B). There were sixty-five classroom teachers across the district. The survey had forty-one questions that were developed based on factors detailed in the theoretical framework, and by using other published surveys (Hutchison & Reinking, 2011; Muir-Herzig, 2003; National School Reform Faculty; Schmidt, Evrim, Thompson, Mishra, Koehler, Shin, 2009; Vannatta & Fordham, 2004). The survey was piloted to ensure that participants understood the questions as intended and was then made available to all K-5 classroom teachers in June of 2014. With encouragement from superintendent, principals and technology coaches, fifty-eight out of sixty-five teachers completed the survey, 89%.

The survey data provided general district-wide data that was then used to fine-tune focus group and interview questions as well as to help identify teachers to participate in the focus groups. To determine clusters of teachers from which to include in the focus groups, teachers were scored by percentage of their total for the knowledge and belief questions from the survey. For example, each question had a possible score of four points if a teacher responded to a question about her knowledge to a "Large Extent", three points for "Moderate Extent", two

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

points for “Small Extent” and one point for “Not at All”. Each teacher’s total score was divided by the total possible score to arrive at a percentage that became her “knowledge” score. The same calculations were made for the belief questions.

Then these scores were graphed to help identify initial clusters of teachers with a range of belief and knowledge scores since belief and knowledge are important factors for technology use. Next, I explored the initial clusters to determine if there were any inconsistencies within the clusters to help ensure they were an identifiable group. Once the clusters were identified, outliers were explored to determine if they could possibly fit into a cluster closest to them, or not, depending on how their answers to other questions on the survey were answered. The clusters were used to select teachers for the focus groups to make sure each group was fairly represented. There will be more about the link between the survey and the focus groups in the Data Analysis section.

Focus Groups and Interviews

The following two sections provide information about participants, and the content of the questions for the focus groups and individual interviews. All focus groups and interviews lasted about 60 minutes and were audio recorded and transcribed to ensure accuracy of the data that was collected and analyzed (Patton, 1990). Focus groups and interviews took place in the Fall of 2014 and the Winter of 2015. They were used for teachers, coaches and the tech support personnel, while interviews were used for administrators.

Patton (1990) and Creswell’s (2009) guidelines for qualitative interviews were utilized for collection and analysis procedures. Qualitative interviewing begins with the assumption that the perspective of others is meaningful, knowable and able to be made explicit (Patton, 1990). I captured interviewee perceptions as they related to technology, the PARCC, policies and

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

training—as detailed further below. The interviews were semi-structured to ensure a systematic approach to the interviews but I allowed for flexibility to explore areas that naturally arose during the interviews. Follow-up questions were also prepared in order to obtain rich, textured accounts. With all focus group and interview protocols, the numbered questions were asked of all participants and the follow-up questions were asked if there was time or the conversation called for the prompts (see Appendix C). In addition to the interviews, I was in contact with the superintendent and the curriculum directors throughout the process to provide feedback about findings as they emerged, and in case problems arose where they could be helpful in completing all aspects of the evaluation. The superintendent was instrumental in encouraging principals to rally teacher participation in the survey as well as providing release time for teachers to participate in the focus groups. Below is a list of participants for the focus groups and the interviews.

Focus Groups

Focus groups are a small-group form of interviewing (Patton, 1990). These groups were used to confirm findings from the survey and go beyond those findings to obtain more detail than the survey could provide. Focus groups also allow for information to be collected from many more participants, than interviews, in a short period of time (Morgan, 1996; Patton, 1990). For example, rather than interview one or two coaches, all of them can be placed in a focus group to obtain the perspectives of the entire coaching staff. Also important is that participants can “consider their own views in the context of the views of others” (Patton, 1990, p. 335). In order to have access to all stakeholders, and collect data that was representative of the faculty and administration, all focus groups and interviews took place during school hours since it can be difficult to coordinate meeting times beyond school hours.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

1. **Teachers:** Teachers were sampled from each of the four cluster groups, which were based on answers to questions about beliefs and skills and knowledge from the survey. There were six focus groups with three to five teachers in each group. Attempts were made to get an even rate of participation per cluster group. While substitute teachers were generously provided, finding times that worked for everyone was difficult. Some focus groups were occupied by teachers who were all within the same cluster, while others had a range of clusters. Therefore, there were heterogeneous and homogeneous groupings based on knowledge and belief scores. In all, twenty out of fifty-eight teachers, 34%, who took the survey participated in the focus groups. Within the groups, four out of eight, 50% of the teachers in Group 1 participated in the focus groups. Four out of ten, 40% of Groups 2 and 4 participated, and eight out of twenty-five, 32% of Group 3 participated. Each group was asked a range of questions about the research questions using the survey results and the important factors from the research like access, beliefs, knowledge, collaboration, coaching, and training.
2. **Technology Coaches:** There was one focus group, which consisted of all four elementary technology coaches. These faculty members are what have been described in the research as the “experts”, “translators” or “mentors”. They can play a key role in supporting desired technology use. Each of the four elementary schools has a teacher who has been designated as a coach and is available outside of school hours, and sometimes during the school day to assist teachers with technology.
3. **Technology Support Staff:** The two tech-support personnel who provide support to the four elementary schools were in a focus group together. These staff members are responsible for keeping the technology functioning well for teachers. They are called

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

upon to fix problems teachers encounter with hardware in the district. Since having technology that functions well is important for teachers when it comes to believing that the technology is reliable, making this stakeholder group a part of the evaluation was important.

Interviews

All administrator interviewees were asked about the innovators, the innovation, and the context. Particular attention was paid to exploring how teacher knowledge, beliefs and needs are planned. Who is responsible for making sure they are planned for, and implemented, as well as what is needed to help ensure that these supports are coordinated was also discussed.

Interviewees were asked about their own needs. Besides these common topics, specific questions and focus of inquiry will be detailed below for each interviewee.

1. **Principals:** Principals from each of the four elementary schools were interviewed individually. Data collected from these interviews helped validate findings about teachers but was also used to identify the need for policy changes.
2. **Curriculum Directors:** Both directors were interviewed to gain their perspective on curriculum and instructional issues in regards to technology integration as conceptualized in TPACK. These key administrators validated findings about teachers, but they also had an important perspective about how technology was interacting, or should be interacting, with current curricular goals. Their role in initiating policy that helps align technology with the curriculum was essential for the recommendations that came from this study. Since most training and professional development planning originates in these two positions, the focus of these interviews

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

- was on how they see their role in supporting technology integration and how they can help coordinate supporting teacher needs for content, pedagogy, and technology.
3. **Information Technology (IT) Director and Network Specialist:** The IT Director and the Network Specialist were interviewed together as they are charged with keeping the district's technology infrastructure running smoothly. They were asked about their role and what they thought about district needs.
 4. **Technology Supervisor and the Middle School Technology Coach:** The Technology Supervisor and the Middle School Technology Coach are often involved in making decisions about training and policy for the district. These leaders were interviewed separately to gain their perspectives about needed training and policy changes, as well as to validate findings about teachers from the survey and the focus groups.

Data Analysis

This mixed-methods program evaluation collected data that was qualitative and quantitative. The research questions were analyzed both deductively and inductively (Creswell & Plano-Clark, 2007). There were three layers of analysis. First, I analyzed the survey using descriptive statistics to partially assess teacher needs. The first layer of analysis used the survey to get a broad picture of the current state of the district in terms of the key variables—it essentially helped to define the district's problem of practice in terms of the innovators, innovation, and context.

Then a second layer of analysis was conducted to take a closer look at the district by linking how teachers rated certain questions on the survey with how they discussed the same topics in the focus groups. To do this I used their scores on the survey, linked those scores to

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

percentage of teachers who answered the same way, and then provided a quote with analysis that contextualized the survey scores and the quotes. For example, Samantha rated whether she received enough professional development as a “moderate extent” as did 30% of teachers, however, in the focus groups she explained that she didn’t need training but wanted to collaborate more with her peers (I’ve paraphrased and simplified this example.). This gave a perspective on how she rated her professional development, where she could be placed amongst the faculty from the survey results in terms of her PD needs, and then how she explained her needs. This was done using the theoretical framework, see Concept Map, (Figure 4 above), using the innovators, innovation, and context as the main themes along with other sub-themes like knowledge, pedagogical beliefs, or training, and coaching.

The third layer of analysis helped validate teacher analysis and provided administrator and support staff perspective. Included in this analysis, was data that was collected from the teacher focus groups but also the stakeholder groups. The stakeholder interviews and focus groups provided: 1) validation of findings from the teacher survey and focus groups, as well as, 2) enlisted stakeholder support and ideas for possible solutions to problems that existed.

Validity

Qualitative validity is about the accuracy of the findings (Creswell, 2009). Validation was conducted throughout the data analysis to ensure accuracy. The quantitative survey data was validated by the qualitative focus groups. By having all stakeholder groups take part in the study, data and analysis from each stakeholder group was used to triangulate findings as themes were established based on “converging several sources of data or perspectives of participants” (Creswell, 2009, p. 191). Throughout the focus groups and interviews, emerging ideas were explored in able to obtain confirming or disconfirming evidence. Both the qualitative and

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

quantitative findings were also employed to report data that contradicted basic themes to help ensure an accurate representation of the data that was collected.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Chapter 4: Findings

Analysis Framework

The analysis framework I am using has been modified from Zhao et al., (2002). They used their framework to explain the complex conditions involved in successfully enacting classroom technology innovations and categorized the factors into the innovator, the innovation, and the context. The innovator, involves the teacher's knowledge about the relevant technology and the compatibility between the teacher's pedagogical beliefs in relation to the technology's role in the classroom. The innovation, for this study is Warren's technology vision statement and the technologies they provided teachers in order to meet the vision statement. Important factors for the innovation are the physical distance between the technologies and the teachers, such as if the technology is located in an overbooked computer lab as well as the distance between the teacher's current practices and the practices desired in the vision statement. The final element is the context in which the innovation takes place, which includes 1) a dependable technological infrastructure, 2) policies and support staff that constitute a human infrastructure, and 3) the organizational culture, which includes how teachers collaborate and support each other. The three main parts of the framework will first be discussed individually, then I will explain how they interact with each other. When possible, relevant information from the survey will be included throughout each section.

The Innovator

For both, basic technical knowledge and integration knowledge (TPACK), survey data can help frame and provide context for the comments that teachers made during focus group interviews. In the survey, teachers reported that they learn technology easily and can solve their own problems much more favorably than they reported having enough time to plan and prepare

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

for using technology, and whether they received enough professional development. For example, in Table 4, the majority of teachers, 84%, reported to a large or moderate extent that they learned technology easily, and 67% reported they could solve their own technical problems to a large or moderate extent. However, only 29% felt they had enough time to prepare and plan for using technology and only 37% felt they received enough professional development to a moderate or large extent. These figures have relevance for the knowledge of the innovator in that while teachers report they can learn technology and solve their own problems to some degree, for many teachers these tasks are time consuming and they want more professional development support. The knowledge they want can be categorized into basic technical knowledge and integration knowledge using the TPACK framework.

Table 4. Survey Results: Technology Knowledge, Time to Plan, and PD

Survey Answers	Learn Tech Easily	Solve Own Problems	Enough Time to Plan?	Enough PD?
Not at all	0%	0%	18%	12%
Small Extent	15%	33%	52%	52%
Moderate Extent	60%	57%	26%	30%
Large Extent	24%	10%	3%	7%

Basic Technical Knowledge

During the focus group interviews, there were numerous examples of teachers saying that they found simple tasks cumbersome and wondered if there were ways to make using the technology easier for them. For some teachers, this lack of easy use caused them to use the technologies less often or less effectively, while others expressed their lack of knowledge as more of a time-consuming issue that they wanted help overcoming. This desire by teachers

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

would help explain why having enough time to plan and prepare for using technology was rated as one of the lowest scores on the teacher survey. Considering that the district's vision statement includes the desire to "inspire and support" teachers to be more "competent and confident", this idea of easy use could be a relevant way to improve upon current practices and meet the district's goal.

In this passage, Mila and Maggie discussed their technical knowledge when asked about their training needs. Mila was in the majority of teachers, 52%, in that she rated having enough time to plan and prepare for technology use as small extent. She mentioned wanting to be more efficient with using the websites like Raz Kids (eBooks and leveled reading instruction) and Think Central (digital tools with the Go Math textbook). However, Maggie, who rated the same question to a moderate extent, as 26% of teachers did, stated that she was not using Think Central as much as she should be because she didn't know how to use the program easily and efficiently.

(1) Mila: // I know how to use Raz-Kids and I know how to use, um, Think Central but maybe, maybe I'm missing some components. Everyone says there's so many things ... I don't know how you even use it all in one day. Like, for example, I think there's so many different ways to access the same page. You can do it through interactive white board, you can go through the, you know, the e-planner. Y-you know I think it's just ... I don't know. Just clearing everything up.

(2) Paul: So you just need more// Training on...

(3) Mila: //The best way... Maybe efficiency. Just how to efficiently use all the, you know, websites.

(4) Paul: Okay. So really just more basic training on the websites.

(5) Maggie: Yeah. Raz-Kids and maybe Go Math Because I know I'm not using Go Math as much as I should be. Yeah. Maybe much more efficient with it. I couldn't even remember how to put, how to assign an assignment. It drives me crazy.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

In line 1, Mila explained the different ways she can access the same page on the website depending on how she is using it and wanted help with navigating the different aspects to make her use easier. As Maggie mentioned in Line 5, her lack of knowledge was hindering her use. She also mentioned that she had trouble remembering how to accomplish a basic task, assigning an assignment.

As their conversation progressed, Maggie and Mila were joined by Julia and Rachel who talked about basic ways they wanted to learn how to use their technology more efficiently and effectively. They discussed Think Central, which they had been using for over a year. Maggie talked about her lack of basic knowledge and then the conversation moved toward using Think Central more efficiently to assign math homework that supports the classwork, which is an important benefit of the technology.

(1) Maggie: Only because a little girl I tutored, when we finished our work, she said, "Now I have to do an online assignment," and I went. It was like one of the animated math things. I was like, "Oh, this is great. I need to be doing this,"

(2) Rachel: You know what? I ... I just figured out, instead of assigning it all, like I find out which skills and which, um, Mega Maths are for the chapter, and on my website, I write, "You can go to skill this, this, and this. And Mega Math this, this, and this." That way, it's there and I don't have to worry about assigning anything.

(3) Maggie: You don't have to assign?

(4) Mila: I'm going to go on your website.

(5) Rachel: But I don't have it. I just took it down because we just took a test so I have to re-put it up.

(6) Maggie: Okay.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(7) Rachel: But, like, for Chapter 3, I write, "Mega Math using arrays KLM," and then I write, "Animated Math Skill 7," because when they go on it "Animated Math," they can click on skills ...

(8) Maggie: And you're looking at the planning guide to get the ... okay.

(9) Rachel: Yeah, I go to the e-planner and I sit there and I take notes on like what is good for each lesson.

(10) Maggie: So you're not putting a link there, you're just putting where they need to go?

(11) Julia: You see, its things like that that we need. That's not like official training but it's hearing how someone else is using it in their... Do you know what I mean?

Rachel, in line 2, had not only figured out how to easily assign online work, by directing students to the webpage instead of being slowed down learning about how to embed a link to her webpage, but we can also glean that taking that information down from her website is important for test time, which is something that could be useful information for teachers to know. Maggie, Mila, and Julia clearly thought this was helpful knowledge to have. In line 11, Julia wanted more of this type of information in general.

It should be noted that Rachel has provided training on technology before and even within this focus group was able to help teachers with some hints, yet on the survey, she rated the question about having enough time to prepare and plan to only a small extent so the issue of time can still be a factor for teachers who are somewhat independent technology learners. These above mentioned teachers are working toward building their knowledge to make their use "easy and efficient".

In the next passage is an example from Natalie who was struggling to get started. She rated having enough time to plan as moderate, like 26% of teachers did, but rated receiving enough PD as small extent, as 52% did. Natalie expressed feeling "overwhelmed" about the

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

number of programs she learned about at the district's October in-service training a few weeks before and still needed to learn a simple fact to get her Study Island program working for her.

Natalie: // We got all the kids their number. We printed out their little codes, because these were separate, it was already giving them that. They all got there and said, "We can't open it". "We can't open it, we can't open it". I am like, what you mean you can't open it, you have to be able to open it. Then we come to find out they had to take a 30 question pretest before they could do anything in there. No one told us that at the workshop. It was just so easy and wonderful, and they are all using it. We were like, are you kidding me! Then when I went to this "Conquer Math" workshop last week, I asked Sophie who was with me, and she said, "yeah I assign that [pretest] for homework in the beginning of the year. We just gave that as homework. I am like, nobody told me.

Natalie: We wasted time on trying it, and we were frustrated it didn't work, then you did that. We will overcome that but we got so frustrated with it we didn't even assign it and we were like, we will try that another time.

Natalie explained that despite trying to get some of the technology started in her room, she was hindered by a basic problem. With multiple applications to manage at once, she either was not told about this simple task that she needed to do prior to getting started or didn't pick it up in the training. No matter why, lacking basic knowledge can hinder teachers from enacting the technology into their classrooms quickly.

In this next example of basic technical knowledge, Maggie described her iPads as being not reliable, but Julia and Rachel explained that maybe the problem was students signing on to the wrong wireless system. Maggie's students might be using the "guest" wireless network and not the "Warren Township Wireless" network; sometimes the iPads reset to the guest wireless or the students can accidentally pick the guest wireless, which will prevent some programs, or some elements of programs, from working correctly.

(1) Maggie: //Sometimes they [iPads] work and sometimes they don't.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(2) Rachel: Especially on the iPad Spelling City. Like, the audio thing, like won't work if it's on a certain. If it is on guest, it won't load.

(3) Maggie: No, we're logged in on our accounts.

(4) Rachel: No, no, no. Meaning the internet connection ...

(5) Maggie: The internet?

(6) Julia: I would check that. Make sure you're on the Warren Township, not the guest one.

(7) Maggie: Oh. Something you should know. I'll be mad if that's it.

In this example, we don't know if the different wireless systems were the nature of the problem but the fact that Maggie did not know that this possible issue could be causing her problems is an example of a lack of knowledge that Maggie needs to enable her iPads to dependably function. As part of the conversation, Maggie mentioned that this had been happening for over a year. She didn't think to ask for help with learning to use her iPads more effectively because she attributed the problem to the unreliability of the iPads, not her insufficient knowledge about the two different wireless systems. Maggie had repeatedly mentioned that her iPads were not reliable but this was not something other teachers mentioned in the focus groups.

In the passage below, Margo discussed how she gained the knowledge about how to use Raz Kids in her class. One aspect of teacher knowledge the district might find relevant is how teachers learn to effectively use the technology in their class and how long this might take for some teachers, even for just one program. Margo, who like the majority of teachers rated both having enough time to plan and receiving enough training, as small extent, discussed how her colleague Rachel and she learned how to use Raz kids.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(1) Margo: I think when we started doing Raz-Kids a couple of years ago, uh, we basically sat down constantly, how do we do this, how do we build the classroom, how do we ... You know, how do we ...

(2) Paul: And your group did that like you're sit- you and like Rachel...

(3) Margo: And Rachel, right. We sat and we just worked on that. So we basically ... And she usually takes the lead but we figured things out and then even with Spelling City, you know, ... how [to] do your words and what's the best way, ... how do you make it into groups so they only have to see their words... I know because we've done it for a couple of years now.

In line 3, Margo discussed something seemingly small like how to create her spelling groups so students could only see their word lists which is important because the students are in differentiated spelling groups. Over the course of years, she and Rachel have learned small, but important things needed to make the program work effectively for them. In this next passage she, despite being somewhat independent with the program and having used the program for years, still feels she needs help making her use of the program more efficient.

Margo //But there's still shortcuts that I'm not aware of when I'm changing levels for the class. I thought, "I had my levels. There's got to be a way. I can just go change everybody's level to a higher level" and I can't do that.

Margo: I had to go to every single student and this doesn't seem right. Maybe it is the way you have to do it but, uh, the shortcuts that sometimes, you just can't figure out.

Margo's sense that there had to be an easier way for a routine task to take less time was a common one. For Margo this did not deter her use but for other teachers, these small obstacles prevented them from using the program, especially if there was more than one problem that needed to be overcome or if that one problem prevented basic use of the program. Beyond the basic technical knowledge, learning how a program might change basic routines for how student work is distributed, collected, and monitored is also part of the knowledge teachers need to develop.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Below, Sara and Marsha, discussed the small barriers they encountered when they tried to enact Spelling City. Sara rated having enough time to plan and prepare as moderate extent, as 26% of teachers did, and receiving enough PD as small extent, as 52% of teacher did. Marsha rated both of those as not at all—placing her in the minority of teachers at 18% and 12% respectively.

Sara: Spelling City, we originally started doing it as a homework. I thought that would bring the pressure off us as teachers, because word study there's sheets coming in every day, putting them in the boxes three different, four different groups. If I could just assign Spelling City, oh my gosh the amount of tracking first of all, to see if they each did their homework was ridiculous. Then the notes [from home], "we couldn't log on ... this is the problem". It's not working on this, we try it on this. We call the company, and then we have the kids say, I did my sentences I must not have hit submit. Now we said, forget it. I am not doing it for homework anymore because it's so much problems, I would rather just send the sheet home. Now we do the Spelling City, like I said two times a week, in class, because I can't. I can't monitor it. It is ridiculous.

Marsha: At the same time, we haven't had enough time fiddle around these programs. We were given half a dozen at one time. My kids are coming in asking questions that I can't answer because I am not knowledgeable enough in the program yet to say, "you need to do this, this and this." What's happening is, because there's not enough time to explore all of these, I am going on my SMART Board and trying to figure things out. They [the students] will say, "no Mrs. B, you need to do this." They are teaching me, because I am not knowledge enough in this software or the program to answer their questions, because I just don't have enough time to play with it. Maybe one new thing a year. This year is Spelling City, next year Raz Kids. Then at least we have time to get our feet wet.

When Sara mentioned that she thought Spelling City could "take some pressure off" she had discussed how she typically had students divided into three or four differentiated spelling groups which required different spelling lists and different pieces of homework paper. She thought Spelling City could help eliminate the cumbersome paper distribution and collection. However, she encountered barriers along the way that made her feel it wasn't worth using it for homework

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

anymore. Instead of Spelling City becoming a nightly routine that connected home and school, it became relegated to a few times a week in class.

Sara and Marsha also mentioned that they felt they didn't know some of the programs well enough to judge their worth or understand where they could fit into their teaching, which can impact their use of the technology (Hughes, 2005). Sara thought that Raz Kids wasn't "much of a program" in her opinion from what she understood about its capabilities. However, Rachel, who learned Spelling City and Raz Kids on her own, as well as provided training in each, considered Raz Kids valuable but hard to learn to use well. This lack of knowledge about the programs may at times be about ease of use to help reduce the time needed to use these programs. However, there is some indication that it can lead to using the technology less, because the teacher is uninformed about the potential of the technology, and because she doesn't know where it fits in her teaching, which will be discussed more in the technology integration knowledge section.

Perspective from Leaders and Support Staff

When talking with the technology coaches, basic technology knowledge seemed to be almost overlooked. As will be discussed in the next section, their focus was much more on integration. But a few of the coaches spoke specifically about tech skills below. They mentioned that when new technology, like the digital tools, or even Gmail, were rolled out, that they felt they became more like "tech support" instead of integration coaches—that they were needed for very basic technical things.

(1) Coach 1: // I mean, I, last year, really tried to step back and be, like, okay, I'm not going to do all the tech support stuff because I really wanted to get to the coaching and free myself up. But it was like otherwise, and then you're like ... Then the teachers were, like, "Well, what good ... You know. Like I just felt like, "What good are you if you can't?" And then you realized they're not going to be able to get to integrating.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

- (2) Coach 4: Until they know how to use the program.
- (3) Coach 1: They're still having ... Right.
- (4) Coach 4: And or ... and to get through these problems or whatever.
- (5) Paul: ... to get to integration.
- (6) Coach 1: Right. Right.
- (7) Coach 2: But when teachers are coming to me, I'm seeing it more as a tech support.
- (8) Coach 4: Yeah. "How do I attach?"
- (9) Coach 2: Right. And, now, we're just starting to get at the point where, okay, I know how to use it, now they're ready for the integration. But that was ... This is almost a year and a half ...
- (10) Coach 4: //And, now, they adding more digital resources. I'm, like, "Oh, now, we got to go back to the tech support in the first 3 months."

In the first four lines, Coaches 1 and 4 discussed that even if they tried to focus on integration, they were still asked by teachers to help with basic technology knowledge. Coach 1 wondered, or maybe that the teachers wondered, what good she was doing if she couldn't get them past the technical barrier stage of using the technology. In lines 7 through 10, Coaches 2 and 4 explained that teachers need to get past a certain point with their proficiency before they can integrate which has implications for how Warren trains teachers. In line 9, Coach 2 mentioned that the basic skills stage of learning seemed to take over a year while Coach 4 mentioned three months. Given some of the examples teachers gave about still needing hints and even some basics like assigning an assignment, even after using some of their tech for a year, the length of time might be the former.

One reason why coaches might not be so focused on some of the more basic technology knowledge is that since the help they offer is typically optional for teachers, a few of them mentioned that they only see the more proactive teachers with technology; the least tech savvy or

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

the tech avoiders don't come to them. They also mentioned that it might be hard for some teachers to admit what they don't know. Many teachers need help obtaining basic technical knowledge and these examples are meant to help the district plan for this type of knowledge learning which for at least some teachers appears to be a precondition for more complex technology integration.

This realization by coaches, that teachers needed basic help, includes building teachers' knowledge so it gets beyond functionality with the technology to a competency level where use becomes "easy" for teachers. Then, they can spend more of their time working on integration. At least for these coaches, they feel there is a need for teachers to address the technical aspects before they can tackle the integration, which is discussed in this next section.

Technology Integration Knowledge (TPACK)

When thinking about technology and its effective integration, using the TPACK framework as a guide, teachers need a nuanced understanding of how the technology, content, and the pedagogy come together for effective instruction. In the survey, the teachers were asked a variety of questions about integration but the question that seemed most relevant for TPACK was, "to what extent do you know how to select a specific technology to enhance learning." For this question, 15% reported small extent, while 57% reported moderate extent, and 28% reported large extent. I will refer to this question as their "TPACK knowledge" rating from now on.

This next passage from Sydney points to a lack of knowledge about the technology and what it is accomplishing in her class. Like the majority of teachers, she rated her TPACK knowledge as moderate. She explained how she had her students using iPads in a center in her room. Her use is a generic technology center that can provide students with an activity, but not in the way that strategically enhances specific learning objectives.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Sydney: So it's ... it's basically for me, it's an easy center that I don't have to think about. That's ... It's a given, okay, here you go. Here's your 5 iPads. You do what you do. Time to switch, go back to the beginning and, you know.

Paul: Got it. And those ... those apps like the ones that came on it and you were told that these are good apps or just ... You just kind of ...

Sydney: We just had ... You know our technology coordinator has had, um, had had ... has had us suggest apps. We had an Appathon last year where we

Sydney: //It was ... It was so fun. It really was. She had, you know, appetizers and she had prizes and so you had to choose 3 apps to preview prior to this, so then she got them and she put them on the iPad and then you can preview them and then you had to critique them.

Sydney: //it was a nice way to, you know, figure out new apps and look at new apps and, you know, ...as I said, I need to spend more time, I need to find the time to go on the iPads and look at the apps and decide what I want each kid to do.

Sydney was not demonstrating a nuanced understanding of how her technology use was helping her students learn. However, she mentioned that she felt that the district typically gave teachers access to technology and eventually “someone” figures out what to do with it and then shares that information with teachers—either informally or in a formal training session. She’s essentially saying that she needs to figure out how to better use her technology but for now she’s at the point where she is simply using it.

Another example that demonstrated a possible lack of integration knowledge was when Sophie, who rated her TPACK knowledge as small extent, as 15% of teachers did, expressed a need to simply make sure she used the technology as much as possible, when asked what she was supposed to use the technology for. Sophie spoke about at first not knowing what to do with the technology and feeling overwhelmed. Then she worked hard to learn each piece of software and even taught her peers how to use it so her entire grade level at her school could use it in a similar way. She also talked about wanting to make sure her students had access to the same programs

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

that other students had in other schools. Given that many teachers just received the technologies, they were hindered to varying degrees by technical problems, and could have been less focused on what they were accomplishing with their tech use. The focus for some teachers seemed to be on “using” the technology and less about developing a “nuanced understanding” of how to use it effectively as envisioned in the TPACK framework. Sophie expressed a desire to speak with teachers who had been using the technology for longer than she had, so she could use it more effectively.

- (1) Paul: So what do you feel like you're supposed to do with those [technologies]?
- (2) Sophie: Use them as much as possible [laughs]. We- I use it in different ways like we use it for when they're writing so they type things ... Then we use academic resources that have been, you know, approved basically the whole district has things like Brain POP or Raz-Kids so we use those types of things.
- (3) Paul: And what are you trying to accomplish with that by just in ... you know, you can pick one and say, "This is what I try to accomplish with that."
- (4) Sophie: To develop ... independent ... I don't know. I guess they work independently ... and they are learning some things and practicing a skill that I'm teaching them and it's kind of just to reinforced self-directed learning activity.
- (5) Sophie: ... we do Spelling City. I've assigned homework through Study Island. Um, I've used Google Classroom when I'm out. I can give them an assignment and they can work on it through that way ...
- (6) Sophie: ... instead of having a worksheet if you put it into the Google Classroom, they can complete a worksheet on their own. So I've done different things.

In line 2, Sophie expressed how the technologies had been approved by the district and that she was using them. She wasn't sure at first what she was accomplishing, but then explained that she was using the technology for reinforcement and self-directed learning. At that early point in the implementation stage, it was understandable that simply using them was a reasonable goal, and she had more knowledge than many of the other teachers in the focus groups.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

The idea that technology that was provided by the district simply needed to be used came up in other discussions as well. Like a majority of teachers, Mila and Maggie, rated their TPACK knowledge as moderate. When pressed about which technology they wanted help with, Mila wanted a little help with “all” of them and Maggie said, “They’re paying for it, we want to use it.” Sophie, Mila, and Maggie were trying to use tools that had been given to them and in that sense, simply using them was partly achieving the district’s objective.

In the next passage, there is more evidence that TPACK knowledge takes a more nuanced understanding. Bridget, who had recently moved grade levels, discussed working to learn the curriculum and prepare lessons at the new grade level, which made it hard to have enough knowledge about how the technology would fit into her teaching. She also didn’t know enough about the programs to be able to prioritize which technology she should focus her attention on. This was compounded by the number of tech items she felt she needed to learn, which was previously noted by Marsha. Bridget rated her TPACK knowledge as large extent, the highest 28% of teachers.

(1) Bridget: // I want to be very familiar with my curriculum...

(2) Bridget: I ... I'm at the point, I'm at the point... what would be the thing that would be most effective for me to use in my classroom? If it's Google Classroom, terrific. Then give me, I would like to ... for somebody to tell ... I don't even know.

(3) Bridget: //See that's how ignorant I am. Like what is it that really would be good for me to be able ... for me to be able to function?

(4) Bridget: Yes, um, and then, um, and then to get training in that. So for me, I'm thinking like I ... I ... everything has just been thrust on me.

(5) Bridget: //And it's like, okay, got Google Classroom, got Spelling City, got Brain Pop, we've got, um, all these things, uh, and I'm, uh, there's just too much. It's like, uh, you know, there's ... there's, um, there's eight frying pans.

(6) Bridget: And there probably are eight, I bet you, maybe more.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

In line 1, Bridget talked about needing to better understand her curriculum, and then in line 2 she wanted to know what she should concentrate on to be most effective. Finally, she also expressed the need to simply “function” with her technology. In the focus groups, all three teachers who were new to their grade level expressed the difficulty of using their technology when they were getting used to a new grade level’s curriculum.

In the example below, during a conversation with teachers who felt they had better command of their technologies than most, these technical problems, and even integration problems were not a major issue. They wanted to be able to discuss, with their more knowledgeable peers, about further integrating technology to move beyond the basic levels of tech integration. They recognized that they were fairly independent with the basic technical aspects of their technology, and could begin integrating it to some degree on their own, but were now ready to develop a more complex understanding of their technology integration. Lane and Mary rated their TPACK knowledge as large extent, the highest 28%, and Samantha rated hers a moderate extent, as did 57% of teachers.

(1) Lane: Um, me. I don't, I think even ... I don't even know if it's, like, formal training. I would feel like just talking with other teachers that kind of, like, are on the same level. To be able to see, “Oh well how are you using this or that type of collaboration and time to go through that ...”

(2) Lane: I think is more beneficial for me than formal training on, okay this is how you log in, this is how you go to Glogster and this is how you create ...

(3) Mary: Right.

(4) Lane: I can kind of figure that stuff out on my own.

(5) Samantha: I feel as though like whatever our district already has, I'm good with ...

In lines 1 and 2, Lane expressed the desire to move beyond formal technical training that teachers in the other groups expressed a great need for. In fact, in this discussion all three of

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

these teachers went on to indicate that the vast majority of teachers need that type of training but Lane, Mary, and Samantha wanted to collaborate with the more tech savvy teachers to discuss ways to better integrate their technology.

Below, Mary also indicated that she was ready to talk about how she could benefit her students more with her technology use and how she could strategically “pull up this piece of technology” to accomplish a task which would be what the TPACK framework envisions. Therefore, there is a need, even in this group of knowledgeable teachers, for technology learning that is more about integration and developing a nuanced sense of why they are using the technology and how they can maximize its possibilities.

Mary: Like, uh, yesterday we had math articulation, and, again, I ... it was, “how to navigate the program,” and I know how to navigate. I just want to know how to make it more beneficial when I'm teaching it. Um, how can I use it or when can I pull up this piece of technology? You know, things like that, like you ...

Mary was frustrated by going to training that focused on the basics and wanted more collaborative PD about instruction to improve her practices. Also of note, Mary is in her twenties and more likely to be a digital native. She knows technology well but still wants help with integration.

In the passages below, was more indication that there are teachers who are confident in what they know and seem to have developed a more complex understanding of why they use their technology. Eve rated her TPACK knowledge as large extent, the upper 28% of teachers. She was talking about Study Island, a leveled reading software program that provides teachers with information like student comprehension of a given text.

(1) Eve: Well, before I used to do like Reader's Workshop options by literally having students you know do some work that I had generated for them. And it would take me time to actually get everything back to them or even just assess the data that's coming off of it. Whereas now I feel like it's kind of enhancing my lessons more by I'm able to use

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

different technology. Like for example I don't know Study Island, just kind of what's coming to my mind right now.

(2) Eve: So Study Island I like because I can actually click on a specific topic that I would like to focus in on. I can go over the topic with the class in a mini lesson. Then I can have them conduct a couple practice sets and then I can actually assign some type of classwork grade, that this way I can then look at that data and decide on who I need to pull back as small group instruction. Which I think is kind of- it actually happens faster so it's like enhancing my teaching ability, as opposed to having to you know like collect everything, have time to grade it, then really look at it. Now I'm just looking at the feedback, like, "How did they do?" So I like that.

In line 2, Eve explained that technology generated the work for her students to do, and gave her quick feedback about how the students accomplished their tasks, so it could inform her instruction. Like the knowledgeable teachers in the previous passages, Eve felt like she didn't need basic training and actually didn't think she needed the district to provide her with further support. When pressed, she explained that her colleagues, which she compared to a "PLC", a professional learning community, were all the support she needed. It wasn't that she didn't need help, but that she got what she needed from them. This collegial support and collaboration will be discussed further in Context section.

Perspectives from Leaders and Support Staff

The sentiment that simply using technology that had been purchased was a reasonable short-term goal was reinforced by both curriculum directors in the passages below. They realized that many teachers were in a replacement mode of use which was somewhat expected at the early stages of the technology role out. Cameron and Charlie, the curriculum directors, explained to me how each was thinking about his expectations for teacher use after an all-day training session that had taken place, which included a planning session to help teachers use the technology in their classroom during the coming months.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(1) Cameron: //Within the context of your decision making, and what you have decided is going to be your flow over the next month, work this out. Begin to use it [the technology] in a replacement manner. That's what we're talking about now.

(2) Charlie: //I think they [teachers] are seeing it right now as just an add-on, a pile on and so now we have to do this too. They are not seeing it yet and I can't say, "they" because there are pockets of teachers that get it but for the most part it is just another thing that we have to do on top of what we are already doing.

(3) Charlie: They are not seeing it as a tool, they are seeing it as another, and I don't even know what they would call it, just another thing that they have to do as opposed to seeing the benefits of using technology as a resource and a replacement of some of their older things.

Cameron explained that for now, using the technology in a basic way would be a reasonable short-term goal. Charlie elaborated, in lines 2 and 3, that for many teachers they were using technology in addition to the other tasks they were trying to achieve which suggests a lack of integration, and that teachers might not even be at a replacement level but an add-on level where the use is aimed at technology as an end goal and less as a tool to accomplish other objectives.

Coach 1, expressed below the idea that many teachers were not at the stage of integrating technology to the sophisticated level desired in the TPACK Framework.

It's difficult to get them to fully understand not just what is the technology, how does it work but then how do I appropriately put it into my classroom that is not just, "Now, today we're doing a tech lesson." I don't want that. That's not what we're going for. We don't want a tech lesson today. Today it should be like the air you breathe. Like when do you choose to use it and how is it benefiting you the most? It's not something you bring in on special occasions.

Coach 1 reiterated a point made earlier that teachers not only need help with the basics but then they need help with knowing how to select a tool and use it to benefit instruction. She also indicated that for some teachers technology use becomes an add-on or a goal unto itself. Students gaining tech skills through tech use is one goal, but as was mentioned in the problem of practice,

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

the goal is to obtain those skills through meaningful technology use that fosters other learning objectives at the same time.

The problem of teachers not having TPACK knowledge that is sufficient for better integration practices was further explained in the next conversation with the coaches. They explained that the goal of the recent training had been to help the teachers find connections between the technology and the curriculum they teach.

(1) Coach 2: The goal was to, uh ... is to explore the digital resources and find areas where you can use those digital resources like within the curriculum. Uh, so that, you know, say, there's a Brain POP video that fits perfect with the science unit or, you know, there's a comprehension skill in Raz-Kids that fits perfect with, you know, that Making-Meaning lesson, um, which I think depending on the ability level ...

(2) Coach 2: And the exploration [time during the training] was the important part. Most of them hadn't explored most of those resources before, so they're just getting familiar with them. They weren't really ready to quite start making a, you know, collaborative document full of these resources and where they should go in their curriculum.

(3) Paul: Okay. So, now, they're just aware of what they have?

(4) Coach 2: They know that there is stuff out there.

(5) Coach 2: But the big problem I'm hearing across the board is, "When do we do all this stuff?" or "Where do we fit it in?"

(6) Coach 4: There's that, that ... add-on, "How do I add this on?" rather than-

(7) Coach 3: And ... and that's an issue. It shouldn't be an add-on.

In line 1, Coach 2 discussed how the training had been set up to help teachers integrate, which in itself is recognition that teachers lacked this knowledge, or at the least, hadn't found time to utilize this knowledge. In addition, teachers wondered where the technology would "go" in the curriculum or how they were going to "add" the technology to what they were already doing. This indicated a lack of knowledge about integration as well. Again, with the recent roll out of technology, this was understandable, but was also a sign that teachers were at the point where

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

they were trying to fit the technology somewhere, not strategically using it to achieve curricular goals. On the positive side, the coaches recognized that this is a problem that needs to be worked on.

Principals reported a similar lack of TPACK knowledge with teachers. Principal Z elaborated on how close teachers were to having enough TPACK knowledge to be effective with integration. Principal Z referred to “3”, when discussing the three elements of TPACK, content, pedagogies, and technology.

(1) Principal Z: Not that close. I think that to strike the balance between these 3 is a challenge. Even your most gifted of all educators can have a tough time with it. I think that you can have teachers that have an amazing way of integrating technology but there might be content that’s lacking. I’ve seen technology used in ways where you’re blown away by the end product but when you dig deep into it it’s really lacking in that content and that higher order.

(2) Principal Z: You know what I mean? Where it looks good. I mean kids can create amazing things with technology. You look into it and you try and get an idea if they have a better understanding as a result of it where they just create something by using the computer. To strike that balance between all 3 is challenging. There’s no doubt about that.

(3) Principal Z: //Yes. There’s a difference between using it and using it effectively. Some people I think are masters at that and some are learning that and some need a lot of work on that. That’s true ... that there are people that are very comfortable with how to infuse technology and then there are some that are apprehensive and a little bit worried about how to do it effectively.

Principal Z in line 1 expressed that even the most gifted educator could have trouble with achieving the proper balance of content goals, appropriate pedagogy and technology use. This principal wondered about the amazing enhancement to presentations that technology can offer but suggested a possible need for reflection about what was accomplished beyond the new technology enhancement. Two of the other principals also expressed that teachers had a varying degree of TAPCK knowledge. One felt that teachers were doing a reasonable job of making

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

“conscious” and “subconscious” decisions about how they effectively use the technology while the other, Principal X below, felt there was a more substantial need to develop that knowledge.

Principal X: I still think we have a ways to go. I think there are some people that you can say, "Yes, they do all of that very well."

Principal X: ...but I think there are many [teachers] that still do pieces of it. It's not all integrated into one concise piece. We talked about it this summer with professional development. We've got to stop having pockets for 21st Century, and technology, and differentiation.

Principal X: It's got to all be blended, and that's going to take time for people to stop saying, "It's this project and that project. How do we make them all the colors come into one pretty rainbow?"... Unfortunately, we've still got that happening. That's when they go, "I'm overwhelmed".

Principal X noted that there were some teachers who possessed TPACK knowledge but many need to develop it. The principal also discussed how all of the initiatives have a tendency to overwhelm teachers if they don't know how to properly integrate all of them—including the technology.

There are clearly a full spectrum of innovators in Warren. It has many teachers who seem to be independent learners with basic technology knowledge while there are many others who need help learning how to use their technology easily and efficiently. In addition to the basic technical knowledge, technical integration knowledge needs to be further developed. When it comes to TPACK, it appears that almost all teachers want help with integration, whether it be to help get them started, sharing ideas about better uses, or becoming more innovative to help push the district forward in terms of new technology uses. In the next section, we move from teacher knowledge to teacher pedagogical beliefs.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Technology and Teacher Pedagogy Compatibility

If there is a conflict between a teacher's beliefs about teaching practices and the nature of the technology they are implementing, it can keep them from fully implementing the technology or completely prevent them from implementing it (Zhao et al., 2002). In Warren, survey results below (Table 5), point to teachers' ambivalence about technology. When teachers were asked if they needed to use technology to "be a good teacher" they rated it lower than 10 out of 14 belief questions on the survey. Only 12% reported that teachers must use technology to be a good teacher, to a large extent, 45% moderate extent, 40% small extent, and 2% not at all. Therefore, a majority believed a teacher must use technology in order to be a good teacher to a moderate or large extent, 57%, but nearly half, 42%, also believed technology was not a significant prerequisite for good teaching. These survey results suggest that a strong belief about the importance of technology in the classroom is not widespread.

Table 5. Survey Results: Teacher Beliefs About Technology

Survey Answers	Good Teacher?	Time Invested Pays Off?	Students Benefit?
Not at all	2%	2%	0%
Small Extent	40%	17%	12%
Moderate Extent	45%	47%	48%
Large Extent	12%	34%	40%

Teachers had a higher opinion about the benefits of technology for students. On the survey, 34% rated the time that needed to be invested to learn the technology paid off in student learning to a large extent, and 46% to rated it to a moderate extent. They gave even higher scores when asked if students benefit from technology use, 40% rated large extent and 48% rated

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

moderate extent. Therefore, a vast majority of teachers, 88%, believe technology benefits students to a moderate or large extent. Yet, it appears fewer teachers feel it is necessary to be a good teacher. This could be that technology is seen as an “add-on” or that while technology can be beneficial, it is not central to instruction. In addition to general beliefs about technology, there was clear evidence in the focus groups that the technology was causing teachers to confront their beliefs about the decentralization of the classroom that some of the technology tends to cause.

The rest of this section will present evidence and analysis about the interactions between teacher beliefs and the technology in Warren. Below are some comments made by teachers who had made a transition to a more student-centered, differentiated classroom and believed that the technology in Warren could help them with their goals. Note that when discussing teacher beliefs and their instructional practices in this section, my focus will be on belief, which can be closely linked to classroom practices. Classroom practices will also be discussed further in the Innovation section.

In the following passages, three teachers discussed how their belief in the value of technology caused them to make changes in their classroom practices. Here they confronted their beliefs about how child-centered their classroom was—a transition they said was not easy, but one they made, or were in the process of making, more easily than others.

Lane: So I put my assignments on there [Google Classroom], which it's been great. They, um, it, took a, a little learning curve for me also to relinquish a little control, ... because I'm grading online and I don't know how to transfer it to the parents for them to see how ... and editing online, that's where I'm, like, right now, I'm like oh I don't know how I'm going to send home the rubric, and, um, how the parents are going to see what they ... how when I do digital grading

Lane had mentioned that she felt students come into school ready to learn in the ways that she was trying to teach using Google Classroom because of today's technology environment outside

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

of schools. This belief propelled her to use her technology even though she admitted needing to relinquish some control and that she had not figured out some of the basics of grading or sharing information with parents. Lane felt that time invested in technology helped her accomplish her goals to a large extent, like 34% of teachers did, and that teachers must use technology to be a good teacher to a small extent, as did 40% of teachers.

Lane's comments were from a conversation with Samantha and Mary below. They talked about their beliefs about teacher control of the classroom, and that technology should be used for learning, not something students can do to keep them busy or simply gain technology skills. Mary reported that technology must be used to a moderate extent, as did 45% of teachers, and that time invested pays off to a large extent, as did 34% of teachers. Samantha rated that time invested pays off to a large extent, and technology must be used to a large extent, as only 12% of teachers did.

(1) Samantha: //I think that that goes back to the teachers' comfort of giving up their classroom, not being the central role anymore, the person that's going to guide every micro-managing bit of their instruction. And we'll say OK, today we're going to learn about X. Let's go find some [web]sites, let's go find ... let's then collaborate on a document, let's put together some facts.

(2) Samantha: I mean, I've done that in my classroom, but I'm willing and able to relinquish that control of me spewing information to them for them to go and find it. Now that, to me, is great learning ...

(3) Lane: Right.

(4) Samantha: Them partnering up, sharing a document, editing it among a class on, you know, whatever topic we happen to discuss that day. Um, that's me. Somebody that is not as tech savvy, is not as quickly to grasp on to this, I think will use it as a piece of technology in their room but not really for learning.

(5) Lane: I can also see people just putting them on ... a piece of technology and think oh we're using, you know ...

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(6) Lane: Oh we're using Raz Kids or we're using Brain POP or we're using this, but you're not really using it to enhance instruction, you're using it as a tool to just kind of like, oh go back there and go on Raz Kids.

In line 2, Samantha made the connection between the teacher's knowledge and how they might use the technology. If they don't see it as a tool for learning they might just use it as an add-on. These three teachers believed technology has a more central for learning than some teachers so they use it for learning. Their pedagogical beliefs about its central role and its potential for learning are aligned with the technology's capability.

Lane and Samantha were also cognizant that there might be a strategic balance of control between students and teachers or between the role of tech and the role of more traditional teaching, but they were more comfortable with that ambiguity than many other teachers to the extent that they were not letting it get in the way of changing their practices. Their belief in the capability of the technology overruled their trepidation about becoming too focused on technology or too child-centered. Below, Samantha's strong belief helped her make the changes she felt she needed to make.

So, um, from like my perspective it's the greatest thing that we've had, um, and it was very overwhelming, uh, to get everything in September, passwords, user names, try to coach the kids, train the kids on all of it.

Samantha and Lane not only believed in the technology but they believed in how their students could help them make changes in their classroom practices. They see their students as being resources for solving their tech problems, even helping to get started with the technology. As Lane noted, "I also do find if you give them the log-in and the password, they can figure this out on their own." It should be noted that Samantha and Lane teach older students, so their openness to let students lead might not be as relevant for all grade levels. However, it shows their belief that as teachers, they don't have to be the main sources of information in their classrooms. Lane

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

and Samantha clearly believe that their students have some of the solutions to their technology problems. Their beliefs contrast with Marsha's, who expressed a need to have the answers to student technology problems figured out ahead of time, before students came to her with things like password problems.

For example, Marsha explained in the Innovator section that she didn't have enough knowledge to help her students troubleshoot. She said, "they are teaching me, because I am not knowledge[able] enough in this software or the program to answer their questions, because I just don't have enough time to play with it." This problem caused her to ask for a slower pace for rolling out new programs. She wanted more time and training so she could feel more secure with the program before she used it with her students. Unlike Samantha and Lane, Marsha seemed overwhelmed by the number of questions that arose, that as their teacher she needed to solve, but couldn't. It is possible that Marsha's concerns were about being in control of the knowledge of the classroom or the digital native perception that some of her students knew more than her made her uncomfortable. On the survey, Marsha reported that time invested in learning technology pays off to a moderate extent, like 47% of teachers, and that teachers must use technology to a small extent, as did 40% of teachers (including Lane's). However, her belief, that as the teacher, she is the person to solve her students' problems appears different from Lane's.

Beyond believing that the teacher needs to have the solutions, the technology is causing some teachers to confront their deeply held beliefs about what it means to be a teacher. These tools, for some teachers, presented a threat to what they think real teaching is. Cindy did not think time invested in learning new technology pays off with student learning or that technology must be used in order to be a good teacher, giving both questions a small extent rating. She mentioned that the tools were too much for her to tackle and that she had "tucked" them away

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

until she was ready to figure them out. By utilizing the tools the way they had been presented to her, she believed she wasn't really teaching or that some of the programs were not worthy of classroom time.

And I felt, um, like on Monday at the in-service the teachers ... some teachers were talking about how they use Raz-Kids ... so they're using Raz-Kids and the kids read this and then they answer questions but ... It just seemed like it's all like they're doing this but when are you actually teaching?

This sense that the changes the technology was presenting to the teacher's role in the classroom wasn't real teaching was further detailed by Sara who felt that time invested in learning technology paid off to a moderate extent and that teachers must use technology to a small extent.

//its like almost we moved from being the teacher where we are actually teaching the kids, to now a record keeper, of going back and electronically checking did they do it? How did they do on it? Let's record, okay now here is your next story. Read it on the computer and get the test.

//I don't think I ever will do that [use tech as mentioned above]. I just feel like, and I don't know if you've ever been on Spelling City, but they are games. Yes, they are typing and they are typing their words in and its practice, but it's still in a format of a game. I almost would like to do that at home, where they can have fun and do that on their free time rather than, they need to be doing school-type things.

Sara's belief in the advantages of the technology, to assess student performance on a task, was very different from Eve's, who felt the information she received helped her do her job more efficiently and effectively. Sara was also clear that she didn't believe Spelling City was helping her students and didn't like being taken out of the assessment process. She had mentioned that she felt like the recent roll out of new digital tools like Spelling City were all geared toward making the students ready for the PARCC—that they needed skills like typing and navigating screens. Her belief that the technology is less for learning and more about skills for the PARCC is compounded by the belief that Spelling City is “just a game” with a “little girl dancing on the

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

screen” that should be done at home. Clearly, her beliefs and the technology are somewhat in conflict.

In the next passage, Natalie who rated time invested in technology pays off as moderate extent and that good teachers must use technology as a moderate extent, was struggling with how the technologies were challenging her beliefs about her teaching.

Kids in fifth grade also have Study Island, another one. That’s only for fifth, and it’s the same kind of thing. It’s like reading passages, answering multiple choice, comprehension questions, and do it all on your own. You are going to read this one, you are going to read this one, and then print out those scores so that you can send them home to the parents. I just feel like, what happened to the interaction. Where is the teaching?

Natalie recognized how her beliefs and the technology are in conflict and she could not help but express her sense of loss in what she valued in her teaching. She knew there were changes she was going to need to make, below, but that she was “not there yet”.

The teaching that I heard was going on using all these resources in reading groups in other schools is so different than what we are doing here. I know we are moving toward incorporating all these things, but they ... it’s like the kids have these menu item and they literally call it, it from the menu of what to do in Language Arts. The teacher I guess is acting as facilitator, which is a good thing, but I am not there yet with, this one is doing this, this one is doing that, and this one is doing that and the computer is doing all the scoring for me. I am just overwhelmed. I feel like it’s a whole other kind of teaching than me introducing the ... Then introducing the lesson with an anticipatory set and going in, it’s another world out there.

While Natalie admitted that she was struggling with the technical aspects of simply using the technology, she was being confronted by her basic beliefs about her role in the classroom. She believed that the technology was taking up too much of her classroom time. Natalie understood that she needed to make a change, but still questioned how central the role of technology in her classroom should be. She felt like some of the technology was a nice enhancement, or would be

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

good for homework, but that it wasn't what should play a central role. In the same conversation, Sara expressed her own beliefs.

That's exactly what I am feeling. Now that's taking where I would actually be interacting kind of guiding a group, now they are doing it on Spelling City, which is just a little spelling game. They practice their words. I could do that. That was our old spelling [program before we had "Word Study"]. You give them a list, they practice the words and that's it. I feel like it's not aiding anything. It's almost just like a replacement, a replacement for my teaching, ... I think that is what they wanted, they want us aligned to all that. I feel like at this point, where I would want it as an aid and it's not, it's a replacement.

// They [the students] are all working, and it's all quiet. If you came into the class you would probably be like, wow look at this. They are all on iPads. I just feel like, then I am useless, because I am really not doing anything.

// I think being their teacher, that's what I was always taught. Like, you teach. You interact and you go and you help, and you assist.

These teachers are very aware that the technology is confronting their basic beliefs about what should be happening in their classrooms. The message these teachers got from the recent training was that these are big changes that didn't fit with their pedagogical beliefs.

Their concerns were validated to some degree by other teachers who were also concerned about too much independent technology work and not enough interaction that was taking place in classrooms. Samantha was concerned that some teachers might take the independent technology work too far, but that she felt that she had found the correct balance.

Samantha: Same thing, but I am concerned that, I'm, I, and I'm concerned that some people may go more, so that it's so independent that the interaction between the kids on a social level is lost.

Samantha: I think that there was a lot, you know, that, that we've rolled out here in a very short amount of time, and that social interaction I think is so key. We have these phones, we have everything that everybody ... you know, we're so digital now it's like the easy interaction.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Some teachers clearly believed that the technology is more aligned with their beliefs and is promoting positive changes in their classrooms like Eve, Lane and Samantha. Others like Sara, Marsha and Natalie, feel that the technology is causing them to confront their basic beliefs. This conflict is causing them to doubt the usefulness of the tech and resist the changes that it could lead to. Also, in general there seems to be a concern about finding an effective balance with their technology use in classrooms.

Finally, while pedagogical beliefs can on the one hand cause resistance to change like Sara, Marsha, and Natalie, and on the other hand facilitate a change in teaching practices like Samantha, Mary and Lane, alignment between technology and beliefs can also further entrench practices—some more desirable than others. For example, Margo who rated both the time invested in learning technology pays off and that good teachers must use technology questions as small extent, reported that her SMART Board had “transformed” her teaching. Below is an example of how she found an easy fit with her beliefs and the SMART Board technology she had adopted.

Margo: I would have to agree. I think the SMART Board is the biggest thing that has changed my teaching style. Um, I was a board person, uh, you know, and I even put my SMART ... don't cover my board. I need my board. (laughs) I don't use anything but the SMART Board and I use it all day long. From the minute they walk in, they have their homework on it and it's got the objectives on it. It has what activities. I'll use it for teaching. Um, we'll brainstorm on there. It's just ...

Paul: So you use it all the time?

Margo: All day. All day.

Paul: So in general if I said ... So you obviously feel like you're getting something out of it. What is ... What would the benefit be?

Margo: Video ... Um, I can ... I had ... my content in Discovery Education so I'm teaching butterflies. I can put up a video and show the metamorphosis of the butterfly.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Margo: So it's a more ... much more interactive. Everything is there. I want to do Brain Power. I can put on YouTube, you know, dance and I got the kid- kids up and dancing within seconds so it's just that everything tool that you just need.

Paul: Okay. So like it kind of makes everything a little bit better?

Margo: Everything. More interactive. It's more colorful. It's more, um, it's more sensory. It's just ... It's really good.

Margo reported that the SMART Board, the most commonly used technology amongst teachers, had completely “transformed” how she teaches—except the example she gave was one where the SMART Board seemed to enhance her prior practices of centering herself. She transitioned from being a person who needed her blackboard to someone who needs her SMART Board. It is clear that she uses it often and also gains advantages from it. These tools are a good fit pedagogically for Margo but when the technology presents a gap between a teacher’s current beliefs, some teachers will use that as a chance to change their practices while others will struggle to do so.

Perspective from Leaders and Support Staff

Both curriculum directors confirmed that there were underlying pedagogical belief issues that hindered technology use. Both thought that the nature of the technologies to create a more student-centered and decentralized classroom was causing friction for some teachers. Below, Charlie explained the need for teachers to relinquish some control over their classrooms and let the students lead.

(1) //I think what teachers don’t realize is how much tech skills they [students] come with in a district like we are in. The kids are coming in knowing a lot more than I think teachers are giving them credit for. I think they are caught up on “I have to teach them how to use this app” as opposed to “here is the app” and let them figure it out. It kind of goes along with what we are doing with Danielson as far as creating more student centers.

(2) Inquiry based type of classroom. I think that is a philosophical shift that doesn’t necessarily, I don't think it is necessary because it is the technology, I think teachers feel

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

the need to teach everything as opposed to letting the students learn. I think with technology kids will learn it, I do.

In line 1, Charlie's acknowledgement that students sometimes have more technology knowledge than the teachers automatically decentralizes the classroom. Then the idea of using the first steps of implementing an "app" as a problem solving experience is also something that would decentralize the classroom. Combined, these two ideas are in conflict with the more teacher centered teachers like Sara, Natalie, and Marsha but are relatively aligned with the beliefs of teachers like Samantha, Mary, and Lane. A mitigating factor is likely to be teacher's knowledge because it is easier to allow students freedom to solve problems if a teacher knows she has the knowledge to step-in and solve problems if needed as opposed to a teacher who does not have that knowledge and would not be able to step-in in a solve a problem for the students.

In another example, Charlie explained how he thinks teachers have trouble trusting that the technology can be useful.

//they don't trust that the kids will learn from doing something like that, from being [on] Raz-Kids or being on Study Island, they still feel like in order for a student to learn it has to be face to face teacher to student. They are not giving the technology any credit for also helping the kids grow. It's not everybody.

His comments align with Sara's and Natalie's who wondered where the real teaching was taking place and who didn't want to be replaced by their technology.

This sentiment was also confirmed by one of the principals who thought that the more traditional teachers, who were more teacher centered in their beliefs, were having trouble making the changes they needed to make.

There's that very much that apprehension where I find that technology you get very few middle ground. You get people that are all in. You know what I mean? Or those that are traditional in their approach.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

The following statement from Samantha, a more student centered teacher gives some indication that the SMART Boards can be a beneficial technology that teachers can use but that they don't offer the kinds of student-centered instruction that is ultimately desired.

For what has worked for them [other teachers], it has worked for thirty years and no one's taking anything away from them.

Technology is the SMART Board and that's good enough. You know, I'm showing stuff up on there. I'm not bringing it in. I'm not requiring the students. What's worked ... and as far as I'm willing to go, I'm showing it up on my laptop.

Samantha seemed to reinforce the idea that for some teachers the SMART Board is the extent of the changes they're willing or able to make and that their belief about the appropriate role technology can play in their classroom is one that keeps them at the center of the instruction.

Conclusion

The Innovator section details the basic technical knowledge that teachers need. There tends to be many small problems that teachers need to learn how to solve in order to make their use easy and efficient so they can begin to work on more complex integration knowledge as envisioned by TPACK. In terms of belief, technology tends to decentralize the classroom and a teacher's underlying beliefs about her role in the classroom will play an important part in how the new technologies will be adopted. Working on helping teachers change their beliefs is an important factor to consider when making decisions about professional development. Also, finding the right balance that technology will play in the classroom is something that teachers seem to be wrestling with.

The Innovation

As was discussed in the Problem of Practice section, the Innovation is Warren's Goal Statement (see Appendix A) for technology use and the tools teachers reported using. One aspect of evaluating the district's current practices is to see how its technology uses align with the

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

vision and how teachers are using the tools that are given to them. The distance the teachers are to the available tools and the distance between the teachers' current practices and the envisioned practices will also be explored. Because this was a broad program evaluation, there was not a particular focus on vision and tools, it was just one part of the focus group discussions.

Therefore, the sections about vision and tools below are mainly here to help the reader know what teachers mentioned in the focus groups, how they relate to the district vision, and the implications for supports that are needed which will be discussed in the Context section.

Vision

In order to discuss my analysis about the innovation I have divided the vision into two parts below. The first part of the vision is focused on making sure that classrooms are "technology-rich" and "cutting edge". The district had provided many technologies that can address the first part of the goal and teachers primarily discussed this part in the focus groups. The second part is more open ended, creative and collaborative and geared toward 21st Century skills that the district is also focused on. On the survey, 88% of teachers reported that they knew how to integrate technology to accomplish the district's goal to a large or moderate extent with only 12% reporting knowledge to a small extent. It should be noted that no teachers mentioned the district goal statement in the focus groups when asked about the purpose of the technology tools they had access too, although there is evidence that their practices address some aspects of the vision below, mostly Part 1 of the statement.

While my characterizations of these tools could, and probably should be debated by stakeholders in Warren, I present them here in very general terms so the readers can have an idea about what the district has in terms of tools and possible links to its vision. My overall purpose with this short summary of the vision and tools is to demonstrate that there are tools that have

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

replacement and amplification potential and tools that have more transformative potential, especially if students have one-to-one access like with the Chromebooks in fifth grade. Part of the Implications section will provide suggestions to help Warren link its vision with its tools. The district goal is below.

We will strive to provide a cutting-edge, technology-rich environment (Part 1) conducive to our students becoming creators, collaborators, upstanding digital citizens, critical consumers, and innovators (Part 2)

Part 1 vision

In order to provide a cutting edge, technology-rich environment, Warren has provided many technologies that are briefly detailed below to help enhance teaching and learning. Teachers noted that these technologies offer enhancements by providing more resources than they normally could create on their own. They also noted that these tools could help with differentiation and teaching using different modalities (audio, visual) as well as engagement. Many also offer a home and school connection for homework, review of material, and practice of skills. While they might not be as creative, and open ended as the Part 2 technologies that follow, these Part 1 technologies can help make the classroom more student-centered. Some offer assessments that can help teachers make data-driven decisions because they can quickly assess a child's learning. Therefore, the teacher can adjust instruction or place students in differentiated groups based on the feedback provided by the software or websites.

Part 1 technologies

Part 1 technologies include the digital tools that come with the Go Math textbook series. There are tools for the SMART Board that enhance instruction and online features for homework, skill review, and informal assessments. For Language Arts, teachers have Spelling City which teachers mostly use to provide differentiated spelling activities in school or at home.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

They also have Raz Kids which can provide students with writing and reading activities like eBooks, some that provide feedback on student performance to the teacher so differentiated instruction can be more timely. Finally, Brain Pop offers short content area videos that can enhance instruction or independent work. All teachers have an interactive whiteboard, SMART Board, in their room. While these tools could possibly be used in some transformational way, they have a tendency to replace or amplify, potentially very significantly, current modes of teaching and learning.

Part 2 vision

This part of the vision is the more open ended, 21st Century Skills, creative, and collaborative part of the goal. There's a lot of potential for learning here, but I have little evidence of these uses. Since determining what this goal looks like in a classroom is more complicated than using something like Spelling City for spelling practice, this part of the goal creates more of a challenge for teachers. It would take more integration knowledge as envisioned by the TPACK framework to successfully enact these tools and this part of the vision.

Part 2 technologies

These following tools can help create a tech-rich environment like the Part 1 tools, but they have more of an open ended, creative, and collaborative potential intended by Part 2 of the vision statement. Included in this group are laptops, iPads, and Chromebooks since they have access to the internet, and have general software that can be used for a variety of purposes. While these could also be used for more basic replacement and amplification uses, individual students, or groups of students can potentially work with these tools in a more student-centered and open-ended way.

Google Classroom can be used to simply manage student workflow but when it is

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

included with the multitude of applications in the Google App Store there is greater possibility for open-ended and creative uses. Google Classroom was mentioned mostly by fifth grade teachers since they have one-to-one Chromebook access but any teacher with access to the internet and a Gmail account could access it. Edmodo is an online social media platform, which can provide teachers with a tool for the creators, collaborators, and innovators section of the vision statement. Glogster is a creative program for students to express their ideas in a variety of media forms like audio and visual. Glogster and Edmodo were mentioned by only a few teachers in passing.

Distance from Current Practices

In the Zhao et al (2002) framework, the distance between the teacher's current practices and the objectives of the new innovation determined how successful the innovation was. If what the teacher wanted to accomplish was closely aligned with the teacher's current practices, a modest adaptation or extension from existing practices, the project was more likely to be successful. On the other hand, when the teacher needed to reorganize her teaching to incorporate the technology, it was less likely to be successful.

There were many examples of widespread uses in Warren that were very close to a teacher's existing practices. These would fall under replacement or enhancement uses in that the technology's use was a close enough fit with current practices that the teachers, assuming technical barriers were reduced by training and support, adopted the technology into their classrooms rather easily. Examples of this ranged from teachers using an eBook in Raz Kids instead of a regular book, or using the SMART Board with a digital projector instead of a blackboard and overhead projector. Programs that were used for skill practice and content review, like the digital tools from the Go Math software or Spelling City, as well as technologies

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

that were used to help link home and school were also mentioned as uses that were close to previous practices.

Examples of these replacement and enhancement uses were detailed by Sophie. She rated herself as having moderate knowledge about how to integrate technology using the district's goal statement, the most common teacher rating with 57% of teachers giving themselves this rating. Replacement and enhancement uses that Sophie explained below had to do with having her students use the Go Math digital tools to accomplish tasks like taking tests online, that assessed the child's progress and gave feedback about what questions he or she answered incorrectly. Sophie noted that students could always use the program to print out another sheet of homework if they forgot it, and they could even keep up with classwork when they were absent. Below, she talked about how Raz Kids enhanced her instruction in ways that seemed close to her previous practices.

(1) Sophie: //... they've got to read something and ... and then do something else with that and now they're already designed programs through Raz-Kids through, um, Study Island where the skill is there and there's a video then they read, then they practice with the game and then they end with the quiz so it's much more than I would have ever have been able to come up with on my own.

(2) Sophie: //And especially the game stuff, I mean we can all come up with questions and have them do quizzes ... but I never did because I don't have the time.

(3) Sophie: // they're doing a lot more quick assessments than I've ever done before. I don't necessarily always use every assessment as a grade... but they're doing a lot of that, more so than I've ever done before. So I think they're doing more learning in Language Arts through these technologies and they're doing more practice than they would have before.

(4) Paul: Okay. Great. Um, the stuff that you said that they're using it for, is it similar to what you would normally use it for ... is it like a tech replacement? Would you say it's tech, uh, replacement plus an enhancement of what you were doing before or is it completely transformed your classroom?

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(5) Sophie: A little bit of both or all 3.

Sophie had mentioned how hard it was to learn to simply use the technologies but she didn't mention having a difficult time changing what she was doing in her classroom. It seemed very much that she found practical uses for the technology within her existing classroom instruction. For example, in line 1 she mentioned that the technology helped expand the number of resources available to her and helped coordinate the presentation of resources like video and text. She again referred to the number of resources available for things like games, something she had trouble doing before but now could do more easily. Finally, Sophie reiterated how the resources and the assessment tools made a big difference for her. She could easily be seen as providing a tech rich environment like envisioned in the district's Part 1 goal statement but in ways that were a close distance to her previous practices. It seems like all of these things she mentioned were improvements and enhancements but within what she was doing before, except the example of the games, which were something she wanted to do before, but didn't have the time. The lack of distance for Sophie will become clearer when the examples from other teachers reveal greater distance from their current practices.

Similarly, below is a conversation about SMART Board use. These teachers had just discussed how they all use the Go Math digital tools for instruction on the SMART Board and in this exchange elaborated that the SMART Board was also used during Language Arts time. Mila and Julia rated their knowledge of integrating technology to accomplish the district's goal statement as moderate extent, like 57% of teachers, while Rachel rated hers as large extent, as did 28% of teachers.

Paul: Okay. So that's good [Go Math tools for the SMART Board]. So that's a nice-I've been out for a year. That didn't exist when I left so that's a nice instructional tool that ... are you using it too?

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Mila: Yeah. Every grade.

Paul: Using it? [Go Math SMART Board tools]

Rachel: Oh, yeah.

Julia: And for Raz Kids.. and reading it is so you can project the text. It's like, to do a shared reading or, you know, we're looking at informational text features, like I can put informational text up on the SMART Board and we can underline, highlight, make notes, all kinds of things.

In this group's discussion, they reinforced the idea that the technology was a great amplification for their current practices so the distance between what their current practices were and the practices that the digital tools enhance were very close. As their conversation progressed, Julia mentioned that Raz Kids and Spelling City were great for differentiated instruction and allowed her to pick resources that matched the reading levels of her students. She never mentioned that Raz Kids was causing her to change her practices. She thought it helped her accomplish her goals. Therefore, the distance between her current practices and the technologies' uses were small. This is not the case for some of the other teachers.

Below, Monica mentioned that she might need to change her teaching practices to use the technology, which would lead to greater differentiation. Monica rated her knowledge of how to achieve the district's technology goal as moderate, as did 57% of teacher, but she also expressed a desire for a 1:1 student and computer ratio in her class. However, she recognized the shift that the technology was causing her to confront.

(1) So I'm not scared about it personally but setting up the time and time management so it should, if you take the time to figure out what to use it for, it should help you in the classroom.

(2) And maybe reinforce some things like for math, // to go over it to see it at a slower pace but you have to change your teaching like said like you don't do centers in fourth grade but now maybe you have to set aside time to do centers.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

In line 1 she noted that using the technology was going to take time for her, which only made sense when she noted that she would need to change her classroom set-up to include centers so students could work at a slower pace. She seemed willing to try this because the technology will help her differentiate instruction. However, that fact that she mentioned the amount of time she would need to make that change suggests that her current practices are farther than for the teachers like Mila, Julia, and Rachel with their use of SMART Boards, who did not mention how they needed to take time to change what they do in order to use them.

In another example of the need to change classroom practices, Kristen mentioned that she was having trouble making the changes in her classroom that she felt she needed to make, or that the technology would enable her to make. Kristen rated her knowledge of how to accomplish the district's technology goal as small extent, as 15% of teachers did.

(1) And they'll say "Well, make centers." I, I do centers in fourth grade. I need them to do a lot of independent work. I need them, you know, guided reading groups but I need to be able to say, "Okay, everybody grab a laptop. This is what we're going to work on," but I can't do that.

(2) //Uh, but I'm not sure what that looks like in a classroom. You know, am I supposed to teach a math mini lesson and then go, "Okay, everybody grab your laptop or whatever those, or Chromebooks are and we're going to go to this site, you're going to do this practice problems."

(3) //So I don't really know how to use it other than use it for, "We're going to do a research project on, get some pictures, do a Glogster or do a, whatever." I'm not sure what it really looks like in a classroom.

(4) // I also think that with Google drive and with a lot of the other technology that's been thrown out there, um, I think it's going to be on the paradigm shift about how we do things in the classroom. I just don't know what that looks like and I would like someone to tell me or show me what it looks like and I've gone on to, um, Teacher Tube or Teaching Channel or wherever to try to find videos to see what this really looks like in a classroom and how it's managed and, you know, what it's used for effectively.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(5) //It's a resource that provides an infinite amount of information. So yeah, I think the potential is phenomenal but you just don't go from nothing to everything in one jump.

In line 1, Kristen noted that she used centers in her class, so decentralizing her classroom might not be her issue but the technology presents enough changes from her current practices that she wanted more help and direction. In line 3 she mentioned using the technology for research or for a “Glogster” project. It could be that she is used to using her technology in isolated or contained projects and when asked to use multiple tools as part of her routines like Spelling City and Raz Kids, she is confronted with changing her practices in ways that she hasn't had to before. In her comments, she had mentioned access issues, reliability issues, her own technical training needs, as well, in line 4, a “paradigm” shift she felt she needed to make and that she would be going from “nothing” to “everything in one jump”. It appears that transitioning from using technology sporadically, or for certain types of projects, to making the technology a part of her daily routines was causing her to feel like her current practices were distant from what she sees as her potential practices with her new access to more technology.

There were other teachers who mentioned that using technology more often, or in a more central way, would cause them to make changes to their practices. As noted in the Innovator section under beliefs, Natalie, had mentioned that the way the tools had been presented to her represented a totally different kind of teaching and that she felt like she was in the dark ages. Her beliefs that she was going to need to be more of a “facilitator” were causing her to confront her current practices which caused her to feel “overwhelmed” by what she was expected to do in terms of classroom practices. She called it “a whole other kind of teaching”, different from “introducing the lesson with an anticipatory set” and was concerned about managing different groups of students doing different work at the same time. Clearly she had many changes she felt

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

she needed to make but she had rated her knowledge of how to accomplish the district's technology goal as large extent, as 28% of teachers did.

It should be mentioned that some teachers were so focused on learning how to operate their technology that they might not even be aware that the technology may cause changes to their current practices. For some teachers, they admitted they didn't know enough about the technologies to make a judgment about what they would use them for. For Warren's purposes, being aware that as more teachers begin to learn to use the technologies, there may be teachers who start to realize that it will conflict with their current practices.

Perspectives from Leaders and Support Staff

There was ample evidence from the support staff and the school leaders that there were varying degrees of distance between the desired practices with the technology and current teacher practices. There was widespread agreement that there were teachers who didn't have to change their practices very much, but there were many who would need to. Below are comments from three principals about the changes that teachers needed to make.

Principal Z: I think that even your most veteran teachers feel like they're in Year 1 again where they're trying to get their hands around all the new changes.

Principal X: Then I have a third grade teacher who, this year's introduction of the online digital resources threw her over the edge. This was way too much.

Principal Y: //some people are just like, "I don't get how to put this into my classroom."

If we think back to the teachers in the Innovation section, many of them wanted hints to make their technology use more efficient. Each technology had little aspects of it that changed how they assigned homework, and distributed, collected or graded work in an efficient manner. None of these things is a big change but the new roll out of technology amounted to many little classroom practices that needed to be changed. In that sense the distance for each change is

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

small, but it must be traveled for many technologies. These should not be overlooked because they were adding up for teachers and they wanted help with overcoming them.

However, for other teachers, in addition to making many of those smaller changes, their distance was compounded by the need to make more complex changes so there was even greater distance between the current practices and the desired ones. They might need to decentralize their classrooms and change the basic structure of their classrooms. Below, Cameron, a curriculum director, explained the changes in practices that teachers are going to need to make and why teachers are having trouble.

(1) The breakdown sometimes happens, because the management structures that they [teachers] use in the classrooms, don't allow for the technology to be used. It doesn't relate, sometimes, to their technical skill, as much as it relates to the way that they're planning lessons, and how they would use the technology within the lesson plan.

(2) When you have a [coach], part of what she's trying to do is help people understand the why behind the guided reading, the why behind balanced literacy and the workshop approach. Once you look at transforming that workshop approach, then. It's like, "How does technology support a workshop approach? How does it allow you to individualize instruction using technology in a way that you weren't before, and that you couldn't in a whole class approach?"

(3) That's the value of a Raz Kids and a Spelling City, and being able to use [Google] Drive and Drive documents and responses in different ways. You can very easily individualize instruction. If you don't teach in a manner that differentiates in that way, it doesn't matter what tools you have, because everybody's got to be looking at the SMART Board.

Cameron clearly talked about beliefs and practices but is specifically focused on basic management structures in the classroom that might need to be changed because of the technology. Then, once management structures are changed, actually instructing in a more individualized way using the technology as an aid can become a challenge, which might mean having students doing a variety of activities at once—transforming to a workshop approach.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Finally, in line 3 he explained that there will be inevitable friction if the technology is distant from the current instructional practices like having everyone look at the SMART Board.

Cameron explained the depth and breadth of the changes some teachers are going to need to make, which is why teachers like Kristen mentioned a “paradigm shift” and Natalie felt, “It’s a whole other world out there.” The distance between current practices and desired practices with the technology for many teachers is clear.

Distance from Technology

In the Zhao et al., (2002) framework, distance from the technology referred to whether the teachers had to buy more technology to accomplish the goals of the innovation, whether they needed to arrange for more access, or whether their access was restricted to the available technology in some way, in order for their innovation to be successful. One of their conclusions was that innovations were more successful when access was “easy” for teachers, and considered to be less distant. They also mentioned that when teachers had more control over their access, the more likely they were to be successful with the innovations they were trying to enact, the control made their access less distant.

The setting for their study is different from Warren in that the teachers in the Zhao study were trying to enact technology on their own, not within a much more coherent technology program that exists in Warren. Teachers in Warren were focused on technologies that the district had purchased and were providing support for. Despite the differences between Warren and the Zhao study, teachers in Warren described their access in terms of whether they had enough technology, how consistent that access was, how reliable the technology was, and whether these factors made their tech use “easy”. According to the survey, teachers had a more positive view of reliability than they did about access—although they were generally positive about both. The

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

majority of teachers, 84%, rated their technology as reliable to a moderate or large extent while fewer teachers, 65%, felt they had enough access to a moderate or large extent. Despite their overall positivity, teachers had some suggestions that could improve their access and reliability. Below, Cassidy discussed her SMART Board and her iPads and their relative distance. She rated her access as small extent, like 28% of the teachers.

- (1) Cassidy: Because that's something that you have everyday on the SMART Board. You use it on a daily basis but that's pretty much it because, again, there's no consistency with the other stuff for access.
- (2) Cassidy: // I get iPads once a week and it's on a rotating basis so it's never the same day
- (3) Cassidy: There's no consistency to what I do because there's no consistency to what I have.

Cassidy's access was easy for her SMART Board. It was always in her room so there were few barriers. In line 2, Cassidy's access to iPads was much more distant, which was clearly impacting her ability to use the technology routinely, as evidenced by her last comment.

Sophie, who had a similar situation to Cassidy before she obtained Chromebooks for all of her students, mentioned that when she had access once per week to her iPads she felt she was limited to placing the iPads in a center to play educational games. She took the survey before she received the Chromebooks so when she just had the iPad access, she rated her access as small extent as 28% of teacher did.

Sophie: // I only had a certain amount ... number on one day a week. So it was a center for games when they finished their work like ...

Sophie: ... games academic but that was the only really way I could use it in my room given the type of stuff ...

Sophie: //I don't have the iPads now but we have other technology. We've got the Chromebooks.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Sophie: //A complete transformation because sometimes, I would have given them paper, pencil versions of activities that they're doing or ...

Sophie: ... they've got to read something and ... and then do something else with that and now they're already designed programs through Raz-Kids through, um, Study Island where the skill is there and there's a video then they read, then they practice with the game and then they end with the quiz so it's much more than I would have ever have been able to come up with on my own.

Sophie had recently been given 1:1 access to Chromebooks which helped her make the technology a part of her daily routine in a more constructive way. Therefore, in her situation, as access became easier and less distant, her ability to integrate her technology into her classroom practices was more successful. However, it should be noted that increased access was not the major factor for change for other teachers. Natalie and Bridget received Chromebooks as well but they had trouble with where to start changing their practices and had not innovated the way Sophie had. This will be discussed more in the Implications section.

In this next conversation, teachers mentioned their desktop computers, which most classrooms have two. The desktops were often mentioned as being old and unreliable and this led them to be distant and not easy to use. All three teachers below reported that they had enough access to a small extent, as did 28% of teachers, while Cassidy and Mila reported moderate reliability, as did 74% of teachers. Julia reported that tech reliability was only to a small extent, as did 14% of teachers.

(1) Cassidy: All I have is 2 desktops. That's it. They are so slow and half the time they don't connect to the internet.

(2) Mila: // And they're really slow. They're very old. My are junk. I don't want the kids on it. The teachers use them. I use them to print.

(3) Julia: // Mine's much better this year than it was last year because we got newer laptops this year.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Cassidy mentioned the slowness and the unreliability. This was often attributed to the old age of the desktop computers, as noted by Mila. In line 3, Julia then said her reliability was better because she received new laptops this year. Teachers often mentioned old desktops or laptops as being barriers to the point of not using them very much. When a certain technology is considered old or too unreliable, the distance made use more difficult, and deterred teachers from using them.

The age of the laptops, and their need to have their software updated, were also mentioned as being factors for use in these next two passages. Samantha rated her reliability and access as large extent, as did 10% and 17% of teachers respectively. Lane believed that the technology was moderately reliable but only had enough access to a small extent, as did 74% and 28% of teachers respectively. Mary gave reliability and access a moderate extent, as did 74% and 48% respectively.

(1) Lane: Laptops, but we have the, um, the older ones which then they require, it requires a lot more work because a lot of them shut down, there's ... they're old teacher laptops, and they're old ... We run, we run into the trouble of

(2) Lane: //That some of our programs shut the computers down, um, they're not as gr-, good as the fifth grade. Um, that's where we, we have our, some of our issues, you know. One shuts down one, one doesn't work so that takes a little more time.

(3) Lane: // With the technology issues that we have. With, because we don't have the updated software or we don't have the updated computers. Ours are old.

(4) Paul: Is it a disruption?

(5) Lane: Um, when it does, yes when it doesn't work, yeah.

(6) Samantha: I can vouch and say, like last year, when I tried a lot of things like Glogster that does require a lot of ...

(7) Samantha: So at this time, I mean, fifth grade obviously is very, very lucky. We have these Chromebooks that have been rolled out this year in the district, and they have been the greatest tool I think that has hit our schools.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Lane started by mentioning that the reliability of the laptops was hindered because the frequent software updates required the laptops to shut down temporarily. In line 6, Samantha agreed and mentioned that when she was using the laptops last year, Glogster seemed to overwhelm the laptops, but that this problem was solved by having the Chromebooks. Chromebooks access the Google software applications online and software updates are much less of an issue. This Chromebook success is good news since the district is planning on providing more access to them.

Like in the Zhao et al., (2002) study, where teachers were sometimes competing for access over a busy computer room, teachers in Warren reported that they were borrowing technology from each other, which at times created distance. Below Mary rated her access as large extent, as 17% of teachers did, yet she reported that she would benefit from more access

(1) Paul: You touched on reliability issues so, like, can you talk about your access and your reliability in relation to, like, whether or not you use the technology or not?

(2) Mary: Oh we have, I have access to five iPads.

(3) Mary: //Um, which is, you know, great, but then I'll have a lot of people come to me some days from other grades and say can I borrow your iPads for the day? Or, you know, so maybe a little bit more would be, is that what you're asking me?

(4) Paul: Do you want more?

(5) Mary: I mean I wouldn't need one for every kid, you know? But maybe like two, even two or three to have the kids, you know, know how to you use it. I mean, I should be starting that right away in kindergarten if they're going to end up using it later on. So yeah, I would like a little bit more of it.

In line 2, Mary mentioned that while she had access to five iPads, other teachers borrow her iPads so she would like to have access to more. If everyone had more access, it would make it less likely that people would have to borrow as often, making her access more dependable. It should be noted that Mary's grade level peer reported that her access was good because she

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

could always borrow iPads from her team, that no one was ever using them at the same time. It seems that Mary doesn't have the same viewpoint about their sharing or iPads.

Lane, in the same conversation as Mary noted that she would love a 1:1 ratio because she felt that borrowing was also an issue. She wanted 1:1 access with Chromebooks because the software updating is much less of an issue and the access is also solved compared to having her current allotment of eight laptops. The Chromebooks seem to make the technology much less distant.

Below is an example of what Sophie said about her transition to Chromebooks. She started her comment by explaining how her laptops from the year before would need to update their software and that she had to borrow or sign out extra computers from the library.

Sophie: ... because they update all in the same day and that's ... And if you didn't update it and then it's ... It would become more of a pain and I know our school would dread this where we wanted everybody on a computer because with only 8, then you had to take some out from the library and which we could but it would logistically become. There were so many hiccups signing in and then they had to update and that takes forever and then it somebody didn't plug it back in so the charge isn't there and that was hard where now, they all have their own Chromebook and it takes 2 seconds to open and it's on.

Sophie: It doesn't take that uploading, that computers take. They [her students] use it much more frequently and in all different types of capacities. They use them for videos. They do work on them. They prepare things, they read stuff on them so there's all different ways that they can use the Chromebooks and it's much more efficient than when we had the laptops.

The increased access and dependability of the 1:1 Chromebooks in fifth Grade, especially since the software doesn't have to update, creates greater dependability and less distance. The current access for iPads and laptops in other grades has varying degrees of distance which create access issues that hinders the success of the implementation.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Perspectives from Leaders

Helping lessen the distance between the teachers, students and the technology is an issue that the leaders were aware of. Below, Principal X explained the benefit of storing the iPads in the classrooms, as opposed to the library, so teachers could depend on them being available.

Principal X: I still think now the problem is not the technology or the reliability of it. It's how do I use. How do I ... When I'm sitting home on a Sunday or a Saturday planning, is technology an absolute that I know ... I know I can have kids on the computers because it's going to be there and I have it and I know how to use it.

Principal X: I think you're sitting on the cart. I don't think it's a real thing. That's why I took it off the carts and gave it out. I said, "These are your 5. These are ... I think that that has made a world of difference.

Principal X: It's just more time. Go get it. I got to set it up.

Principal X realized that having the iPads in the classrooms helps improve access because the teacher doesn't have to go to the library and get the laptops which saves time, since often they need to be recharged between uses. It also allows teachers to plan their lessons around consistent access. It can be hard to plan for something that a teacher doesn't have reliable access to, like if someone borrows their iPads from the recharging station in the library the way that Mary mentioned.

Warren has created a plan to standardize access so every classroom at certain grade levels has the same access that they can depend on everyday.

Cameron: We have to look at the equity of access for all students. We have ... We're all over the place.

Cameron: // When I reflected on the conversation that we had last time, there are certain grade levels right now that have this level of access that other grade levels don't.

Cameron: // Right. You look and say, starting in grade ... you see here, ideally, we could have 10 iPads with a cart in every K-2 room; a SMART Board table or screen, a document camera, a classroom computer, to serve as a printing station, that kind of thing.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Cameron: // You look at grade 2, it's still looking at iPads, but then we say, "Maybe what we're going to do is buy Bluetooth or plug-in keyboards to go with the iPad, so kids can begin to develop keyboarding skills, that type of thing.

Cameron: // You look at 3-4 and we say, "What our goal is, is to have Chromebooks, but not Chromebooks that they carry back and forth to school, but just one-to-one access to Chromebooks all day." Grade 5, they begin bringing them back and forth, home to school, home to school, and they do that for every grade. That would be the idea of setting up a plan like that.

Cameron's plan to standardize access and increase that access is an admission that it has not been equal across grade levels or schools. This dramatic increase in access would give Cassidy the consistent access that she wanted, instead of rotating 5 iPads once per week. It would also Mary what she asked for, 10 iPads which would be the 2:1 ratio she asked for, and Lane her desired access, 1:1 Chromebook access. This plan confirms that there was a problem with access and the increased access is clearly a good solution based on the teacher needs stated above.

There was an acknowledgment by Cameron, one of the curriculum directors, that the Chromebooks helped with creating easy access for teachers in a similar way to how Sophie explained it. Access is sometimes not just having the device in your hands but having access to the needed programs on that device. Things like software updates, logging on, and even waiting for a laptop to fully turn on actually creates distance in a room full of children. Below, Cameron explained the benefits of these new devices. In this example, fourth grade does not have access to the Chromebooks but fifth grade does. Therefore, fifth grade's access is much easier than fourth's.

(1) Grade 4 does not have that access. If we have that conversation with Grade 4 teachers, about using some type of digital resource to kind of transform your instruction, they're still hung up on kids getting caught up on logging into a laptop computer, and all of a sudden the network being an issue and going down. Grade 5, they're just opening up their Chromebook, and nobody has to log in, because you don't have to turn the thing on. It's on already; that type of thing.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(2) All those kinds of issues are kind of eliminated now, in Grade 5. The conversation in Grade 5 is not about the log in and about the password and about this; the Grade 5 question is about, “How are you going to take these resources, because they are pretty accessible right now, and bring it shift?” For Grade 4 and Grade 3 and Grade 2, we’re having conversations about, “I can’t log into this thing, because I’m having such an issue with the technology.”

The Chromebooks have clear advantages for shortening the distance between the students, teachers and the accessible technology. Also, because they are inexpensive, they allow the district to provide 1:1 access in certain grade levels, which also makes the access easy and minimizes the distance. As Cameron noted in line 2, having reliable and easy access allows fifth grade to begin the conversation about how to use them effectively. Some like Sophie, will have already begun that process of how to use the technology, while others like Natalie and Bridget can benefit from starting those conversations.

Conclusion

In terms of connecting the vision to the tools it has, it appears that Warren is purchasing tools for teachers to accomplish the district’s technology vision but how the tools relate to the different parts of the vision is not something teachers mentioned in the focus groups. When technology created changes to current teaching practices it was harder for teachers to make the needed changes. If the changes are smaller, less distant, it was easier. There were numerous examples of access and reliability problems which created distance but the district also seems to be working to minimize those for next year. Increased access, less distance, helped teachers like Sophie increase her use very quickly while other teachers still needed more support to make use of the technology in their classrooms. The need for support structures will be discussed next in the Context section.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

The Context

The context, within which the innovators and the innovation exist, can influence the success of an innovation (Zhao et al., 2002). For this study, the context is organized into the technical, human, and social infrastructure. When an adequate infrastructure is in place, it largely goes unnoticed (Zhao et al 2002., p. 503). This includes responsive technical staff, knowledgeable “translators” or coaches who can help teachers use technologies to meet their classrooms, and a supportive and informed administration.

Responsive Technical Staff

There are a variety of types of technical support. This analysis discuss, traditional “tech support” which is of a basic technical nature to help keep technology working, and coaching which is more about classroom uses and integration. In the focus groups, when teachers were asked about their tech support help, as opposed to coaching for instruction, it seemed that computer teachers, tech coaches, along with the more traditional “tech support” personnel combined to support their needs for basic technical help. On the survey, 77% of teachers reported that they received “timely technical support” to a large or moderate extent with 22% reporting only to a small extent. Teachers reported that their technical support personnel were quick to help them and were sympathetic to their needs. Below is a conversation about how teachers felt about their tech support. Despite the range of scores on the survey, teachers uniformly praised tech support in the focus groups.

(1) Sophie: I do a “help desk” ticket whether it's either my tech coach or [the Tech Support Personnel] have come in and they're pretty good. I mean obviously, but it's not a big deal, I won't see them right away but I had an ink problem and it was done. I put in the help desk ticket in the morning and by the afternoon, I had black ink in my printer.

(2) Sydney: You know what, and since they made the change to taking the support away from the computer teacher, it has made a huge difference.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(3) Sophie: I agree

(4) Sydney: You know, them... them putting together a tech team was a fabulous idea.

(5) Margo: //We love them.

Of these three teachers, Margo and Sydney thought they were getting timely technical support to only a small extent. Sophie rated her tech support as moderate extent. In line 1, Sophie noted that she felt that she didn't get her ink right away but it was not something that hindered her use—although this was virtually the only complaint by a few teachers. Sydney mentioned that the computer teacher was more involved with tech support now that there is a “tech team” and this helped improve the support. There was a recent addition to the tech support team so two people now have responsibility for the four elementary schools. These two people are considered helpful and they don't “judge” the teachers for their “stupid little things”.

Sophie also mentioned in the same conversation that knowing a tech-support person was in the building eased her mind. This implies that when they are not there, she is worried that something will go wrong that she can't solve on her own. Relatedly, some teachers mentioned that they wanted full time coaches in their buildings so they could get help right away if something went wrong with their technology. Teachers seem to recognize the constraints of the two tech-support personnel, and considering those limitations, they were very pleased and appreciative of their tech support. However, it seemed some would like to be able to have someone on-hand all of the time in case help was needed. Below is a conversation from teachers who gave higher scores on the survey than those teachers in the previous example.

Lane: They can't even walk through the building without getting attacked

Mary: Exactly.

Samantha: I said yeah, “you guys are like the VIPs of the district ...”

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Mary: Yeah. (laughs)

Samantha: ... because everybody loves you. You walk in, they fix the, they fix your problem, you go thank you so much.

Samantha and Lane rated their tech support as large extent and Mary rated it as moderate extent.

As noted in Zhao et al., (2002), when teachers are dependent on someone else to solve their technology problems they don't have total control of their tech use. If something goes wrong, they can't use the technology until someone comes to help them. This might explain why tech support personnel get attacked when they arrive in the building. Timely help is always desired.

When teachers were asked about tech support, they also included their tech coach or their computer teacher in their tech support because these people could sometimes help them solve their problems. While some of their tech support problems were problems that any of those three support people could likely solve, other problems were more about how to use the technology in the classroom which the traditional tech support personnel reported not being able to help teachers with.

Given the easy confusion of pure tech support and tech integration coaching, I am briefly discussing, "tech support" here and then I'll delve into coaching next. Tech support for this purpose is more about the purely technical while using the technology correctly or troubleshooting a type of instructional use is more suited for a coach, or possibly a computer teacher. For example, Marsha, who rated her tech support as moderate, mentioned needing timely help to get her SMART Board working. It is unclear the nature of her problem, purely technical, or more about using the technology effectively. Either way, there was a sense that she'd like someone available to help her when she needs it.

Marsha: //If you are in the middle of a class and you do it you look like an idiot in front of your entire class. I always think of, oh my gosh I am having technology and I am

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

getting observed and it doesn't work. You know what I mean, there is all that pressure. You know technology. You turn this SMART Board on and it doesn't work, and you need it for your lesson.

For Marsha, the lack of timely help caused her stress, which is something that teachers expressed wanting help with. As noted earlier, this could also be tied to her lack of knowledge about troubleshooting, her beliefs about her role as the center of knowledge in a classroom or the level of control she expects to have over her technology. It is hard to tell but a combination of increased knowledge or increased troubleshooting help could make her less stressed about the inevitable troubleshooting that will arise.

Below Rachel, who also rated her tech support as moderate, explained that she could use more timely help with her technology from the tech coach, but the coach was not available because she had a full teaching schedule.

Rachel: Yeah. I feel like you, when you're rolling out all these kinds of things, you need a more ... uh, she's [the coach] teaching in a classroom and, you know, like, it'd be great if I get call her and hey, I'm stuck right now.

It seemed that at least for some teachers, they consider the tech coaches, the computer teachers, and the pure tech support people to be under the umbrella of tech support even though their roles, and their expertise can be different. It can be hard to tell exactly what a teacher needs and who has the skills to help her. For example, sometimes the computer teacher has enough classroom knowledge to help with a technical question about how to use a program, that the two tech support personnel who are not teachers, wouldn't know how to answer. Those tech support personnel mentioned that they were willing and able to help with basic technical problems, but that they were not able to help with the teaching part of the technology use since they were not teachers. Therefore, looking at the purely technical, teachers would benefit from even more timely tech support but they were generally happy with what they were currently getting. The

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

next section will provide some validation about these claims from the support staff and district leaders. I will then elaborate on tech coaching needs which are more complex and for which there was more demand.

Perspective from Leaders and Support Staff

The tech support staff commented that they get emergency calls to immediately fix things right away especially if a teacher was getting observed, but in general, they respond to calls within the same day. Here is an example of what they mainly do.

All right, so when we would go to set up a new SMART Board, which is very rare now a days, because every classroom pretty much has a SMART Board, so when we go to set something new up in their classroom I'll give them a crash course on how to use it, the basic functions, what's all included, the remotes, zoom, view finders for the ELMOS and stuff like that, I'll just show them that. Then they can do whatever they want with the remotes for the SMART Board, that's out of our hands...

They went on to say that there is a somewhat undefined team of people, but include the computer teachers and tech coaches depending on the extent of their technical abilities, who also help with basic technical problems.

Recently, the two tech support personnel were placed in charge of hardware while the computer teacher and the technology coach were asked to help with software updates and other software issues for basic technical help. Here's what tech support said about those recent changes.

Okay, well, that's probably different this year than it has been since I've been working here, because this year has been really good with software. The tech coaches and computer teachers have actually been handling them better, more efficiently.

This would confirm the teacher comments from Sydney that the "Tech Team" was an improvement from previous years. Also important, the tech support people have tried to teach the

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

teachers how to solve their own problems when possible. This came up with troubleshooting the printer problems.

//we've had these printers now for 6, 7 years, so they're very familiar with them. SMART Board calls, we tell them to look at the LED indicator light, is it blinking red, is it solid red, solid green, is there no light? If there's no light, make sure it's plugged into the wall, basic stuff like that. That definitely helps us. They're not doing our job, they're basically helping themselves.

When describing this, he explained that they can often help the teacher solve the problem quickly over the phone because the teacher knows what to ask for, or how to provide them with information that can shorten the time span of the problem. They went on to say that they do get called for, “stupid little things”, and that “90%” of the problems are usually something like “a cable is unplugged”. While this is something small and easy, one of them commented that they understood that the teachers were busy and were often in the middle of something else so they just didn’t have time to troubleshoot. In all, it seems from the purely technical aspects of tech support, teachers felt that their support helped make their use relatively “easy” and their access less “distant”, the importance of which was discussed in the Innovator and Innovation sections.

A Knowledgeable Group of Translators (Coaches)

When teachers were asked to what extent, their technology use was supported by coaches or trainers, their answers again skewed positive. A majority, 69%, felt they were supported by coaches and trainers to a moderate or large extent, with 31% reporting a small extent or not at all. Therefore, while mostly positive, nearly one-third felt they get support to a small extent or not at all. There was a substantial call for more coaching even from teachers who rated their support as moderate or large extent.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

How Coaches Help Teachers

In at least one of the schools, a coach held an “Appathon” to have teachers try new iPad software applications. This allowed the teachers to try them out with help from the coach and pick applications they felt they could use in their class. The coach was promoting iPad use by helping teachers select an appropriate app and get started. In the Innovator section, Sydney, who rated her coaching support as moderate, as did 31% of teachers, mentioned how the Appathon helped her try the applications out and get started in her class. Her students were using the applications as a center in her room, although Sydney still needed help moving beyond her initial uses. This type of initial replacement use could benefit from an administrator structuring time with the coach to help improve Sydney’s uses.

In addition to helping teachers select iPad apps, coaches were cited as simply helping teachers overcome technical barriers when new tools were introduced. In this next passage, Cindy, for whom all of the digital tools were new and had “tucked” them away until she could figure them out, explained how the coach helped her. Cindy rated her coaching help as small extent as did 21% of teachers.

Cindy: Uh, she [her coach] completely setup my classroom.

Cindy: And the reason I went to her a week or so ago is because I had five emails from parents, “We got these passwords why cannot... why is my child at, a kindergarten level at Raz Kids?” I never heard of Raz Kids until this, like I didn’t pay attention to it because it wasn’t applying, it didn’t apply to me. So I had to then... I explained to them that I was going to be trained on Monday, but I went to [my coach] and was like, “Please help me, how do I get this set up so at least they can look at something.” And she completely helped me with the Raz-Kids and Brain POP.

Cindy was very appreciative of the help she received from her coach. She was one of the teachers in the previous sections who felt that the changes to her teaching that the technologies were causing were not really “teaching”. Her coach helped her navigate the passwords, set

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

appropriate reading levels for students in Raz Kids, and made sure her students could use Brain Pop. Cindy could still use more help with integrating technology into instruction, but her coach helped her get started and made sure her students could have access to the programs. Given that most of the teachers were recently given access to a variety of programs, this type of “start up” help was common. From her coach’s perspective, the type of help she gave Cindy was basic technical help that she might not consider real coaching for integration. However, helping teachers set up the programs and get started is an important task that the coaches fulfill, one the traditional tech support personnel mentioned they did not have the expertise needed to help.

In-class Help Support

While many teachers reported getting help from their coaches outside of class time, teachers also reported getting in-class help. Natalie, who rated her coaching help as large extent, as did 38% of teachers, was very positive about the help she received in her class.

(1) Paul: The coach now, most have helped you with sort of like instructional things or is it more like tech?

(2) Natalie: No, instructional. Natalie: She came in ... we ... when she introduced to the fifth grade how to use Google Classroom she came and we really use Google Classroom a lot. It’s replacing paper and pencil for answering your questions and ...

(3) Natalie: Yeah, it is that still. It is kind of nice, but we did an assignment with [our coach] in the room teaching it. She got us going ...

Natalie in line 2 reported that the in-class help she received was instructional, as opposed to basic technical, and helped her with implementing it in her class with her students. As noted in the Innovator and Innovation sections, this type of replacement use was often the first step in implementation. This help didn’t transform teaching and learning but Natalie got help with making her class more of a “technology rich” classroom. Natalie was also discussed in previous

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

sections when she noted that she wasn't ready to make the transition needed to incorporate all of the tools she now had access to. However, with in-class help, she was able to get Google Classroom up and running in her class. This type of in-class help was often mentioned as being needed.

Since the coaches were not full time, they often had teaching duties that prevented them from going into each classroom. Sara and Marsha reported that they never had in-class help despite feeling that they could benefit from that type of help. Marsha rated her coaching help as not-at-all while, the bottom 10% of teachers, while Sara rated hers as small extent, as did 21% of teachers. Both felt they were "bothering" their tech coach when asking for help. This was mentioned at times in other focus groups because teachers were aware that, despite receiving a stipend for their work, coaches had a full time job of teaching to do as well. It seemed unclear to some teachers exactly how much they could call upon someone who was also a full time teacher.

This same sentiment was expressed by Lane, Samantha, and Mary who all felt like they could learn technology on their own. Despite being independent, they also called for more coaching to be available during class time and wanted coaching to be facilitated better. Unlike Marsha, Sara and Natalie who wanted more basic help, Lane, Samantha and Mary wanted more integration help with best practices, creating better technology routines, or pushing themselves to be more innovative. Interestingly, amongst those better technology users, Mary rated her coaching help as small extent, Samantha's was moderate extent, and Lane's was large extent. Despite the differences on the survey, and having different levels of technology uses in their classrooms, all of the teachers mentioned wanted more coaching help, but help that would take different forms. Overall, the amount and type of coaching teachers were getting was inconsistent.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Translators Need TPACK

There were examples of teachers who felt they needed or wanted very specific help with using programs and that the level of knowledge needed to help them required someone who was not only “techy” but who was also familiar enough with the specific program to know exactly how to best use it in the classroom. This would be someone who had been successfully integrating it into their classroom for a period of time. In this case below, Sophie thought two teachers specifically had this knowledge and wanted help from them and not her coach. Sophie quickly integrated all of her tech tools on her own, but now wanted more specific help using them better. She rated her coaching help as small extent as did 21% of teachers.

Sophie: There ... There's a couple of programs that we could use somebody who's used it. Like we had talked about [one of the coaches] or [a regular teacher] because they were really using it in the capacity that we would need to use it in.

Sophie: //And they were doing it a lot.

Paul: That's sort of nitty-gritty of classrooms.

Sophie: You know, because they were ... [using it] so long and that they've really been able to hone in on some of those programs ...

Paul: Right.

Sophie: And, you know, being able to combine their skills. We would ... We had requested having them come.

Sophie wanted the combined help of a classroom teacher and a tech coach to help her move beyond her introductory uses. She also wanted this type of expert help even though she was able to figure out how to use the technology on her own, and even taught her grade level how to get it started so they could use the technology in the same way. Her request for more expert help suggests the type of detailed and “nuanced” knowledge that teachers often need to be effective.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Below, Samantha is one of those teachers who had been using some of the technology and she explained how other teachers utilized her for her practical hands-on knowledge.

(1) Samantha: I think because I, I'm just kind of doing, and, I mean, I feel like I have a revolving door of people that are asking me too ...

(2) Samantha: I'm the resource for like grade four, grade five. So it's like Samantha what about Raz Kids? What about this? What about ... I'm like holy mackerel.

(3) Paul: Okay because they don't have enough access to the coach, so they go to you.

(4) Lane: They do have access, but it's just easy, you know ...

(5) Samantha: Plus, I'm a classroom teacher who also is using it correctly at that moment, as opposed to them who knows about and will work through it and will work through those barriers, but making implementation of how do you use this kind of comes then to me.

(6) Lane: But the coach being there all day, that's what their job would be.

(7) Samantha: Awesome.

In line 1, Samantha noted that many teachers come to her and in line 5 she explained that it was because she had the specific knowledge that they needed. In line 2, she seemed to feel that this was becoming too much for her. She felt that she was taking on some responsibility of the coach because she had the knowledge that her colleagues wanted. Part of the reason why she wanted more full time coaching was so it could reduce the time commitment she had been making to helping her peers. However, it was also clear that some teachers wanted very specific knowledge that went beyond the general technology help that a coach might be able to provide. Despite their general technical expertise, coaches might not know the fine-grained specifics of a program if they don't use it in their classroom on a daily basis as Samantha clearly does. This might indicate that a broader team of support, beyond the coaches, is more suited to meet the variety of specific needs that teachers have.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Below Sophie explained a training she went to with her coach, comparing it to the help she got from a more knowledgeable teacher.

(1) Sophie: ... and that part was the overwhelming part and, um, we can go to our tech coach on some things but our tech coach doesn't necessarily have the expertise that somebody else might have to give that quick answer because I think there's so much that the tech coach has ... or at least from our perspective might be overwhelmed with all of them and some coaches are just more tech savvy and they know ... they know the answers that I am asking really quickly.

(2) Sophie: ... and it [the training] was an hour and then when I spoke to another person from another class, they said, "You can learn Google Classroom in like 5, 10 minutes." And I did from another teacher and so it wasn't ... It just wasn't productive and ... and effective.

In line 1, Sophie mentioned the expertise she was looking for, that some coaches might have different areas of strength, and recognized that the technology coach was responding to a lot of teacher needs. She had spent an hour, in line 2, with her coach and still didn't get all of the information she needed but was quickly helped by someone with the specific knowledge.

I'll discuss this more in the Implications section since identifying the teachers who might have this very specific knowledge that Samantha has, and that Sophie wanted, might be beneficial for helping other teachers. While specific knowledge is sometimes needed, more general knowledge about integration, or the basic structure of their instruction, might be what other teachers need. Below, Bridget, Eve, and Stella discussed the need for integration help. They note that in-class help was needed and that it didn't have to be a tech coach or a "lit coach" who the district also had designated to help teachers with Language Arts instruction. Stella and Bridget rated their coaching as moderate, as 31% of teachers did, and Eve rated hers as not at all, as 10% of teachers did.

Bridget: What we do need is to have a full-time tech coach in the building to help, at least right now. Until all of us are comfortable with that.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Bridget: So they had to free somebody in every single building, that's what I'm thinking. Where that person isn't just doing stuff in the, you know, in the morning or after school.

Bridget: It'd be to have someone that's available during the whole day, where you can arrange to have a period, or two or three, to say that, okay, this person will come in and help me. So we need dedicated ...

Eve: I ... I'm going to ... I'm going to piggyback on that. And even say, too, the same thing with the lit coach would be great. Like an instructional coach.

Stella: I agree. It doesn't have to be a lit coach

This conversation raised in-class help as a need again, but it seemed like they were having a hard time naming what that help would look like. It could be because there are many different initiatives that are supposed to be going on at the same time and haven't been fully coordinated. There is a 21st Century real word learning initiative, the Common Core, PARCC testing on the horizon, and technology that is supposed to be integrated through these things.

Bridget was mentioned in earlier sections in that she didn't know where to start and wanted basic help about what programs she should be focusing on and then help with how to use them. On the other hand, Eve expressed little need for help, and Stella was independent with learning technology but wanted help with best practices and better technology routines. Their needs are varied. They might be about technology, literacy, or more broadly about an approach to instruction. This conversation above, and the previous ones, point to a complex array of needs that a coach might encounter. And while people appreciate their tech coaches and find them helpful, the district could benefit from being aware of the complex, and varied, needs of teachers and the possible broader number of teachers who have expertise to share, beyond the designated coaches.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Coach's Schedule

While some teacher's mentioned that their coaches had little time in their schedule to come into their classroom, others mentioned that even though their coach had more time, that time needed to be more structured. It should be mentioned that some coaches have less available time in their schedule depending on the exact schedule of their regular teaching assignment. The optional nature of the coaching, it being simply available, also left this important support too open-ended and that coaching time could benefit from more direction from either the coach or an administrator.

Samantha: I don't think that the position is effective with [the coach] saying, "I've got a teach all of this, then, OK, now I'm available for coaching". Listen, if I say I'm available also for dinner tonight you may call me you, may not call me.

Lane: [My coach] doesn't have a very heavy schedule, so she's available a lot more.

Samantha: Because she's got 30 minute increments as a opposed to [my coach] who's got an hour.

Samantha and Lane felt independent with their tech use, but still felt that more structured time would be better. This idea that more structure was needed arose around collaboration and support, that making time available was not enough, that it needed to be managed by an administrator which will be discussed more in the collaboration section.

Perspectives from Leaders and Support Staff

The idea that the type of knowledge that teachers need help with requires expertise that might best be shared between multiple people was elaborated on below by Principal X. This principal explained what the district needed in order to develop a more nuance knowledge about the technology integration as envisioned by TPACK.

You almost have to have the literacy coach and the technology coach and whoever the math gurus. You almost got to get in a room together and say, "How do we ... What are

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

those lines [in the curriculum] so that this is just the way we operate. Until you get comfortable with that ... It's not just I'm using Raz-Kids. I'm using Spelling City. It's going to probably not be able to satisfy a definition until we get those.

Principal X was confirming the statement by Sophie that there were multiple people with a variety of expertise that could collaborate to develop this knowledge. Principal X was explaining that the district needed to get people working together to determine the best way to blur the line of subjects and technology so better integration could occur. Also important, as noted in the Innovator section, she didn't think that this TPACK knowledge existed yet, which meant the district was still figuring that out. Therefore, the coaches, and other knowledgeable teachers can share their expertise about Spelling City, or Raz Kids, but their job might also include building knowledge about how to integrate 21st Century Skills which was the much more open ended, and somewhat less defined part of the vision statement. If that is the case, coaches have a more complex job than just showing teachers what to do with Raz Kids, or sharing expertise about Spelling City.

One of the curriculum directors, Cameron, provided some insight into the next steps of the technology integration that also confirmed the idea that expertise was spread across multiple people and roles, and that the end goal was very different than what currently exists. He talked about using the computer teachers and librarians to add more technology and content expertise support for teachers while explaining that he wanted to transform much of what is currently being done.

If we're going to transform what we do, we need them [computer teachers and librarians]. They're the ones that have to be the support for everybody, to make that transformation.

That model, of the way we do the computer room, and the way we do the library, has to change completely. It's an archaic model. We're kind of caught in a prep cycle issue right now, driving that instructional design. I'm kind of like, "We need to revisit all of that." If we're really talking about 21st century scenarios, and integrating technology, and kind of

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

cross-cutting across disciplines, then you have to look at those 2 areas and see, they have to become the resources and not a separate entity, as such.

He recognized the need to provide more help to teachers that the coaches alone might not be able to satisfy. I mention this because not only does it indicate that various people are likely needed for different types of expertise, it is clear that there are plans for large changes to how teaching and learning are conducted. If that is the case, coaches will be part of a change that involves more than them simply sharing their expertise, but also helping to build and construct new types of knowledge that cut across disciplines and creates 21st Century real-world scenarios for learning. While there is a short term vision that involves straight forward replacement uses, that Cameron admitted were expected at this point in time, there is a larger, more complex vision that is still somewhat unclear or undefined. I will address this more in the Implications section.

Some of the coaches confirmed Cameron's comments about the increase in teacher needs. In a few short years their job went from helping individual teachers with getting a single software application established in their class to supporting the entire staff with basic skill help and furthering integration from kindergarten through fifth grade with various devices and software.

(1) Coach 2: Um, from when we started the new initiatives. Like, when I accepted the position, there was a couple of people that wanted to try blogging.

(2) Coach 2: It was literally ... It was actually for teachers who were ready to start using tools and how they could use those tools in the classroom. And then, when we rolled out Google, it became "how to read your email," and, like, we became more of like tech support than integration, like ... like tech integration.

(3) Paul: Do you feel like sometimes you're more tech [support]... like, right now especially ...

(4) Coach 2: Definitely, right now.

(5) Coach 4: Oh, yeah.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(6) Paul: and it's not tech support?

(7) Coach 2: ... not like if you look at the original like what our role was, that's ... that wasn't it at all.

(8) Paul: It was integration for...

(9) Coach 4: Like, I was doing it in all the schools, and it was like that thing, blogging, it was using it. It was ... None of it was tech support.

(10) Coach 2: ... but it was all about, like, "How do I use Raz-Kids?" Like, how do I ... Yeah. Like in the context of using it

(11) Coach 4: Exactly. "This is the way I structure my classroom." It was all integrated.

In lines 1 and 2, it appears that as technology went from being something that teachers could adopt to something that was required, the demand for help increased and the coaches have been addressing those demands. It could be assumed that the increased demand might include teachers who are less willing or less able technology users, which is why the coaches are reporting doing so much work on basic technical help. It seems like these coaches think of basic technical help as "tech support" but the actual tech support personnel noted that their technical knowledge stops at a very basic level of operation so it is possible that there is a gap, or relative weakness in support, in this basic assistance for teachers. This gap is for start-up help and technical training where many teachers have a substantial need. If that basic training can't be supplied by tech support, because they don't have that know-how, and the coaches feel it is not really what their role is for, although they are filling that role—there might be a need to clarify who provides basic training or how teachers get basic training which seems to be needed for many teachers.

If we think back to Sydney who utilized her coach to pick apps for her to use, or Cindy who had her coach "completely set up" her classroom so her students could get access, these examples might be what some teachers are beginning to expect from their coaches. For those teachers this is what coaching is, basic help to get started and then stagnant progress after that.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

This is where the administrators could begin to help structure these interactions to make them more geared toward improved integration (once teachers have had the basic training).

The curriculum directors were aware that the coaches have a difficult job and will require more support and direction in the future.

Cameron: It made me realize, we have to use these coaches in a very different way. One of the things I've been very clear with principals about ... [We] are very involved with the coaches, talking with the coaches. I'm getting more involved with the tech coaches now, because I feel like they need more direction.

Cameron: //It's the kind of thing where, when you look at the coaches. The principals have to plow the way. I tell them, "I don't want any coach out there going to somebody and saying, 'You have to do this,' without the principal being fully supportive and understanding, and being the one ..." The principal is the one that says, "You have to do this." What the principal has to do is set the schedule up, or the training, with the coaches. Until that happens ... it doesn't happen everywhere ... you're not going to get any movement from anybody, because you can't have the discussion about the why, because people aren't dedicating the time to it.

Cameron validated previous assertions that the coaching needs to be better organized to help structure what goes on during coaching and to make sure the teachers who are more reluctant to seek out coaching, get coaching too.

The idea that some teachers were avoiding getting help was confirmed below by Charlie. He also touches on the problem of the principals not being involved enough in the process.

Charlie then validates and expands on Cameron's comments.

(1) Paul: Even though they [the coaches] are great on their own, they need support direction?

(2) Charlie: They are not administrators either, they can't assume their way into a classroom and say to a teacher, "you don't really know what you are doing. I am here to fix you." They need direction from the principal. It has to be facilitated that way. What was I going to say, when we mandated these, and there is not that many, there is like four mandated programs. That is when certain buildings were really blindsided because they didn't even know those things existed.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(3) Charlie: No matter how many leadership councils we talked about, this building is going to use Raz-Kids, we want to pilot in your building, there were people...It is like “I have never done this, I have never even heard of it before.”

(4) Charlie: I think we have the structure in place ...//if you take a lit coach and a tech coach into a second grade Language Arts block of time, there could be great support, it could be phenomenal support there. We are like baby stepping into it though because our lit coach is a full time teacher and our tech coach is a full time teacher.

(5) Charlie: Their availability for that [coaching] is not that great. In theory it’s just in practice, it’s a little weak I think we are still trying to figure out how to make it work...That lit/ tech coach, Cameron and I talk about changing that role to more of the instructional coach ...

Charlie reported in lines 4 and 5 that the fact that the coaches still have full time positions as teachers is something that they are working on changing. They might change the position or find a way to improve the availability of the coaching. Charlie reiterated the idea that principals need to be more involved with the directing of the coaches but he also mentioned that there seemed to be a problem with either communication or follow through at the school level when it came to technology use.

In lines 2 and 3, it appears that teachers in some schools didn’t know about the new technologies and that they were “blindsided” when they were rolled out. If the principals are going to be more involved with communicating the plans for technology, identifying teacher needs, and directing coaching, there will need to be better coordination and communication between the curriculum directors and the principals as both Cameron and Charlie have noted above. Otherwise, this responsibility will fall to the coaches, or it might not be tended to at all.

Professional Development (Training)

Teachers reported wanting to know more about technology integration and felt it was largely their responsibility to learn about technology integration, which were the highest scoring items on the Belief section of the survey. To a large or moderate extent (see Table 6), over 90%

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

of teachers reported they wanted to learn about technology integration in general, in terms of the PARCC, and Common Core specifically. They also felt it was their responsibility to learn about technology. However, only 37% felt they received enough professional development to a large or moderate extent. This next section will elaborate on their training needs.

Table 6: Survey Results: Teacher Beliefs About Professional Development

Survey Answers	Your Responsibility?	Learn Tech in General?	PARCC/Common Core?	Enough PD?
Not at all	0%	0%	2%	12%
Small Extent	9%	10%	9%	52%
Moderate Extent	42%	30%	30%	30%
Large Extent	55%	60%	60%	7%

The faculty had recently been given access to many digital tools, and had just been to an all-day training on Columbus Day. The training was fairly similar for each grade level in that there was a large portion of the day dedicated to technology. Teachers had this experience fresh in their minds and had a lot to say. Rachel and Julia rated getting enough professional development as moderate extent, as did 30% of teachers, while Mila and Maggie rated theirs as small extent as did 52% of teachers.

(1) Paul: Okay, so for you, the training was okay because you knew it. You're kind of ... You had a head start on it.

(2) Rachel: I mean, I left with a head ache because it was like ...

(3) Maggie: Overwhelming?

(4) Rachel: Yeah, you were over ... you felt like they kept hitting you with more and more and you're expected... and 5th grade had to go off and do Study Island. It was just continuous.

(5) Julia: It should have been one resource at a time.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(6) Rachel: It was like, "Okay, here's Google Classroom." In 20 minutes, we spend ... You know, only in 5th grade right now is using Google Classroom so all the 4th grade teachers were like, "We don't even have the Chromebooks or the laptops to be using Google Classroom right now. And then it went on to, like, um, Brain POP and it was like, okay.

(7) Paul: So you got, you got a little bit of training but it was too much. Like of, you know way too many resources.

(8) Maggie: Not enough [training] at best (laughs).

(9) Rachel: It was an overview and it wasn't enough detailed about the programs that ... You know, okay, for me, I didn't need Raz-Kids or Spelling City but everybody around me was like, "Why, huh, how, what, how do you use that? What do you use that for?"

First, it should be noted that Warren doesn't typically roll out this many tools at one time so this might be seen as an anomaly. However, with a planned roll out of a lot more technology access next year, how teachers respond to big changes in technology will have relevance. The important parts to take away from this passage are that many teachers can only handle so many things at a time (see line 6). When too much is covered at once, it leads to not being able to provide enough detail for teachers, as Rachel stated in Line 9, possibly making it hard for teachers to even keep up with the pace of the instruction, as is evident at the bottom of line 9. Again, Rachel was a teacher from the Innovator section who had provided training in some of these websites and programs before so she has some idea what teachers need in order to be able to use the technology in their classroom.

This is explained further in the next passage. I asked this group what they would like in terms of training after a day like they had just participated in. Cassidy joined the conversation and rated her PD as small extent, like 52% of teachers did.

(1) Paul: //so what is that going to look like? If I say, "They need more training." They're going to be like, "What does that look like?"

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(2) Cassidy: Exactly what she [Rachel] did last year. She had an after-school workshop in Raz Kids.

(3) Rachel: Um, I mean, I just took them through like Raz-Kids. Like we ... I sat there and um, I had it on the SMART Board and I went through, "Okay, here's how you sign in. Here's how you create an assignment."

(4) Cassidy: Step-by-step. "Here's how you file cabinet things. These are the some of the components of the program that are available to you. Here's how you should use ... here's how I use it, here's how you can use it ..."

(5) Paul: Okay, and so you're just showing not only just how to actually figure out Raz-Kids but also here's how you might use it in your classroom.

(6) Julia: It's almost like it needs to be like 2 hours. Like the first hour is like somebody showing you and then the next hour ...

(7) Cassidy: And then the second hour ...

(8) Mila: Playing around with it.

(9) Rachel: //So for me, some of it, like I didn't know anything about Google Classroom so that was helpful for me but I...it was so fast that I don't know that I could take any of it back and apply it.

What this group is asking for is both more time and detail from their training than they are currently getting and fewer items to learn at once. In line 4, Cassidy explained the type of detail that she needs, including time to play with the technology. This was a common theme amongst everyone except the very highest users. This point was also made by Rachel. She only had to learn about Google Classroom but she didn't feel that she received enough training to apply it.

In another focus group below, they described what they needed after the October in-service. All three of the following teachers rated their PD as small extent, as did 52% of teachers. They also explained how they felt the in-service day went.

(1) Sophie: And sometimes when we're being trained, it might be too overwhelming because they're giving us everything ...

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(2) Sophie: //... for us to be just given an account and then have guidance while we're there sometimes that is and then you have that collaboration, "Oh, hey. I can do this or I can do that." And, you know, maybe meet up half way through the playing time to show us something but when you show us everything, we catch maybe 1 thing and then ...

(3) Paul: Okay. I heard that. That ...

(4) Margo: Isolate it more.

(5) Sydney: I remember 2 things out of the 10 things that they

(6) Paul: It's like if you don't use it quickly, you're going to forget it and then...

(7) Sydney: Where do I click, let me think... (laughs)

Sophie reiterated the need for fewer things to learn at once in line 1 which was confirmed by Margo and Sydney in line 4. When there is too much to learn at once, they feel they only remember "2 things out of 10". This pattern was previously confirmed by the tech coaches who felt like their role became more about basic tech support when new technology was rolled out. The key takeaway from this passage is that after an in-service day on many new resources, some teachers need substantial training and ongoing support.

For many teachers, they need more basic help than they get from the training sessions so the coaches, to some degree, have to provide that basic training. However, as the coaches noted, this delays them from working on tech integration. Also of note, Sophie mentioned that she liked the aspect of the training where she could work in groups with teachers and also get "guidance" which was given by technology and literacy coaches. Teachers liked that they had access to these experts during the training sessions. There will be more about different types of expertise later.

Because training often takes place during full day training sessions twice per year, it can be hard to provide timely training so teachers asked for continued support. In their focus group, Sydney and Margo asked for ongoing refresher courses for things that they had been trained to do but had forgotten. This type of timely ongoing support also arose around beginning-of-the-

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

year start-up problems that some teachers were having as evidenced below. There was a change that happened to the Think Central website and it was an example of a small problem that was hindering people from accessing what they needed to.

(1) Cassidy: One of the teachers in my building asked [one of the administrators] a direct question at one of our last meetings and said the dashboard has changed for Think Central and everybody's confused and they don't know how to access it. "Will there be time at the meeting that we're going to next week, the whole day meeting, to talk about this and figure it out?" He said, "No," but didn't have an answer as to how we were going to get that training. Just said "no."

(2) Paul: And that's the dashboard on ...

(3) Cassidy: On Think Central, which is Go Math!

(4) Rachel: You have to go to "Resources" to finally ...

(5) Mila: First page changed but if- there's a word that says, "Resource" you hit that, it's the same after that.

(6) Cassidy: Everything's back but no one told us that. You kind of ... you had to figure it out for yourself.

(7) Maggie: No one told us that.

(8) Rachel: Yeah. Mine keeps coming up to 2nd grade every time but it's still ...

(9) Mila: I know. It happened to me last year. I'd get ... kindergarten stuff.

(10) Cassidy: But even they asked, you know, "What about, uh, Monday's session? You know, could we do it then?" "No, that's not what it's for so ..."

When Cassidy in line 1 was explaining this problem, part of what she was trying to say was that she was learning about new technology on the following Monday when she still had needs with her current technology. This in-service day was on Columbus Day so if these teachers didn't have access to the program yet, then they didn't have access for the month of September. She wanted what the research might explain as "responsive support" (Granger et al., 2002). She wanted some quick and timely help. It seemed like it was a simple solution in lines 4 and 5, but

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Cassidy wanted more structured help because she then said that she had to figure it out on their own. What also came up in this conversation is the “No one told us” comment from Maggie in line 7. This idea that there were lots of little things that teachers need to know came up repeatedly in the focus groups. If a teacher changed grade levels, like Rachel from line 8 who used to teach second grade so her screen comes up as second grade, there were a variety of little changes to the programs that they wanted help adjusting to. In some ways it is a communication problem, telling people all of these little things in some efficient way, or a training problem because they need to be told this in more continuous training. The useful takeaway from this passage is that the district can anticipate that there will likely be beginning-of-the-year technicalities that some teachers will need help with in addition to the ongoing help throughout the year, which was mentioned previously.

Not all teachers felt they needed to tackle fewer pieces of technology at a time. A smaller group of teachers expressed a frustration with being bored at the Columbus Day in-service because it was too slow, or too introductory. The conversation below was about how the previous training went for these more independent teachers and what they would like to see happen in the future. Samantha and Lane rated their PD as moderate, as did 30% of teachers, and Rebecca rated hers as small extent, as did 52% of teachers.

Samantha: Um, I will tell you my response was, you almost need to tier that to, like, “I know nothing ...”

Lane: That's what [Coach 2] did one of her workshops ...

Paul: A little more specialized?

Lane: And I was telling Paul... There were three different tiers and it was so much better. So that way, “I don't know how to log in” was in one room...

Samantha: //And then your goal is to get from the inter-, to the intermediate stage.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Samantha: Like that's your goal, by the end of that day, I have all of this accomplished now I consider myself an intermediate user of two of them.

Lane: So then they don't feel overwhelmed, and we don't feel bored.

Samantha: Right.

Paul: OK. Do you feel the same way?

Mary: Yeah I totally agree.

Samantha: This is the line you should use in this entire piece, “we differentiate in our classrooms, we should differentiate in our workshops.”

These more competent tech users were agreeing with what Sydney, a lower tech user said earlier, that some people need a lot of help, like refresher courses and basic training, and some people don't. These more independent teachers confirm that other teachers need more help than they do, but they would still like the chance to move their skills and knowledge along at their level too.

Some of these issues could be addressed by anticipating these needs, and providing training before the initial rollout as well as providing ongoing support during the early stages of implementation. Part of the desire by teachers to get more training, or to take the training “one-thing-at-a-time”, appeared to be because they wanted to feel more secure about their own abilities, which could lead to achieving the district's goal of creating competent, confident, and inspired teachers. Bridget below discussed what she would like to have happened with the new technology roll out and the training that followed. Bridget rated her PD as small extent, as did 52% of teachers.

Bridget: Well it's a time factor too, like I think because I was thinking in terms for the summertime. Because we're getting Chromebooks we knew in September, like we were going to get September 19th was the launch date I was thinking. And just looking in retrospective I think , “Well how is it one changes things that have happened in the past and make a better future?” I was thinking it would've been a perfect opportunity, pay teachers and you give them the time this summer to say look we're getting Chromebooks. These are and or all these other software components, these are the days that are going to

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

be offered for doing specific training, and to offer like three hours of training in one program instead of just like a piecemeal product of saying, “Well we got an in service and we got 7 programs.”

Bridget: I feel like it wasn't really done in the matter that would suit me. I would like to be able to have trained on it a lot, to be able to use it effectively in the classroom. And secondly moving forward, I hope that that happens in terms of having a plan. Instead of saying, “well you can go to this” you know we're figuring our own professional development but for me my main focus is teaching the kids that are in my class and teaching my curriculum. And I would like somebody else to figure out well what is it that we need to do to make this [technology] effective for teachers.

Bridget wanted more training before she received access to the Chromebooks, or at least before her students received access. She then wanted specific training about the software components, and most importantly she wanted someone to designate what she should be doing with the technology, not just how to operate it. If the district could try to set a desired vision, coordinate training for teachers in that vision, and then support its implementation, she would feel more confident and inspired in using her technology.

Bridget also mentioned time as being an element, wanting training to take place over the summer, and that she wanted “a lot” of training. The idea of planning training over the summer might be something to consider, although it is hard to tell if many teachers would come or if the district would be willing or able to pay for it. Either way, many teachers seemed to need basic help that required more time and the summer provides time that is often lacking during the school year. For the teachers who don't learn technology well on their own, and need more “where-to-click” training as well as how to use the technology in their classroom, the summer might be an option. More ongoing help during the year to help them at a pace they can handle could also help satisfy this need.

Linking the training in this Context section to the Basic Technical Knowledge and the TPACK integration knowledge sections, Bridget wanted the basic technical knowledge before

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

the technology was rolled out and then wanted help linking it to her classroom to make it effective which would have gotten her started with at least some kind of integration intended by TPACK. In the short-term, establishing a vision for basic replacement uses might benefit Bridget. She seems to be asking for more explicit short term vision that would help her make meaningful changes, and would help her develop basic technical skills with her new Chromebook.

The idea that there was too much to learn at once was reiterated by Sara who felt that the increase in access to the technology created pressure to change but that she wasn't given the support to make that change. She rated her PD as small extent, as 52% of teachers did.

Sara: I think, I know [administrator] is saying like, "no pressure, you do what you can," but there is this impinging pressure that's like, oh my gosh we have all this, you need to use it. You need to send the homework, you need to this ... I feel like that's, I try almost every day to at least put some sort of that in [my activities] ... anywhere. You are getting observed, where is your technology? There is no technology in your [lesson]. I feel like they are saying to ease into it. They are saying there is no pressure, but there is.

There was no doubt that the increased access increased the expectation that teachers use the technology. However, given the varying levels of knowledge, and the types of changes teachers were going to have to make in their practices, this created a situation where some teachers took the technology and implemented all of it within weeks, while others didn't know where to start. Rachel, who was one of the teachers who already had some of this technology working in her classroom, and rated her PD as moderate extent, like 30% of teachers did, stated it this way.

Rachel: Yeah, and it's like ... and you know the parents talk on the soccer field. Oh, Rachel's class is set up already but Mrs. Lane's class is not and why is it ... you know, and these are the emails that are coming through and it's hard, it's hard because everybody's in a different place and nobody's really being taught the best ... You know, there's so many components. Spelling City is pretty easy when it works, I guess, for you guys. It's pretty simple. But like Raz-Kids are so many components -- there's Reading A

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

to Z, ...Like, people need to learn how to, like, navigate through and then really use it to the best of its ability.

Rachel noted that teachers were at varying levels of use and implied that without a vision for the “best” way to use the tools, as well as training and ongoing support, there were a disparate range of uses emerging in classrooms.

Stella reiterated the point that Bridget was making about getting help with effective classroom practices. Stella was further along than Bridget and didn’t think she needed basic training. She wanted more time to collaborate on how to make her technology routines better. She’s clearly ahead of people like Bridget, but wanted to go to training where she could get examples of how it was already working in a classroom.

Stella: And when you see it, it actually motivates you. You're like, “wow, I didn't ... okay, I can do this.” Like “I can try this. //And it might ease some stress and anxiety, and say, “okay, I'll try doing one of what she just ... what I just saw.” Try it on, and then maybe I could go to the next step. And I know there's definitely teachers in our district, like you said, you'd be more than happy, like we want to help each other.

Stella: // I think that's really important to see something that works, rather than say, “Oh, try this,” and then it might not even work. Like you want to see something that's working well in a classroom or two, ...because you can take it and spin it.

While some teachers were asking for more hands-on detailed training, Stella would like follow-up to the initial training to see the technology in action so it could help her “take it and spin it” in her classroom. Taken together, these examples provide an argument for differentiated training to meet the needs of a diverse group of technology learners, from the initial rollout stages to the follow-up training.

Perspectives from Leaders and Support Staff

One of the administrators, when asked about coordinating training and roll out, admitted that getting enough PD for teachers was hard to do with only two days of training per year set

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

aside in the calendar for it. This administrator also seemed to indicate that the exact vision for technology use had not been fully determined.

(1) We are building in the PD as much as possible, I mean I think we are also ...//get the biggest and the best first and then figure out how we are going to make it work.

(2) Technology yes, we have tons of apps and programs and software and things in place that teachers need time to, [administrators] looked at it [the training day] as play with, it's probably not in those term but we did build into our in-service in October just that, like time with ...

(3) We are building in structures like the tech coach in every building, we now have the lit coach who really part of her job is to figure out how to integrate technology into a balanced literacy block.

(4) They [the two coaches] are not separate really, they need to be working together and that's what they did in October, they teamed up with grade levels and sort of gave the time but we are such varying levels of understanding that it is kind of hard to decide how to format a day like that.

In line 1 this administrator explained at least to some degree that even though they are scheduling as much training as possible, it might not be enough to meet the demand. The administrator indicated that the combined efforts of the two types of coaches in every building could help mitigate that. Also expressed was the idea that the exact vision is still yet to be determined and the coaches were helping teachers figure that out. This lack of vision also prevents them from planning training that is tailored to achieve clear classroom outcomes.

In many ways, the district is still trying to determine how to integrate the technology into the curriculum, and the coaches are a key part of determining how that will be done. This supports the idea that coaches are more than just sharing their expertise, they are helping to develop the changes with an unclear vision as they interact with the teachers and the technology. Even though a much more comprehensive and complex vision that includes integrating subject matter, 21st Century real life scenarios, and technology is in process, teachers like Bridget, and

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

even others like Natalie could benefit from more tangible short-term goals and support. With a short term vision and support to achieve that vision, they can begin improving their skills and knowledge now, and might be more prepared for more complex changes when the long-term vision is clarified.

The idea that the district was buying technology before they had a clear vision for what it should be used for was also mentioned by others. One support staff member mentioned that once the technology was purchased, teachers had to “figure out how to make it work” in their class without much guidance. The coaches below confirmed that access occurs without the type of guidance that some teachers are asking for. They described how technology use has spread in the past.

Coach 4: //... I think the districts have a tendency to purchase a program or subscription or whatever, provide like just bare-bones training and then you're kind of like left to your own devices. And, usually, the following year, or the year after that, where you get enough, um ... I'm ... I'm trying to think of the word ... have enough people that have been using it ...

Coach 3: That figured it out how to use it.

Coach 4: ... that figured out how to use it. And then they ... Like that would be an opportunity to do more turnkey training ...

Coach 3: Right.

Coach 4: ... when you have people that have been using it, feel comfortable with it, and then ... But, usually, in the 1st year, you're just scrambling around trying to figure out how it works.

Coach 3: Mm-hmmm. (affirmative)

Coach 4: And you're kind of ... I think, historically, we've all been kind of like islands unto ourselves and then we reached out to other people. And-

Paul: So it's been more about access and some very basic training?

Coach 4: Very basic training.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

One reason for an unclear vision could be that there are much grander goals than replacement uses and that leaders don't want to stifle teachers' creativity, or micromanage their use. Below, an administrator didn't want to tell teachers exactly what to do with Raz Kids.

Administrator: //... I want to get away from is saying, "You have to use Raz-Kids in this way." What I want them to do is think about ... maybe it's kind of narrowing it down a bit more in certain grade levels, to say "Focus on the next Language Arts unit that you have,"

This administrator wanted the teachers to collaboratively work on more complex tech uses in Language Arts. It makes sense in one way that if teachers are simply doing what they are told to do, that it might short-change their learning process and make them less likely to learn how to be more sophisticated with their use in the future. However, for some of the weaker technology users, more guidance from the start could be helpful. If these tools were being rolled out to all teachers because they started to become more popular amongst some teachers, then there are at least a few ways these early adopters were using them that have been deemed worthy of replicating. These uses could be used to make a short-term vision for more basic users. For example, Bridget wanted guidance and training. If she were told to use the eBooks on Raz Kids to have her students do independent reading at their reading level then she would know what the goal was, and then training could be geared toward that goal. There might be better uses that are envisioned for the future but this would get her started and would provide a specific focus for training sessions.

While there is an unclear vision, and not enough training being offered for some of the teachers, it also appears that at least some teachers are not being proactive about their own learning or are avoiding technology specifically. Below, these coaches discuss Flex Courses,

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

which were in-district trainings where teachers got credit towards professional development requirements.

(1) Coach 4: Or there's training that's offered like in the "Flex Courses", but you'd usually often times get the techie going ...not the teachers what you would really want to step it up a little bit.

(2) Coach 2: And that's the problem we're running into right now...

(3) Coach 4: //... um, you know, we're providing for an after school, but it's only for the people who want to come and learn about it. If it's not being done in-school and they're not already ...

(4) Coach 2: ... doing it and they're not getting credit for it ...they're not really as willing to come. Until there starts to become pressure ...

(5) Coach 4: Yes. ... from some other part that's saying, "You have to use these things." I think we've already got the teachers that want to use them.

It is clear from the coaches that they feel that when pressured is applied, it helps get less ambitious teachers, or tech avoiders, to seek out training. Only then, when teachers were given a lot of access to technology, were the coaches starting to see the less willing or able come to them for help. On the one hand, this is a positive development because they are now seeking out training but on the other hand these teachers are likely to be more resistant or require more of the coaches' time.

Also in line 1, "Flex Courses" were mentioned. It used to be that teachers had to attend six hours of training annually outside of school so they received credit for going. Now those have been removed to make way for a more comprehensive approach to training that teachers specifically need. These coaches are indicating that there are teachers who won't go to training unless it is during the school day or they somehow get credit for it, which indicates that at least some teachers are not willing to take responsibility for their own learning. This type of teacher, who's practices or pedagogical beliefs might be very distant from desired outcomes, will likely

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

create a greater demand for training. These teachers might require more resources than teachers the coaches previously have been helping. The problem of teachers who are less involved in their own learning will be discussed further in the Social Infrastructure section.

Social Infrastructure

One of the important findings from Zhao et al., (2002), was that peers either supported or discouraged technology use of innovators. When collaboration went well, it made the work easier and more productive. When it didn't go well, it hindered use and discouraged innovators. There were signs of both of these in the focus groups. In the survey, teachers reported that they collaborate somewhat less with their grade level peers about technology than they collaborate in general. Teachers reported that they collaborated with their grade level to a large extent, 52%, or moderate extent, 31%. Their collaboration about technology dropped to 28% for large extent and rose to 43% for moderate extent. While lower than their general collaboration, a vast majority still reported collaborating about technology to a large or moderate extent. A large majority, 74%, also reported that administrators try to foster collaboration to a large or moderate extent.

Eve had been mentioned in the Innovator section as being a teacher who felt she knew what she needed to know and didn't need more support from the district. Below she described the support she has. Eve rated her collaboration about tech as large extent, as 28% of teachers did.

(1) Eve: Well the first thing that popped into my head is that I feel pretty comfortable and confident with what I'm using so far in my classroom. So I don't feel like I need that much support, that's just my personal take. I you know I know that I have my go to people in the building that you know if there is a question like sometimes that does arise if I'm in the middle of something and just not working for some reason and I have to ask, I do go to my tech coach or I go to the lit coach. And usually that helps me out a bit. But I know that some-

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(2) Paul: So would you say that you have a like a working network of support for people, kind of informal?

(3) Eve: Yes, but I will say that it's also my team members.

(4) Paul: It's not like it was mandated by the principal. You guys just have this little informal network of support.

(5) Eve: It's almost like we've had a PLC going for the last like seven years, in a way.

(6) Eve: ... ask a friend of mine, you know, about something, or even them come ask me, even though they're, you know, technically like a lit coach or a tech coach, I think that we just have this very open relationship that we can ... we can work out whatever kink there might be in a certain system.

(7) Paul: So you kind of have what you need, and if you need something, you know where to get it?

(8) Eve: Yeah. Uh-hmm.

It should be mentioned that within her system there is a technology coach and a literacy coach so there is substantial expertise for the technology and the instructional (pedagogical) aspects of technology integration for TPACK, which she alluded to in lines 5 and 6. This group of teachers were the early adopters of some of the digital tools and had worked on implementing them over years so Eve had developed a system of support over time. Also of note, it was not officially established by the principal, it came together informally. Later in this section, the difficulty of collaborating will be discussed.

There were many instances of productive collaboration from the focus groups. In the Innovator section, Margo had mentioned that she and her colleague, over the course of more than a year, learned how to use Spelling City and institute it in their classes. Even within the focus groups, when I simply asked reflective questions, problems about technology arose, and peers tried to solve each other's problems. This happened when Maggie didn't know about the two different wireless systems and that her students might be accessing the "guest" system by

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

mistake, or when Rachel explained how to assign homework easily on Think Central which at least a few of the teachers didn't know how to do. Each time this occurred, I pointed out that this was a productive collaborative discussion and everyone agreed that more of them would be beneficial. However, there were caveats.

Making sure everyone is doing their fair share of the work is not always easy, as is evident below. Sophie rated her grade level collaboration about technology as small extent, like 24% of teachers, and Sydney rated hers as moderate extent, like 43% of teachers. It should be noted that Sydney later commented that she does no collaborating at all with her grade level peer, despite her moderate rating.

(1) Sophie: It was a lot of extra time on my own to figure it out. And then we did meet with each other to help ...

(2) Paul: Like in your grade level? Like

(3) Sophie: In our grade level. Yeah.

(4) Sophie: Okay. So you kind of ... It forced you to kind of collaborate be like, "what are we going to with this?"

(5) Sophie: But it was really only myself and one other who had actually done it so it was more like us talking it out and telling everybody else.

(6) Sydney: There's 1 or 2 people who will figure it out and say, "All right. I got this. All right. Now this is what you do."

Sophie expressed in line 1 that she spent a lot of her own time learning the technology and then turned around and taught it to her team. Sydney somewhat validated this pattern of interaction even though they don't teach in the same schools when, in line 6, mentioned that teachers sometimes waited for someone to figure it out for them, which was a quote I used in the Innovator section. This is a problematic dynamic that could arise. Therefore, while Eve had a

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

supportive and collaborative arrangement with her peers, not everyone has a group that can, or will, collaborate fully on their own.

Later in Sophie's conversation, the drawbacks to collaboration became more evident. While Sophie was able to get her group started, she felt that the collaboration was uneven. The below conversation covered some of the drawbacks of collaboration, teachers not sharing their work, or not being the "collaborative type", and there not being enough expertise within the group to make it fully productive.

(1) Sophie: ... which is hard if I'm doing a lot of the work to prepare and other people aren't and then I want to use it. I'm going to use it.

(2) Sophie: And if they're not going to use it ...

(3) Paul: It's not your fault.

(4) Sophie: No. ... That sounds awful.

(5) Sydney: No.

(6) Paul: No. It's the reality.

(7) Sophie: We do have a really good team but I feel like it's myself and one other person helping everybody else and ...

Sophie expressed frustration with her role of learning the technology and then teaching her team. She noted that she was doing it so her students could get access to the technology and that she didn't want to be held back by her peers who were not able, or willing, to learn the technology on their own which is a dynamic that will be confirmed by the coaches and the administrators later in this section. Sophie, also expressed a desire for some recognition for her work, that while she was doing it for her personal satisfaction, she resented doing much more than her teammates.

Samantha, another more competent technology user, expressed that she wanted to collaborate with more advanced peers like herself, otherwise she felt like she was training

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

people, not collaborating. Like Samantha, there might be teachers who are at the higher end of the technology competency level who would be less than eager to collaborate with their peers who don't know as much as them. There are also others who might be trying to avoid the technology, or those who are not the "collaborating type" or who "guard" what they do. Besides these issues, which might occur with any type of collaboration, Sophie below mentioned that her team could benefit from expert technology and integration help.

(1) Sophie: There ... There's a couple of programs that we could use somebody who's used it. Like we had talked about [Tech Coach] or [Literacy Coach] because they were really using it in the capacity that we would need to use it well.

(2) Sophie: //they've really been able to hone in on some of those programs with [the Tech Coach] being so techy.

(4) Sophie: //And, you know, being able to combine their skills. We would ... We had requested having come.

Sophie was asking for the missing elements of TPACK for her collaborative team. Eve had those elements and she felt like she received the support she needed. Sophie didn't and was aware those pieces were needed for her team to be in a position to use the technology effectively. This includes the instructional pedagogical expertise (Literacy Coach), technical expertise (Tech Coach), and the content expertise of the people in her grade level. When these three elements are present, they possess, or are at least much more likely to possess, the components of TPACK so their conversations have a chance of producing an integrated technology use that is desired. That's not to say that it will automatically happen. As noted, there are teachers who resist sharing, and those who are trying to resist the technology, but at least the knowledge elements of TPACK are there.

The idea that collaboration alone would not solve the problems of some grade level teams was commonly stated. In one discussion, a teacher who wanted to collaborate, specifically did

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

not want to collaborate with her grade level peers at her school because they were “anti-technology”. She did not have the expertise herself so she was seeking out teachers at other schools who had the knowledge and the beliefs needed for technology innovation. Each of these obstacles to effective collaboration mentioned above indicate that administrative guidance or structuring would be beneficial for at least some teacher teams.

Perspective from Leaders and Support Staff

The coaches confirmed that peers can either help or hinder progress when it comes to technology.

(1) Coach 2: //And then, within the grade level, if the other teachers aren't doing it, um, even if one teacher is ready, they're less likely to do it because they're not all doing it. Like-

(2) Coach 1: //They would be like, "Oh, like, you're doing this now, and there's all this

(3) Coach 3: Making us look stupid.

(4) Coach 4: " ...and you're making us look bad."

(5) Coach 4: And we all have to be the same ...The parents are going to be all

These coaches went on to discuss how the peers can pull each other in a positive or negative direction. The passage above indicates that parent expectations for similar technology use can cause teachers to wait to implement it if all of the teachers in a certain grade level are not ready. It is also a reasonable response on the part of teachers to try to initiate technology in a similar way, within a similar time frame, but problems arise when there are teachers who have varying ability, or willingness to change. This dynamic was brought up by Sophie who solved this problem by teaching her grade level what to do. Rachel also talked about this tension when she mentioned the parents talking on the soccer field about which teachers were using the technology, so this type of social pressure is a real factor for teachers.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

For their part, the curriculum directors understand how important collaborating could be for the teachers. Cameron discussed the need for everyone to have the same tools so they could begin talking about how to use them. However, there were limits of time within the school day and trying to do training during faculty meetings was met with resistance from some union members because faculty meetings technically aren't supposed to be for training. Cameron below elaborated on what exactly he and the other administrator are trying to do. He begins by talking about everyone having the same devices as a foundation for collaborating.

Cameron: Yes. We can't talk about the device, if we have something that's completely different. That's why some of these things where I was like, "We need to have ..."
There's got to be a core set of apps, or a core set of programs, that everybody has access to, that everybody can have a conversation around. It doesn't mean that everybody has to use it exactly the same way, all the time.

Cameron: It's kind of ... once we can address that equity of access issue, then we can start having discussions with teachers. If we all have the same type of access, then we're talking about a shift in practice that everybody should be able to make in terms of resources. Whether they're ready to make that shift yet, in terms of their professional training, is another issue, but is not the issue.

The common tools can lead to collaboration but as he notes at the end, the teachers being ready to make the shift to taking more responsibility for their learning is another issue. He was partly wondering if teachers will begin to take more ownership of their learning as is evident below.

(1) Cameron: You don't need to ... right. Until we get that shifted, and you look at this issue of collaboration and grade level meeting time and collegial visit time ... if we could make that little move of shifting the way we conduct faculty meetings, and prioritizing that time, I think other stuff would start to fall into place. It's like, "We're getting up some momentum right now, in terms of the nature of the discussions that we're having.

(2) Cameron: I feel like, you talk about those pockets over at [Eve's School]; I feel like some of those pockets developed because they were forced, in certain respects. All of a sudden, they take ownership of it, after a while, because they start to respect the process a little bit.

(3) Me: They seem to exist informally, in every school.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

(4) Cameron: It's almost like they're a secret. If you draw attention to it, people feel a tremendous amount of pressure because they're doing something that's.

(5) Paul: Extra.

(6) Cameron: Or better.

(7) Paul: It makes people look bad.

(8) Cameron: It makes somebody else look bad. There's that culture of, we can't call those people out as a model, in some respects.

(9) Paul: You do so at your peril, because it will ostracize them.

(10) Cameron: Right, but if you change the structure of faculty meetings ... if you start to say, what we really want to do is begin to look at ... here's our model of practice. Let's support each other to get there, because this is where we're going. We're going to go kicking and screaming, or we're going to go helping each other, but we have to go.

Cameron was concerned about the lack of personal investment that some teachers have in their own training. He was also aware of the norms of interaction that assert that groups like Eve's PLC make other teachers look bad because they are taking charge of their own learning, or just working harder than other teachers. This was also true within a team. Sydney who said she participated in no collaboration about technology with her grade level peer, informally tried to collaborate with her team member by sharing resources but it was not reciprocated so collaboration didn't take root. This lack of widespread collaborating is hindering innovation because when teachers begin to innovate through collaboration, they are constricted to varying degrees by social pressure (Zhao et al., 2002). Therefore, collaboration on a wide scale will need to be organized, directed, and managed if it will be an effective agent for positive change, which seems like what Cameron is saying in the last passage, line 10. He wants to structure collaboration to be productive, and make it the norm so people can begin to help each other innovate in a more coordinated school-wide and district-wide manner.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Conclusion

Teachers were very pleased with their traditional technical support. They reported that it was timely and they were especially appreciative of the personnel's patience, even for the seemingly trivial and minor things they called for. There were also teacher needs that went beyond the skills and knowledge of the tech support personnel that a technology coach or computer teacher would know how to solve. This would include things like password problems or setting up their class roster in a software application. Finding a way to make the coaches more available during instructional time, or having someone on-call for immediate help with a program or for troubleshooting was something some of the teachers asked for. When technology solutions are out of their control, small barriers can prevent them from using the technology until someone comes to solve it.

Coaches helped teachers by selecting applications for them to review like in an Appathon and getting teachers over the many small barriers during implementation. Coaches' schedules prevented some of them from providing in-class help but all helped teachers before and after school. There are teachers who are not formal coaches but who have knowledge and skills of specific programs because they have been using them for years. These teachers were resources for other teachers and it is possible that they can fill a support need for teachers that coaches might not be able to satisfy. Coaches reported that they spend time with basic technical help before they can have the time to work on integration help. Almost all teachers wanted more help with technology integration as envisioned by TPACK.

Many teachers want more training for basic technical knowledge which included training before the technology was rolled out, beginning of the year start-up, troubleshooting, ongoing

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

training throughout the year, brush-up training, and summer training. There was a call for a slower pace of roll out by some teachers so they could build their skills and knowledge and so their use could become easy and efficient. A short term replacement or amplification vision could also help less knowledgeable teachers focus their efforts on an achievable goal and provide a focus for training that could be more detailed. The more advanced teachers suggested that training be differentiated so the more knowledgeable teachers could advance their skills at their level and the lower skilled teachers could get the basic help they needed.

Teachers expressed a desire to collaborate with their peers because they like to share ideas with them and solve problems together but it is clear that effective collaboration will not happen automatically and will require structure, guidance, oversight, and leadership if it is going to be effective on a large scale. If it is not structured, it will occur in pockets, one way collaboration might take root which can drain those who do most of the work, or collaboration could actually restrict improvements because teachers won't innovate, until those who are less willing or less able do, so as not to make anyone look bad. Other factors are a lack of wide scale teacher ownership of their own learning and professional development. Fortunately, the curriculum directors are aware of these dynamics and are working to mitigate them.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Chapter 5

Discussion of Findings

The purpose of this study was to help clearly define Warren's needs for improved technology integration. By engaging teachers, administrators, and support staff, I was able to describe a range of needs for the innovators, in terms of their knowledge, and pedagogical beliefs. Then I described Warren's innovation by parsing its vision into two parts, a tech-rich replacement and amplification vision and a more integrated, transformational, 21st Century vision. I also related the tools Warren had provided teachers to each part of the vision. The innovation section described the relative distance between teachers and their tools—their access, and the relative distance between their current practices and the desired practices. Finally, I described the technical infrastructure, the human infrastructure, and the organizational culture. In this chapter, I will discuss the findings in relation to the relevant literature and the implications for changes to Warren's practices.

Knowledge of the Innovators

A majority of teachers reported that they didn't receive enough training, and that they didn't have enough time to plan for using technology in their classroom. As the research on teacher knowledge has concluded, teachers need to be able to fully operate the technologies at their disposal (Hew & Brush, 2007; Mishra & Koehler, 2006; Sandholtz & Reilly, 2004; Teo & Wei, 2001). I was able to provide context related examples of needs for improving teacher knowledge that can now help inform changes to training. These varied examples can help Warren be prepared to differentiate its training. For example, there were teachers like Bridget who needed basic help with which tool to start learning how to use, which could be solved by creating a short-term vision. There were others like Julia, and Mila, who wanted hints to make

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

their use more efficient. Yet, a smaller group of teachers like Eve, and Samantha, felt like they didn't need any help with basic technical knowledge. Besides the teachers who expressed no need for basic technical help, teachers tended to explain the small occurrences, which either slowed their use or prevented them from fully utilizing their technology effectively. For example, Maggie didn't know about the two wireless systems or how they could possibly hinder her use, nor how to easily assign online Math homework to her students even after having access for a year.

Besides the relatively few teachers who didn't want more training, many teachers reported needing help with learning to make their use easy, effective, and efficient. The literature frequently mentions the need for teachers to be fully trained, but I was able to provide context-specific examples of what fully trained actually looks like. I made explicit, which I often found implicit in the literature, that a lack of training can lead to some teachers not having enough time to plan and prepare for technology because they don't know how to use the tools easily and efficiently. This study provides examples of what constitutes fully knowing how to operate a piece of technology so its use is not cumbersome and teachers can spend more time on planning for effective technology integration.

As districts like Warren begin to amass an increasing number and variety of technology tools, there is a growing importance of their ease of use by teachers. This easy use sets a high bar for basic technical knowledge that is needed if more effective and complex integration is going to take root in classrooms. Considering this emerging reality, which is likely to occur more often in schools as technology gets cheaper and access is increased, knowing how to efficiently and easily use the technologies at hand will take-on growing importance. Therefore, these results further what is known about what constitutes the knowledge needed to be successful with

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

technology in classrooms. The basic technical knowledge for many teachers in Warren needs improvement, so they can begin to work on more complex integration knowledge that involves a strategic understanding of how the content, pedagogies and technology fit together for effective instruction (Mishra & Koehler, 2006).

Technology integration knowledge (TPACK), involves the nuanced understanding about how technology, content, and pedagogies interact (Mishra & Koehler, 2006). Almost all teachers reported wanting help with improved technology integration. For the most knowledgeable like Samantha, Lane, and Mary, they wanted help furthering their knowledge of creating more innovative practices by collaborating with their more advanced peers. Others like Sophie who, had the knowledge needed to get all of her tools started in her classroom, are ready to learn from more expert peers. There were also teachers like Marsha who admitted to not knowing enough about some of her technology to judge its worth, which was an important knowledge threshold noted in the literature (Teo & Wei, 2001), because fully understanding the technology is needed to be able to integrate it effectively.

Pedagogical Beliefs of the Innovators

Adding to the research base, this study provides important examples of the reasons why teachers resist or stop at replacement levels of technology use. For example, Sara, Natalie, and Cindy openly admitted that the technology uses didn't feel like real teaching. The level of alignment between teachers' pedagogical beliefs with the capability of the technology will likely determine how a teacher utilizes the technology (Zhao et al., 2002). This alignment can help solidify teacher-centered practices like Margo's, who explained how she had transformed her teaching from being a person who used her blackboard constantly to someone who uses her SMART Board constantly. What she described were a multitude of replacement and

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

amplification uses of her previous practices that achieved the district's goal of a tech-rich environment but these did not lead her to actually transform her practices in the way described in the literature (Hughes, 2005, Pea, 1985, Sandholtz & Reilly, 2004).

Technology tends to decentralize the classroom and a teacher's underlying beliefs about her role in the classroom will play an important part in how the new technologies will be adopted. Working on helping teachers change their beliefs is an important factor to consider when making decisions about professional development. The underlying change toward more student-centered pedagogical beliefs will need to be addressed through on-going reflective dialogue about what's worth knowing (content), how it can be learned (pedagogy), and how the technology can help (in replacement, amplification or transformational ways) (Windschitl & Sahl, 2002). Reflecting on how these three elements of TPACK work together will reveal teachers' beliefs and lack of understanding so they can be openly addressed.

Distance Between Teachers, Technology, and Practice.

Granger et al., (2002), consider technology support, and collegial support as being prerequisites, not silver bullets, to responsive support that can produce changed teaching practices. The key is how responsive and flexible those supports are (Rutkowski et al., 2011), and this study provides validation and insight into those assertions.

As has been mentioned previously, Warren is dramatically increasing access to technology so teachers will have a 1:1 technology to student ratio for Chromebooks or laptops in Grades 3-5 as well as a 2:1 ratio in Grades K-2 for iPads. Zhao et al., (2002), gave the example of the overbooked computer room but in Warren the two main issues were inconsistent access in terms of number of devices and the sharing and borrowing of devices, which created distance. Standardizing these tools and providing ample access dramatically closes the distance between

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

teachers and their tools (Zhao et al., 2002). This study validates Warren's plan for increased access that will help close the distance between teachers and technology.

Once the access problem has been minimized, training for basic technical knowledge and replacement teaching practices can be the focus. There is ample evidence that many teachers need to start with basic goals to build their technology practices in their classrooms.

Replacement uses would provide a reasonable starting place (Ertmer & Ottenbreit-Leftwich 2010; Zhao et al., 2002). Technology can hinder or conflict with commonly used teaching practices so this conflict should be anticipated and addressed. The instructional coaches should be aware that underlying beliefs and basic practices might need to be addressed before technology uses are embraced (Hew & Brush, 2007). Changes in teacher practices are more likely to be successful if they are small changes from current practices. Plans for PD and support should focus on meeting teachers at their current level of use and moving them forward in a step-by-step fashion.

What I think this study adds, are the concrete examples from teachers and other district stakeholders that previous research has called for (Granger et al., 2002; Rutkowski et al., 2011; Valcke et al., 2007). One example is the way technology might change how teachers and students interact around student workflow and the substantial barriers it can create for some teachers like Sara who struggled to implement Spelling City and thus relegated it to a small part of her weekly routine because of frustration with the changes it created. This change was a replacement for something she was already doing, differentiated spelling work. Others like Kristen felt like she was confronted with a "paradigm shift" if she was going to change so many of her teaching practices. This shift was compounded by her lack of technical knowledge as well.

However, Kristen seemed more open to making this shift than others like Cindy who

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

wondered when “actual” teaching was going to take place if these technologies were going to be used in class everyday—and had thus “tucked” them away until she was ready to use them. As called for by the research, making sure that the support is meeting the teachers’ needs is essential for improved practices. These examples, can help the district begin to create a more responsive context and plan for PD that engages teachers in conversations about teaching practices, provides them with the skills and knowledge they need, and then helps them move past their current practices. Without the examples provided by this study, the content of the beliefs discussions and the exact training that is required would be unclear.

For example, providing substantial access to technology proved to be the support that teachers like, Lane, Samantha and Sophie needed to begin furthering their technology uses. In their cases, increased access made the difference. For Sophie, going from sporadic iPad access to 1:1 access with her Chromebooks, along with the digital resources like Spelling City and RAZ Kids, enabled her to quickly adopt replacement uses just weeks after their introduction. Samantha felt that the Chromebooks had enabled her to transform her classroom in ways that she couldn’t when she had less access. Lane also felt that the increase in her laptop access allowed her to get started using Google Classroom more consistently.

On the other hand, access was not enough of a factor to get other teachers to progress in the same ways. Sara, with access to the digital tools like Spelling City and RAZ Kids was using Spelling City in a sporadic way, had decided that RAZ Kids wasn’t much of a program, and was not thinking of making it an integral part of her repertoire. Teachers like Cindy, Kristen, Bridget, and Natalie were not even at the replacement stage with some of their tools. To some extent, they were unsure where to focus their attention, lacked some of the technical skills needed for easy use, had varying degrees of doubt about the technology’s utility, and varied distances between

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

their current uses and the desired uses. Therefore, the increased access did not dramatically improve their technology practices. Changes to the context supports could help them improve some of those factors more quickly.

Context

Better coordination of a variety of supports could make improvements to factors like beliefs, knowledge, and ultimately improved classroom practices (Ertmer & Ottenbreit-Leftwich, 2010; Granger et al., 2002; Hew & Brush, 2007; Rutkowski et al., 2011; Sandholtz et al., 1997; Teo & Wei, 2001; Valcke et al. 2007; Zhao et al., 2002). For the most part, Warren has all of the supports in place but making them all work effectively will be an important factor in future success. Coordinating their web of flexible and responsive supports so they are designed to meet teacher needs in relation to a more articulated vision will help create a better context. The passages from teachers in this study contribute to the research with examples that provide greater contextualized detail that can then be met with responsive supports. I will elaborate on what those supports might look like in the Implications section.

This study also detailed the various types of tech support that teachers wanted or needed and how a variety of people in this context might provide that support. There was the basic technical help from the traditional tech support personnel that kept technology running smoothly. For this type of help, teacher needs were being met. Then there were a variety of problems that could be handled by many different support people, some in official or unofficial roles. Samantha was an unofficial source of specific technical information for her peers with some of the new digital tools that had been rolled out. Sometimes coaches were in a position to help because of their general technical expertise. Other times more expert teachers who had used a technology for a few years were requested by teachers for help because of the very specific

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

knowledge these expert teachers had. Teachers considered basic help with how to operate the software or websites they were given to be part of “tech support” but these were areas that the more traditional tech support personnel could not help them with because they didn’t have the knowledge that teachers do, like how to set up a class roster in a specific software application. Finally, there was the more advanced instructional help that teachers like Lane, Samantha, and Mary requested in order to go beyond current replacement or amplification uses. These would require a collaborative group of people who could start to determine how the technology, content, and pedagogies could interact to change teaching and learning.

Granger et al., (2002) put forth the idea that the important context supports alone are not likely to be sufficient for widespread improvement of practices. Together, if these supports are responsively coordinated, they can provide what is needed for teachers to innovate. They note that just-in-time learning of the technical aspects, as the teachers needed them, were what helped the teachers progress. For some teachers in this study, access and dependable technology infrastructure was all that was needed. For others, there were an array of needs that could be planned for. Maggie wanted training to use her technology more completely. She also wanted collaboration time with teachers who were more tech oriented, or more skilled, so she could get needed help. More experienced teachers and coaches could provide that support but that support needed to be coordinated by someone in the district. A problem like learning how to manage student work on Spelling City could be solved in a timely way by a knowledgeable peer or coach—it might not have to wait for an official training if a grade level team is working together to help each other and knows who to go to when they need help in a timely way. Basic training, peer support, and coaching can probably help most teachers establish replacement or amplification uses in their classrooms as long as those supports are targeted in the right way.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

For the district's more open-ended goals such as goals to integrate curriculum content with 21st Century learning units and technology, there will likely need to be a period of prolonged and structured collaboration with teachers, coaches, and administrators who can determine how to accomplish this very complicated and still undefined task. Knowing how to use the technology for certain tasks within complex content and pedagogy interactions intended by TPACK will take time, expertise, and collaboration (Mishra & Koehler, 2006). While individual support will be needed, creating an infrastructure of supports for collaboration, basic technical skills, and TPACK will help provide responsive supports on a wide-scale. If the district can formalize a clear vision, it will allow the district to target its supports.

Without a clear short-term vision, some teachers didn't know where to start with their technology. By providing broad overview training instead of training targeted toward a specific vision, many teachers didn't feel they received enough detail to be able to get started in their classrooms. In addition to vision and training, promoting a context that supports collaboration and peer support networks could create conditions that can also foster improved technology integration (Zhao et al., 2002). Peers can either work to enable technology innovations or constrain them (Zhao et al., 2002), and there were many examples provided that demonstrated both. Therefore, collaboration will need to be structured and managed to help promote effective collaboration.

Contained within the supports for training and collaboration was the explicit need for the elements of TPACK. When collaborators had technical knowledge and pedagogical knowledge, it enabled technology innovations and when it was not present, teachers actually requested it. For example, Eve felt like she received the help she needed from her team, which included an instructional coach and a technology coach. Sophie explicitly asked for those same coaches to

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

come to work with her team because they could deliver the technology and instructional help that her team needed to make their uses more effective. Maggie also asked for collaboration time but with specific teachers who had the needed beliefs about the usefulness of technology and the skills and knowledge to use them in the classroom. Even though Eve and Maggie worked at the same school, Eve felt that she received the help she needed while Maggie reported that she wasn't getting the same support so further coordination of the resources that are already at that school could help meet Maggie's needs.

This study fills a gap in the research that called for more contextualized studies about all stakeholders (Granger et al., 2002; Rutkowski et al., 2011; Valcke et al., 2007) By including the teachers, support staff, and administrators, the expressed needs of the teachers could be validated and areas for improvement in the system of support could be identified. The conclusion is that Warren has much of the support structures in place and can now begin to make those supports more responsive and target those supports for more specific and manageable goals.

Implications

The implications call for more basic technical training that is tailored to the specific technologies teachers have access to so the innovators can easily use their technology and understand its capabilities. Building basic technical knowledge will act as a foundation for teachers' technology integration knowledge. Also needed is open, constructive conversations about pedagogical beliefs in order to help facilitate changes toward a decentralized student-centered classroom. The key for changing belief is helping teachers have early success with their technology, which would mean providing more training and support before teachers are asked to implement technology in their classroom. Warren's innovation would benefit from clarifying a

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

short-term vision for technology uses that would help the district make progress toward its less-defined long-term goals of a highly integrated 21st Century classroom. This envisioned classroom will have more content area integration, and real life problem solving that meets the high standards of the Common Core. Warren will need to create a process that can help teachers move toward this desired goal. In the short term, training for replacement uses will help close the distance between the desired teaching practices and the envisioned practices by building teachers' skills and knowledge one step at a time.

Improving the context so it can foster a pervasive IT culture would involve increased management of Warren's web of responsive supports so they can meet teacher needs in a timely and flexible manner. This would involve more coaching and training that is tailored to differentiated teacher needs in relation to a more-articulated vision that includes detailed teaching practices (Valcke et al., 2007). Further, fostering a culture where teachers embrace their responsibility for their own learning, and collaborate and support each other to make the changes they need to make, will also help Warren progress toward its vision.

Prior research suggests that schools should be working on improving teacher beliefs and knowledge in order to increase the chances that teachers will integrate technology effectively (Ertmer et al., 1999, Prestridge, 2012). Giving teachers "easy access" is important in making technology use more successful (Zhao et al., 2002). Considering there will be two full time coaches next year and an increase in access, Warren will be providing much easier access and more support. This study can help provides insight for these coaches about how they will need to change teachers' beliefs and improve their knowledge. My suggestion for the short term is to bring the basic level of use up to a point where all teachers use a selected technology easily and effectively with competence and confidence.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Teacher Needs: Beliefs, Skills, Knowledge, Collaboration, and a Common Vision

Making the transition to a more technology rich classroom will likely be a slow and steady process (Sandholtz & Reilly, 2004; Zhao et al., 2002). Forming teacher networks around grade-level teams can be very helpful (Sandholtz & Reilly, 2004). Thus, it would be beneficial for many teachers to provide them with a short-term goal, one that helps move everyone in the district toward a more tech-rich classroom, but is simple enough that everyone can accomplish. For example, teachers who get Chromebooks can be given a goal that can help bring together the different aspirations of the school district, primarily 21st Century learning, the Common Core, and the available technology. Teachers would work together with the coaches to accomplish the goal. The short-term vision would not be too restrictive but it would be direct enough to get them started. Here are two example goals, which I've provided below for teachers who have 1:1 access with their Chromebooks. A committee of knowledgeable stakeholders that consisted of teachers, the instructional coaches, and curriculum directors could probably construct better goals but these could begin the discussion about potential goals. This is a two-year vision.

A goal for the first year would be for teachers to simply use the technology easily, efficiently, and effectively. Training should focus on providing teachers with the knowledge and skills to fully function with the device. Then they could begin working on a goal as given below:

Grade level teachers will work together, with the help of the instructional coach, to use Google Classroom in a common way to manage student work on a daily basis so Google Classroom becomes integral to how student work is managed.

A goal like this sends a strong message that Google Classroom is not optional and it should be used in a common way at a particular grade level. For it to be achieved, many teachers would need substantial training at the start, and would require routine follow-up throughout the year to bring their basic technical skill level to where they could use the technology daily. Asking

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

teachers to work together to use Google Classroom creates a chance for them to collaborate and support each other, which provides an opportunity to begin to build a supportive peer network. The example objective above is a simple replacement use, but it is a chance to build skills and knowledge about the Chromebook and one of the Google applications. It is possible that this is the only goal that could be accomplished in Year 1 depending on the amount of training and support that could be offered.

Another goal that could start to get teachers working collaboratively on integrating the 21st Century goals with the Common Core would look something like the example below. Again, a more knowledgeable group of teachers and administrators could create a better one. This is just an example.

With help from an instructional coach, teachers in the same grade level will create weekly (not necessarily daily) routines, activities or assignments that integrate technology with a Common Core objective and a 21st Century objective using an application from the Google App store.

Again, part of the goal is simply to build skills and knowledge about the technology while also forging an environment for collaboration and peer support with the help of the instructional coaches. This type of goal would allow the district to start building technology integration knowledge as envisioned by TPACK. The objective calls for weekly routines because we want teachers to move beyond sporadic use. Depending on the amount of training, this would be a Year 2 goal. The same type of goal could be selected for an application on the iPads for the teachers in the primary grades.

I've included a chart for needs driven supports (see Appendix D), that I will discuss section-by-section over the next few pages, which shows how teacher needs can be a starting point for informing supports for teachers. Below is the first section of the chart and is a proposed way of thinking about how to use already established structures to obtain teacher needs.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

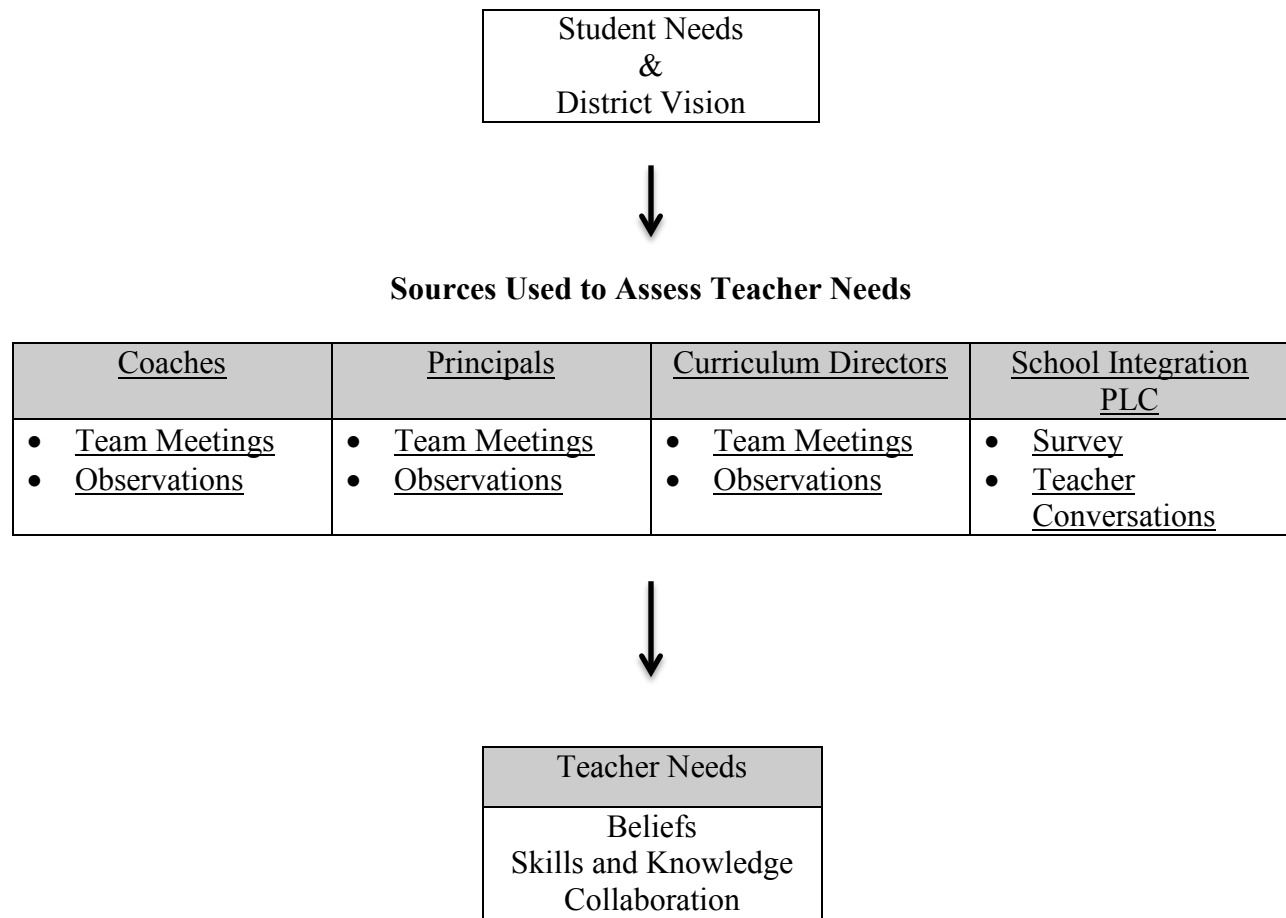


Figure 5. Sources Used to Assess Teacher Needs

In this model, student needs and the district vision will help determine what teachers will need. Personnel from a variety of support structures should be utilized to assess these needs through their interactions with teachers in meetings, observations and conversations. Teacher needs assessment should be considered an ongoing process if the supports are going to be responsive.

School and District Integration PLCs

Planning, coordinating, and monitoring the web of responsive supports will be a complex task that will need a diverse group of stakeholders to manage. As was discussed earlier, it is beneficial to have teachers be a part of either a school-based technology committee, or to have direct input into the committees that drive the content of professional development. Also

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

important is having a team-based administrative approach to meeting the substantial demands of fully supporting teachers with technology integration (Dexter, 2011). For this reason, in the needs driven supports document (Appendix D), there is a School Integration PLC and a District Integration PLC.

The formation of a school and district integration committee, below, (Figure 6) would help provide leadership around technology and integration issues and help coordinate the responsive web of supports that will be needed for teachers to innovate. Warren is moving toward a radically different type of classroom than it currently has. These two committees should operate together to help ongoing assessment of teacher needs and to responsively provide training and support.

The committees could also work on constructing a document that connects the potential of each technology, with curricular needs, and the desired classroom practices with the technologies. An example would be to determine the possible enhancements and limitations of a SMART Board or a Chromebook. Being explicit about the capabilities of each technology can help provide insight for the potential vision for each technology. This would allow teachers to be able to knowledgeably select the appropriate tools for the desired outcome. Below is Figure 6, the District PLC, including stakeholders and tasks it could fulfill.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

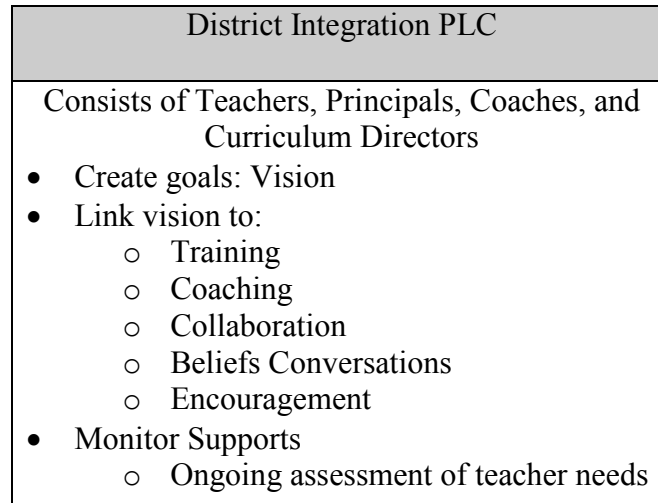


Figure 6. District Integration PLC

This PLC can help manage a web of supports that includes these listed below in Figure 7, the main supports that Warren can plan to utilize. Within each support, are suggested goals that could be accomplished.

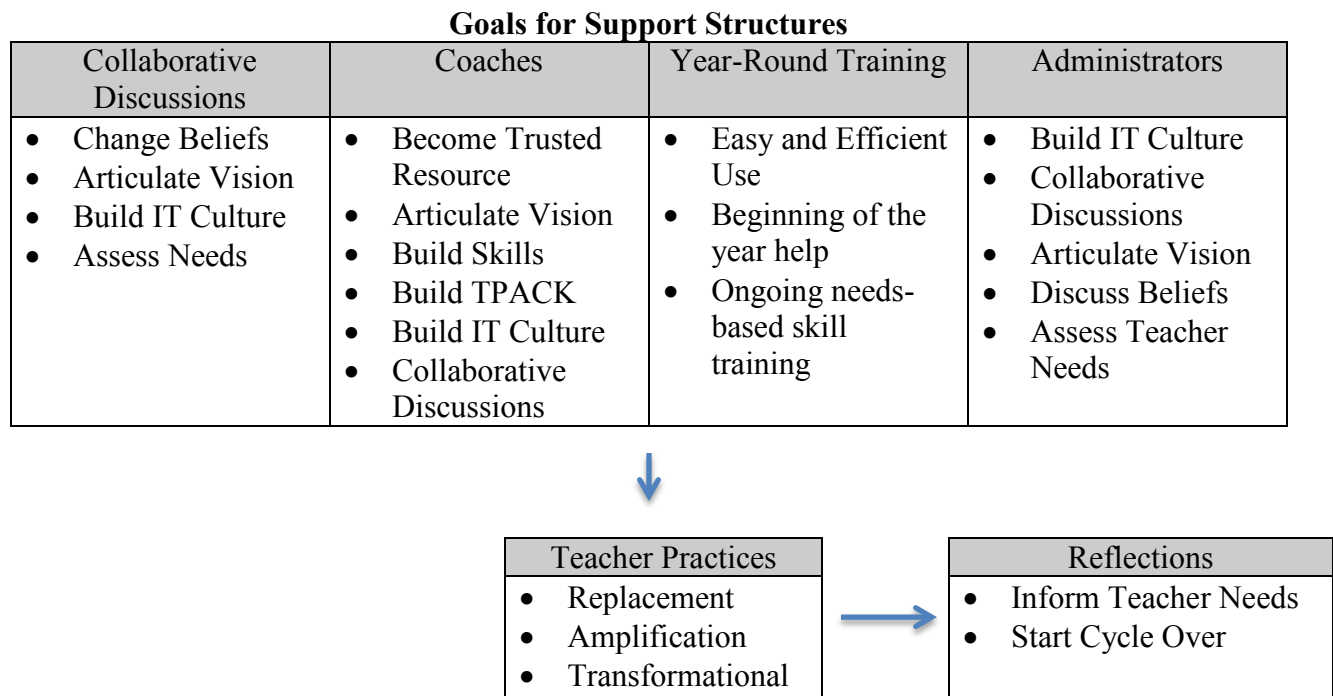


Figure 7. Goals for Support Structures

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Common Language and Reflective Dialogue

Having structures that help promote ongoing discussions about teaching and learning are important for facilitating change (Windschitl & Sahl, 2002). Part of changing beliefs is talking about them openly and reflecting on them. Public conversations, through common planning times, about beliefs on how students learn, how best to teach them, what is worth learning, and how the technology can help accomplish the goals of the classroom, are necessary to change beliefs in terms of technology integration (Windschitl & Sahl, 2002). A common language could reflect on technology use. Instituting common language like replacement, amplification, and transformational technology uses, as well as talking about their basic definitions will help form a basis for these discussions. This is in addition to training. Training needs to be part of an ongoing conversation, between the stakeholders about their beliefs about how students learn and how best to teach them (Mishra & Koehler, 2006).

Training

When I started this study, I was focused on TPACK because I felt strongly that Warren, in general, was not at a level of nuanced integration knowledge. However, after speaking with teachers, it is clear to me that we need to substantially increase our training for basic technical knowledge around the tools that we have purchased. The goal should be training for “easy and efficient” use. For the foreseeable future, teachers will still need help with building their basic technical knowledge to make their use easy and efficient. The focus groups indicated that, even after a year of working with a technology, ongoing training and brush up training was desired. There was also evidence that there were changes to technology that occurred at the start of the school year that created barriers for teachers so these should be anticipated and planned for. The coaches will be able to accomplish much of this support, if they are routinely meeting with grade

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

level teams, but it is possible that they won't be able to meet the demand. Therefore, additional training sessions might be beneficial before the start of the school year, and then before and after school during the school year. Summer "Boot Camps" for teachers who might want or need intense help to build their skills would also be a way to improve overall knowledge levels in the district.

One idea to meet that demand is to identify teachers who have expertise and who are willing to be a resource for their peers. Compensating them is always an issue. However, I mention this because coaches might not know all of the tools, as well as some of the teachers who use them every day, so finding ways to include those teacher experts and harnessing their knowledge could be a way to meet the demand for basic training and ongoing support. Another possibility is designating and cultivating Chromebook or Google experts, iPad experts, or digital tools experts in each building so there are always staff on-hand for problems with the two main devices, and for the websites and software that have been purchased.

As one of the teacher focus group discussions mentioned, there is a need for differentiated training so some teachers can get the basic help they need while others can work on collaborating with more expert peers. There seemed to be tiers of help that were needed. There were the teachers who wanted or needed help with the basics, the "where-to-click" level of instruction. Then there were the teachers who could figure out the technology on their own, or who had worked with peers to get started but now wanted more "easy and efficient" "hints" to make their use faster and effective. Finally, there were the teachers who didn't need any training but wanted collaboration time with coaches and expert peers about how to innovate beyond the standard uses. Keeping these three groups in mind could help plan training. Below is a proposed

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

timeline for training that is focused on creating higher levels of basic use for those first two tiers of teachers.

Timeline for Roll-Out and Training

Example Objective: Grade level teachers will work together, with the help of the instructional coach, to use Google Classroom in a common way to manage daily student workflow so Google Classroom becomes integral to how student work is managed.

Rationale: Why is this important? We want to change the way teachers and students use their technology. We can build teacher and student skills by using Google Classroom as a hub for student and teacher interactions. Building these skills is the first step toward integrating technology to achieve Common Core and 21st Century goals in the future so this step will help make everyone ready for more content-based technology integration. We also want teacher teams to begin working together so they can become a collaborative support network for each other. This is complicated work, which requires us to become supportive resources for each other. We know teachers often need technology help as well as instructional help so the coaches are included in this goal. For those who don't need extensive help with the technical aspects, and who can begin implementation early, they should not feel held back. They can innovate beyond these core goals but everyone should recognize that we need to build core uses so that everyone can use their technology effectively.

Spring /Summer
<ul style="list-style-type: none"> • Articulate short term vision • Needs assessment • Plan training • Offer Summer “Boot Camps” for those who might need it. (as identified by principal, coaches, or the teachers themselves)
First Quarter
<ul style="list-style-type: none"> • Training for “easy and efficient” use • Training for “beginning-of-the-year” technical set-up problems • Use PD days in September and October to build skills and begin planning for the official roll out. (During these PD days, tiered PD could be divided into three categories, “Where-to-click”, “Hints and Efficiencies”, and “Collaboration for Advanced Uses”) • Offer before and after school training for those who need extra help • Begin planning for initial uses
Second Quarter
<ul style="list-style-type: none"> • Official roll out (the expectation that all teachers (who have access) are using Google Classroom). • Begin classroom uses with in-class help from coaches • Ongoing technical help and help for classroom practices
Third Quarter
<ul style="list-style-type: none"> • Strive toward “easy and efficient” use • Google Classroom becomes primary way workflow is managed

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Fourth Quarter
<ul style="list-style-type: none"> • Celebrate successes • Reflect on areas for growth (needs assessment) • Articulate Year 2 goals for vision and needed training and support
Summer
<ul style="list-style-type: none"> • Plan training • Offer “Boot Camps” for those who might need it. (as identified by principal, coaches, or the teachers themselves)

Figure 8. Timeline for Roll Out and Training

Guiding Questions To Plan a Roll Out

In an attempt to anticipate teacher needs, and plan training when rolling out a new technology like Google Classroom, I have provided some reflective questions that a committee, like the District Integration PLC, could use to plan for the needs of teachers.

Guiding Questions For Planning A Tech Role Out

Goal: 1 Implement tech at uniformly higher levels across the district, and to reach those higher levels more quickly. To establish basic core uses that raise the current level of basic uses.

Goal: 2 Create a more tech-integrated and student-centered learning environment.

The Nature of the Technology

- How does the new technology support our curricular goals? The more explicit we can be, the more I think it will help the teachers get started.
 - Does the new tech offer replacement, amplification, transformative uses (or all three)?
 - What is the long-term vision (this might be undefined)?
 - What is the short-term vision that everyone can attain (What can we fully support?)?
 - How might these uses (vision) change or challenge the current practices of some teachers?
 - How will we support those changes or challenges?
- How do we structure teacher training and initial experiences for success?
- Once we answer these questions, how will we communicate them effectively to teachers? (I would share the answers to these questions with the teachers to begin the conversation about their training and support needs for the tech we are providing them).

Teacher Needs

What do teachers need to be successful with the device or the software?

- Ongoing discussions at team planning to assess their needs. If needed, a very short survey.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

- Training seems to have three parts 1) Training on how to use the device/software ahead of time, 2) how to use it in classrooms in an easy and efficient way, and 3) then reflecting on those uses and improving them.

Support Structures

- How will we utilize support structures like: training, collaboration, coaching, beliefs discussions, and administrator interactions with teachers?
- Based on teacher needs, how will we
 - Train them ahead of time?
 - Support during the implementation phase?
 - Sustain practices over the long term and begin to reflect on what should be our best practices?
- What is a reasonable timeline for these activities?

Future Research

This study fills gaps in the research by providing contextualized examples of teacher needs and then attempts to connect supports for those needs. However, exactly which supports improve which uses, and how they work to improve uses, is yet to be determined. For example, how does knowledgeable peer support and coaching lead to improved practices on a wide scale—how are the interactions on Eve’s team different from Maggie’s and how can we try to replicate those better practices on Eve’s team? Can a coordinated effort of coaches, teachers, and administrators determine how to achieve or make significant strides toward, a classroom with 21st Century real-life problem solving, and a tech infused environment that still accomplishes Common Core objectives? Can these context supports produce that type of classroom on a wide scale? Future research could help identify which supports help which outcomes as well as how, and if, the various stakeholders can work together to dramatically change teaching and learning.

Limitations

The most significant limitation of this study is the absence of classroom observations to validate the findings. Since this study is a formative assessment, and it is meant to provide a starting point for future improvement, the administrators can further explore the most relevant

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

findings and use them for reflection when doing their classroom observations throughout the school year. For example, I described many replacement and amplification uses by teachers. Administrators can use those findings to identify the types of uses they are seeing in classrooms. As a researcher who also works in this context, I may have special insight but I might also have biases that impact my analysis and viewpoints. These limitations are mitigated by the triangulation of data sources, which bolster validity. I also made a significant effort to provide evidence from a full spectrum of teachers, from ones with very few needs to ones with a multitude of needs. Despite these limitations, the basic findings that teachers could benefit from 1) more training that meets their individual needs, 2) conversations about how children learn, how best to teach them, and technology's role in that learning 3) more flexible and responsive supports, have been validated by a variety of stakeholders.

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A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Appendix A

Strategic Planning Technology Vision Statement

Technology Sub-Committee Goal Statement & Strategies

Goal Statement

We will strive to provide a cutting-edge, technology-rich environment conducive to our students becoming creators, collaborators, upstanding digital citizens, critical consumers, and innovators.

Technology Strategies

1. Provide a seamless, integrated technology environment for students, teachers, parents, and administrators.
2. Maintain an infrastructure dedicated to a streamlined, efficient, and learning-focused user experience that promotes and encourages widespread use and access.
3. Identify and develop an evolving set of core competencies and best practices for students and teachers to provide a solid technology foundation on which they can build to equip them for the world in which they will live and work.
4. Inspire and support our teachers to continue developing the competence, hone the confidence, and foster a culture where technology is embedded in the foundation of the growth and education of our students.
5. Ensure maximum utilization of fit-for-purpose technology by having a structured, planned, and coordinated approach to the introduction, adoption, and ubiquity.
6. Harness our collective knowledge by engaging the district and community in structured meaningful conversations about how teaching and learning should change in light of the explosion of technology.

Technology Committee Co-Chairs – Paul Duncan, Scott Cook
Committee Members – Sheila Connelly, Chris Burkhardt, MaryEllen Roberts, Michelle Zgombic, Aparna Virmani, Sridhar Govindarajan, Jose Garcia, Scott Walker, Meenal Mandavkar, Ken Creedon, Lance Riegler, Patrick MacNamara

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Appendix B

Survey

When answering the following questions, keep in mind the district's technology goal statement that is listed below.

“We will strive to provide a cutting-edge, technology-rich environment conducive to our students becoming creators, collaborators, upstanding digital citizens, critical consumers, and innovators.”

The term “technology” refers to laptops, desktops, SMART Boards, and iPads.

Teacher Knowledge of Technology

Tech-Knowledge

1. To what extent do you have the technical skills to fully operate these technologies?

Not at all	Small Extent	Moderate Extent	Large Extent
------------	--------------	-----------------	--------------

2. To what extent do you learn technology easily?

Not at all	Small Extent	Moderate Extent	Large Extent
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3. To what extent do you know how to solve your own technical problems?

Not at all	Small Extent	Moderate Extent	Large Extent
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Knowledge in Relation to Teaching and Learning

4. To what extent do you have the classroom management strategies needed to implement technology effectively in your classroom?

Not at all	Small Extent	Moderate Extent	Large Extent
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5. To what extent do you know how to integrate technology into your classroom in order to meet the district's goal statement?

Not at all	Small Extent	Moderate Extent	Large Extent
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6. To what extent, do you know how to combine mathematics, technology, and teaching approaches?

Not at all	Small Extent	Moderate Extent	Large Extent
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7. To what extent can you teach lessons that combine, language arts, technology, and teaching approaches?

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Not at all Small Extent Moderate Extent Large Extent

8. To what extent do you know how to choose a specific technology to enhance the content you are teaching?

Not at all Small Extent Moderate Extent Large Extent

9. If there is anything that you feel you need to know about technology integration that hasn't been mentioned above, please list it in the space provided.

Fill in the blank

- 1.
- 2.
- 3.
- 4.

Culture: Training that is focused on teacher needs, beliefs, and specific strategies for success and is supported over the long term.

Technology Specific

10. To what extent have your technology professional development experiences been followed up with continued support (from either coaches, trainers, your principal, or your peers)?

Not at all Small Extent Moderate Extent Large Extent

11. To what extent has your technology professional development taken place within your own grade level or classroom?

Not at all Small Extent Moderate Extent Large Extent

12. To what extent do you have a chance to work with trainers/coaches that have the expertise required to help you meet your specific grade level technology needs?

Not at all Small Extent Moderate Extent Large Extent

13. To what extent has the training you received been focused on how specific technologies can accomplish specific learning outcomes in your classrooms?

Not at all Small Extent Moderate Extent Large Extent

14. To what extent is there a shared vision for what good technology integration looks like at your grade level?

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Not at all	Small Extent	Moderate Extent	Large Extent
------------	--------------	-----------------	--------------

15. To what extent are there opportunities for an exchange of ideas about technology, both within and across, grade level teams.

Not at all	Small Extent	Moderate Extent	Large Extent
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16. To what extent are there opportunities to discuss problems about technology integration with peers, principal, or coaches?

Not at all	Small Extent	Moderate Extent	Large Extent
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Broader Cultural Components

17. To what extent do teachers take risks in trying new technology techniques and ideas?

Not at all	Small Extent	Moderate Extent	Large Extent
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18. To what extent do teachers feel honored for their expertise within the school as well as within the district?

Not at all	Small Extent	Moderate Extent	Large Extent
------------	--------------	-----------------	--------------

19. To what extent does school leadership keep your school focused on collaboration that fosters continuous improvement?

Not at all	Small Extent	Moderate Extent	Large Extent
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20. To what extent do teachers work together to develop shared understandings of students, curriculum & instructional policy, but also produce materials & activities that improve instruction, curriculum, & assessment?

Not at all	Small Extent	Moderate Extent	Large Extent
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Teacher Beliefs About Technology

21. When writing your lesson plans, to what extent does technology integration factor into your planning?

Not at all	Small Extent	Moderate Extent	Large Extent
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22. To what extent do you feel the technology is reliable?

Not at all	Small Extent	Moderate Extent	Large Extent
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23. To what extent do you feel you can be a good teacher without using technology?

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Not at all	Small Extent	Moderate Extent	Large Extent
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24. To what extent do you feel that technology is, “one more thing” you have to teach in your class?

Not at all	Small Extent	Moderate Extent	Large Extent
------------	--------------	-----------------	--------------

25. To what extent does the technology make it easier for you to accomplish your goals for learning?

Not at all	Small Extent	Moderate Extent	Large Extent
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26. To what extent do you think you have enough time to plan and prepare for using technology effectively?

Not at all	Small Extent	Moderate Extent	Large Extent
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27. To what extent do you feel you have enough class time to integrate technology?

Not at all	Small Extent	Moderate Extent	Large Extent
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28. To what extent do you feel that the time you will need to invest learning to use the technology isn't worth the pay off you will get in student learning?

Not at all	Small Extent	Moderate Extent	Large Extent
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29. To what extent do you believe you have enough access to technology?

Not at all	Small Extent	Moderate Extent	Large Extent
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30. To what extent do you believe there is timely technical support?

Not at all	Small Extent	Moderate Extent	Large Extent
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31. To what extent do you believe there is enough professional development on how to integrate technology effectively?

Not at all	Small Extent	Moderate Extent	Large Extent
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32. To what extent do students benefit from using technology?

Not at all	Small Extent	Moderate Extent	Large Extent
------------	--------------	-----------------	--------------

33. Which statement below describes your belief about technology integration?

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

- A. Technology should not be used
- B. Technology is not important
- C. Technology is supplemental
- D. Technology is central to instruction

34. To what extent do you want to learn more about technology integration?

Not at all Small Extent Moderate Extent Large Extent

35. To what extent do you feel it is your responsibility to learn how to integrate technology?

Not at all Small Extent Moderate Extent Large Extent

36. To what extent would you like to learn how to use technology to help meet the demands of the NJASK or the Common Core?

Not at all Small Extent Moderate Extent Large Extent

37. How much technology training have you completed this year? (in hours)

0 1-5 6-10 11-15 16-20 over 20

38. What grade level do you teach?

K 1 2 3 4 5

39. What is your age?

20-29 30-39 40-49 50-59 60-69 70 +

40. What is your gender?

F M

41. How many years of experience do you have teaching?

1-5 6-10 11-20 21-30 30+

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Appendix C
Teacher Focus Group Protocol

1A. What is the role of technology in elementary school? (Beliefs, Vision, Knowledge 1,2)

Think about our tech: SMART Boards, Laptops, iPads, Chrome Books. What are we trying to accomplish (from your perspective)?

- **How vital is it? Explain.**

1B. How does it change how we teach and learn?

- What do we gain? Explain/Example.
- What do we lose? Explain/Example
- How do you manage the students being digital natives, especially if you are not?
- To what degree are we teaching them to be tech savvy, and to what degree is the tech helping them learn content like Common Core/PARCC?
- **Do you need to use tech to be a good teacher? Why or why not?**

2A. Think about a common technology use in your class. What is the device/App/Software?
How do you use it?

- Explain the use. Explain what you hope to get out of it.
- What are the kids doing? What are you doing?
- How does it improve the learning compared to if you didn't have the technology?
- How do you pick a technology to improve learning or improve instruction? (From Dan)
- **How frequent is this use?**
- **Barriers?**

2B. Describe a recent technology training for the iPad or Google Drive (PD, Human Supports)(2). (Doesn't have to be iPad or Goggle Drive)

If they did go to the in-service:

- **Can you describe something that was useful?**
- **Was there something that you would like to have seen improved?**
- **Describe how it will improve your technology use in your classroom (2) (results).**
- **What did you think of the resources provided? How will you use them?**
- **Best resource? Why?**
- **Is this typical of all training? Is it typical for tech?**

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

If they didn't go to the in-service, keep these questions:

How does the training that you went to compare to what you heard?

- What did that look like? Describe in detail.
- How did it meet your grade level needs?
- How was it subject specific?
- **When you started implementing it in your class, what else could you have needed in terms of help? (on-going needs).**
- **If you haven't started using it yet, what would help you get started?**
-

2C. If you could get on-going/periodic help (beyond training sessions), what would be most helpful? (might have already been covered above)

- What do you need between now and the scheduled February in-service?

2D. Describe recent coaching you've had. How did it help/change what you do? (PD/Human Supports) (2)

- What was the coaching for?
- Describe how it has improved your classroom uses.
- What else would you like from the coaches? Be as detailed as possible.

3. In the survey, teachers reported wanting more training. What are the three most important things you need to learn in order to improve your technology use? (3)(Needs)
Might have already covered?

- Any other tech training needs that we haven't talked about yet?
- **Basic Operational**
- **More Complex Instructional Integration**
- **What about how it all works together, the wireless, printer, iPad, server?**
- What else do you need to know about, Laptops, SMART Boards, iPads, Google Drive?
- Or something that comes up like Edmodo, the Student Center, etc.
- **What about the PARCC? Needs? Concerns?**

4. Having a support structure helps teachers implement new things like technology so we're now going to switch gears a little and talk about things that go into supporting teachers (beyond training). We'll talk about current levels of support and then support needs you have.

4A. One type of support is tech support (2)

- Describe something they've helped you with?
- Describe what you can solve on your own?
- **What else do you need support for? How can we minimize your technical problems?**
- What would be ideal tech support?

4B. Another type of support is reliable access to technology.

- Describe your access to technology.

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

- Describe how reliable it is.
- **How do access and reliability impact your use?**
- What would be ideal?

4C. Another type of support is teachers collaborating together:

- Think about your key peers, grade level or others.
- Describe how you collaborate and support each other about technology use(2).

OR

- You collaborated at the in-service:
-
- What was beneficial?
-
- How often do you do that with your team? How, When? Where?
- What do you collaborate about?
-
- Is there **collaboration for instruction** or is it more about helping someone with a tech problem?
- How could collaborating about technology, say as a grade level, help your technology use?
- What would you need to help support better collaboration?

5A. In the survey, teachers report a lack of time when it comes to implementing tech.

- **(2) What about technology takes time?**
- (3) What could be done in terms of training and support so tech could take less time for you?
- What could coaches, librarians/media specialists, computer teachers, principals, administrators, etc. do)?
- **If you had the skills and the time (and support and access) What would you like to do with tech? Think about all of those resources you just got.**
- **Is there a way we could use it better to help you with technology use?**, or with anything you need help with? Would you be willing to give up some of that time if it really helped you accomplished something relevant to your day-to-day?
- **If something optional was set up during your prep (once a week or twice a month for example), what would get you to show up consistently?** What are your burning issues? What would make it vital to you so you made time for it? **If** we could make the coaches, tech support, available, what would make it worth your while? (we could even make it short, 30 minutes out of a 50 minute prep so you had time for other things).

Technology Coaches Focus Group Questions

1A. What is the role of technology in elementary school? (Beliefs, Vision, Knowledge 1,2)

Think about our tech: SMART Boards, Laptops, iPads, Chrome Books. What are we trying to accomplish (from your perspective)?

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

How does it change how we teach and learn?

- What are the advantages? Explain.
- Any disadvantages? Explain.
- How does having students as “digital natives” change the classroom?
- To what degree are we teaching kids to be tech savvy, and to what degree is the tech helping them learn content like Common Core/PARCC?

2A. What are you helping teachers with?

- Actively training? How? Training sessions? In-class help?
- Troubleshooting? Overcoming tech barriers?
- Instructional help? How?

2B. What is your role as the tech coach?

- Actively promote tech use? (Reaching out to teachers)
- Respond to teacher needs? (More passive)
- Help with technical?
- Instructional?
- Some teachers reported that finding time to meet with you is hard, any ideas how we might overcome this?
- What support/help do you need from administrators?

3A. You have a unique perspective in that you see what teachers are having trouble with, what are the most immediate teacher needs and then what are more long term needs for full and valuable tech use? What do teachers need now?

- What training should we be offering?

3B. What do we need to do in order to maximize and fully implement tech in the future? Long term teacher needs?

- Overall tech approach? Are we headed down the right path?
- Coordination of tech roll out and training?

Having a support structure helps teachers implement new things like technology so we’re now going to switch gears a little and talk about things that go into supporting teachers.

3C. Beyond training, on-going/periodic help and support has been shown to be useful. What type of support should we be implementing between the big professional development days?

4A. How is basic “tech support” meeting teacher needs? (2)

- Teachers seem pretty content.
- Replacing old tech is somewhat of a complaint. Thoughts?

4C. Another type of support is reliable access to technology.

- How equal is access to technology?
- What do we need to do to make it more equitable?

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

- Is it consistent by school/grade level?

4D. Another type of support is teachers collaborating together:

- Some teachers reported wanting time to collaborate as a grade level but also expressed need for tech coach help (they need tech help/expertise). **How might you help with this need?**

5. Look at this graphic that helps conceptualize technology and its relation to the curriculum and pedagogy. (Handout Below)

Figure 1: Common conceptualization (Technology as separate)

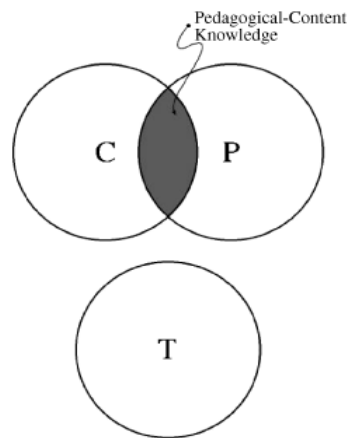
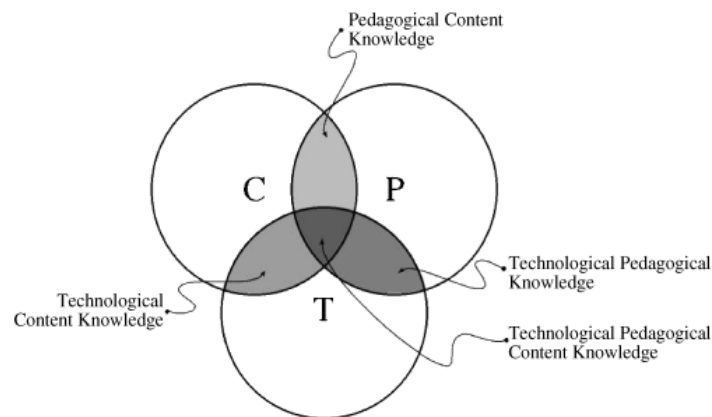


Figure 2: New conceptualization (Technology as integrated)



“quality teaching requires developing a nuanced understanding of the complex relationships between technology, content and pedagogy, and using this understanding to develop appropriate, context specific strategies ...” (Mishra & Koehler, p. 1029).

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Think about helping teachers with tech integration for all of the different subjects, from Kindergarten through 5th grade, as a coach, what are your needs if this is the type of knowledge we want teachers to possess?

- Do you have this knowledge?
- If not, what are your needs to help develop this knowledge?

Is there something else we should be focused on? What am I missing?

Administrator Interviews

1A. What is the role of technology in elementary school? (Beliefs, Vision, Knowledge 1,2)

Think about our tech: SMART Boards, Laptops, iPads, Chromebooks. What are we trying to accomplish (from your perspective)?

- **Why do we buy them and give them to teachers?**
- How clear do you think this role is to teachers?

2A. Think about the most common technology use you see in classrooms. Explain the use.

- What are the kids doing? What are the teachers doing?
- How does it improve the learning compared to if we didn't have the technology?
- Are there any drawbacks to the technology use?

When thinking about ideal tech use, it takes teachers understanding tech in deep ways and using it very strategically. Here is an example from a research article that explains what teachers need to know in order to use tech at a high level.

[Handout]

... “quality teaching requires developing a nuanced understanding of the complex relationships between technology, content, and pedagogy, and using this understanding to develop appropriate, context-specific [teaching] strategies” (Mishra & Koehler, 2006, p. 1029).

- **Are you seeing widespread use that demonstrates this deep knowledge?**
- **What do you think we need to do in order to get widespread use that involves this complex understanding of tech?**

3A. Part of the role of administrators is to provide and coordinate support for teachers when they are making changes. From what you see when you are in classrooms, talking with teachers, as well as being involved in district leadership meetings, what are your views on these topics?

3A. In the survey, teachers reported wanting more training. How do we assess teacher needs so we can plan training? What are the most pressing training needs?

- Beyond immediate teachers needs, what are our long term needs in order to reach ideal tech use?
- Do we offer enough training?

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

- Do we have documentation of who has been trained?
- **What role can you play in training for ideal tech use?**

3B. After teachers are trained how to operate an App or device, they often need ongoing support for implementing it in their classroom. What type of on-going support would help improve our tech practices on a widespread level?

- Do we offer enough support?
- **What role can you play in terms of helping with on-going support?**

3C. How is coaching going?

- How might we better utilize and support the coaches?
- What is your role in improving support for coaches?
- **Is there enough coaching?**
- **Coaches mentioned scheduling time with teachers as something that was hard to do, any ideas on how we might overcome this?**

3D. Another type of support is reliable access to technology. Is there equal access across the district?

- **3E. Another type of support is getting teachers to collaborate together to create collaborative teacher support networks.** Teachers want time to collaborate and plan for tech use, what can we do to help them with this?
- What are we doing, if anything, to support collaboration?
- What could we do to improve collaboration?

4. To what degree do we plan for all of these supports before we roll something out?

- Supports are: Purchase of the tech driven by teacher needs, access and training, ongoing support for implementing it in their classroom (coaching, tech support) after they have been trained, ongoing collaboration/peer support to sustain day to day use and then improve tech use over the long term.
- **What is your role in planning for and coordinating these supports?**

5. Clearly, these supports place a lot of responsibility and demands on administrators which might create training and support needs for administrators.

- If we could get principals/administrators more support/training/PD, what would they benefit from?

Administrator Interviews

Tech Support Leaders

1A. What is the role of technology in elementary school? (Beliefs, Vision, Knowledge 1,2)

2. After teachers are trained how to operate an App or device, they often need ongoing support for implementing it in their classroom.

- What type of on-going support do teachers need? (After they've been to training and are back in their classrooms trying to use it.)

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

- How might we make the changes needed to implement those supports?
- **What role can you play in terms of helping with on-going support?**

3. Another type of support is reliable access to technology.

- How would you describe the current state of access and reliability?
- Do all of the schools have the same access? Do you have numbers on this?
- **What is your role in terms of access and reliability?**

4. Think of the Chromebooks 1:1 initiative in 5th grade, or the recent roll out of all of the apps from the digital tools workshop on Columbus Day. What sort of preparations do we make ahead of time to support teachers in using them?

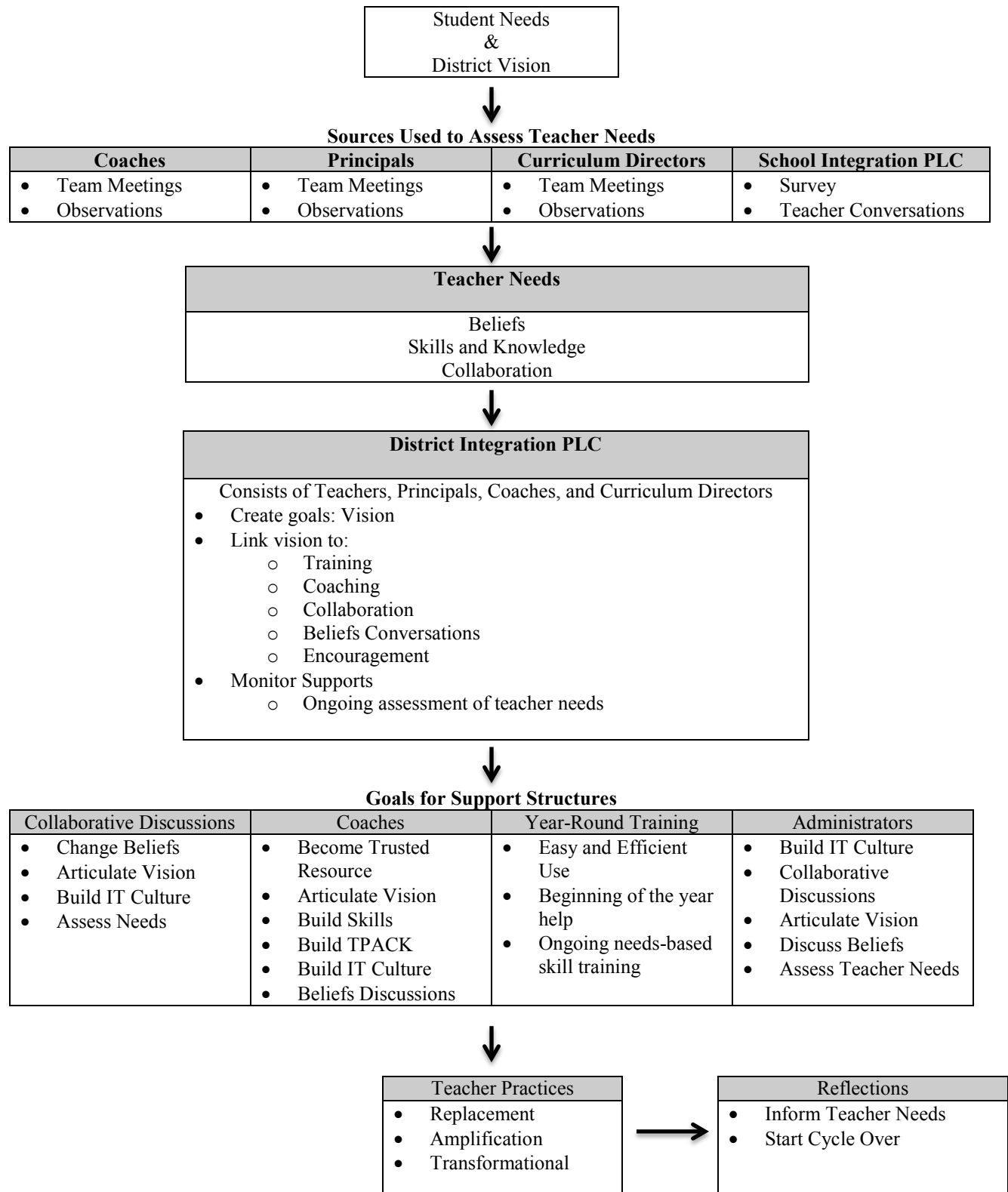
- Do you hear discussions about all/any of these things?

5. Clearly, these supports place a lot of responsibility and demands on administrators which might create training and support needs for administrators.

- If we could get principals/administrators more support/training/PD, what would they benefit from?

A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Appendix D
Support That is Driven by Teacher Needs



A PROGRAM EVALUATION FOR TECHNOLOGY INNOVATIONS

Appendix E

Supplemental Materials: Administrator Resources

Below are links to websites, and a 1:1 research brief which could be used to help keep Warren connected to new ideas and research about technology in schools.

UCEA 1:1 Brief

http://www.natickps.org/CASTLEBrief01_LaptopPrograms.pdf

1:1 Blog from UCEA Website

<http://1to1schools.net/about/>

Dangerously Irrelevant Website, Blog, and Daily Texts

<http://dangerouslyirrelevant.org/bio>