A Delphi Study: Technology Leadership Network's Perceptions of ISTE Essential Conditions for Technology Integration in Professional Learning Communities

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To my father, who held on to my hand on the first day of school, who ignited the love for books in me, and who bequeathed me with the audacity to speak my mind…

To my mother, who never gave up on me and whose support I will have for the rest of my life...

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ABSTRACT

A Delphi Study: Technology Leadership Network Perceptions of ISTE Essential Conditions for Technology Integration in Professional Learning Communities

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Purpose: The purpose of this Delphi study was to identify the essential conditions (ISTE) required for technology integration in Professional Learning Communities for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by members of the joint Technology Leadership Network of the Riverside County Office of Education and San Bernardino County Superintendent of Schools, California.

Methodology: A structured Delphi Study using mixed methods was conducted to find the expert panel's opinions, the members of the Technology Leadership Network in Riverside County Office of Education. Round 1 and Round 3 comprised scaled questions, producing quantitative data. Round 2 consisted of open ended questions, producing qualitative data.

Findings: Delphi expert panelists ranked shared vision, ongoing professional learning, empowered leaders, and student-centered learning as the top four ISTE essential conditions required for technology integration in PLCs. The Delphi expert panelists also identified the preconditions necessary for technology integration.

Conclusions: Based on the findings, a transformational plan and a change model were designed to effectively implement technology integration in Professional Learning Communities. The purpose of the plan and model was to provide step-by-step

instructions for a transformational change plan for technology integration in Professional Learning Communities.

Recommendations: To prepare educators for 21st century PLCs, it is crucial to have technology integrated in professional developments. Technology integration is indispensable for PLCs to build effective teams and to have collaboration and effective decision making; however, it is not possible unless PLCs have a deliberate shared vision, embedded ongoing professional learning, empowered leaders at all levels, and data driven student centered learning. The prerequisites, if addressed properly, can provide the strong foundation required for technology integration in PLCs. Yet, the change needs to come within one's self, and educators as lifelong learners are the right people to integrate this change.

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CHAPTER ONE: INTRODUCTION

Overview

Since the beginning of the 21st century, the traditional classroom has experienced tremendous changes. The major changes are due to technology advancements and easy access to the internet. Schrum and Levin (2009) asserted that Web 2.0, the second generation of the internet, "…offer[s] more interactivity, allowing users to add and change Internet content easily to collaborate and to communicate instantaneously in order to share, develop, and distribute information, new applications, and new ideas" (p.5). As a result, an educator sitting in the United States can teach students in Afghanistan (H. Eckmann, personal communication, January 19, 2013). Today, online classrooms are typical in any high school and are not limited to higher education. Most school districts are integrating technology into learning and are offering their students alternate schooling, such as online and hybrid classes. Schrum and Levin described some of the components of online learning, "some of these programs provide resources for homeschool learners, and others offer diplomas or advanced placement credits,…courses not available at a particular school, and repeating courses" (p.162).

The introduction of Common Core State Standards (CCSS) has convoluted the scenario for educators who are already struggling to keep up with changes in technology, budget cuts, and an ever-changing student population. In response to the requirements of the CCSS, the states, education departments, and school districts all are trying their best to train their educators for the upcoming challenges. Some states are ahead of others and are already in the process of implementing CCSS. Others are at the initial stage and are

trying their best to train their educators for the massive transition. Wiener, Aspen, and the Council of Chief State School (2013) explained,

> To carry out this new mission, state education agencies (SEAs) must reinvent themselves: establish a new culture, develop a different set of competencies, and adopt new approaches to their work with school districts… State departments also must work with school districts to ensure that changes in practice are substantive and comport with the increases in rigor and depth called for in the Common Core. (p.1)

However, implementing CCSS is not a simple matter of introducing a new curriculum or a new method of assessment. It is a totally different academic program that requires educators to not only to change their teaching styles but also to revise their teaching philosophies. CCSS requires educators to devise creative strategies to teach students and to look beyond the textbooks. The curriculum based on CCSS will give educators a guideline, and educators are supposed to use that guideline to design their own lesson plans based on the resources available through technology and internet access. The textbook, consequently, is just another resource or a tool that educators can use as a reference material for their lesson plans (T. J. Kerr, personal communication, September 23, 2014). Considering the circumstances, implementing CCSS is an overwhelming task that educators have to undertake. Not only do they have to change the classroom and school culture, but they also need to furnish the resources, strategies, and tools to effectuate these changes. Gewertz (2013) summarized these changes in a few words, "in districts of all sizes, teachers are scrambling to get their arms around the

new guidelines. The demand for good curricular resources and professional development outstrips their availability" (p1, p10).

Limited resources and time constrains render piloting an unfamiliar curriculum in a short period of time daunting. Confronting these issues requires educators to devise creative ways to implement the changes and to innovatively plan to achieve the task in a short period of time. Riddle (2012) addressed the present issue in following paragraph.

> School leaders need so much more than understanding the standards. Rather than simply drilling down into the details of the Standards, school leaders, including principals, assistant principals, teacher leaders, and district leaders need a practical understanding of the school wide changes made necessary by these new Common Core State Standards and how to lead those changes to create a culture of success in our schools. (Web log post)

The term *shared decision making process* has increasingly resonated in educational spheres, especially in discussions about technology integration. Hoerup (2001) explained, "the decision stage is where 'the individual engages in activities that lead to a choice to adopt or reject the innovation' (Rogers, 1983, p. 172)" (p. 9). Districts have evidenced educators' willingness to make decisions, but shared decision making requires effective team culture and collaboration. Hoerup believed that "many factors change year-to-year in schools that affect the roles teachers and administrators play in successful implementation of innovations" (p.1), and "the superintendent, principal, and peers can all be either facilitators of a new innovation or inhibitors of a new innovation for any teacher. The teacher needs to feel support from the administration in adopting the innovation" (Hoerup, 2001, p.21). With easy access to cloud based technologies, wikis,

survey monkey, website creating tools, blogs, and SharePoint, technology integration in professional learning communities (PLCs) for team collaboration is not a remote idea or mere imagination. Lepsinger and DeRosa (2010) indicated, "There are many ways to implement effective communication such as team v-meetings, emailing, videoconferencing, instant messaging, collaborative group technologies, blogs, wikis, and web-based bulletin boards" (Kindle Edition). It is imperative to integrate technology and to engage teachers in collaboration and decision making through strategies like PLCs if schools are to be successful in their efforts to implement ongoing change.

Problem Background

When it comes to technology, educators are adamant about the ways they use to teach and collaborate. Suarez (2013) et al. cited, "The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn (Toffler, 1970, p. 271)" (p.3). Time constraints account for a major reason that educators do not adopt the new technological changes. Morgan, Parr, and Fuhrman (2011) elaborated, "while collaboration provides many benefits for students and teachers alike, it also requires extra effort. One of the hurdles impeding secondary teachers from collaborating is a lack of time (Delnero & Montgomery, 2001)" (p. 79). To overcome this barrier, educators must employ many of the available resources effectively. Technology, which can increase the efficiency of teacher collaborations, represents one resource. Morgan et al. (2011) believed,

> Current internet technology has provided a means for individuals to collaborate with a fraction of the time requirements associated with face to face encounters. Tools such as wikis, blogs, and communities of practice, as well as social

> networking sites (e.g. Facebook, Twitter, MySpace etc.), have made interaction between individuals much more time efficient and less prohibitive in terms of scheduling (Friedel, Rhoades, & Morgan, 2009; Morgan & Parr, 2009, p.79).

In addition to time constraints, teachers are often unprepared for real life situations in education settings. Jeffs and Banister (2006) expounded, "often times, preservice teachers graduate from their programs with little experience in how to collaborate with their peers, integrate technology into their daily lessons, or how to plan instruction for students with special needs" (p.208). Morgan et al. (2011) concurred, "yet the question remains, how well prepared and willing are current teachers to implement the use of technology as a viable means for collaboration toward contextualized learning?" (p. 79).

Nevertheless, educators frequently hear that, "the technology infrastructure in a district or school provides the foundation upon which all educational and administrative technology efforts must rely" (Clark & Associates, 2010, p. 7). Romano (2003) summarized the condition of technology integration in the U.S. education system,

> After 50 years of costly trial and error, technology is still not an integral, routine part of what happens in the classroom. Stated another way: we have not yet found the way to connect education and technology so that teachers might do what they do more effectively. (p. 2)

Shinsky and Stevens (2011) reiterated the need for technology integration, "this is important because technology is an evolving industry that requires ongoing training and application for maximum proficiency (Christensen, 2002)" (p.196).

Due to limited resources, outdated technology poses the biggest challenge for teachers, as Saine (2013) explained,

> Technology continues to be a double-edged sword in our school. It's fabulous when it works, but bandwidth issues and tech support trials keep many of our teachers apprehensive about using it routinely in their day-to-day literacy activities. (p. 102)

Lepsinger and DeRosa (2010) indicated the need for suitable technologies for effective collaboration, "in order for virtual collaboration to be truly successful, the right technologies must be available" (Select the Right Communication Technologies, para 2, Kindle Edition). Saine (2013) echoed the common mistrust in education and stated that teachers under stress "…also lack trust that the technology will be working properly" (p. 102).

Lepsinger and DeRosa (2010) further explored decision making and teamwork with respect to technology integration and added,

> …many high-performing teams use webinars and collaborative technologies for brainstorming and decision making, while low-performing teams rely more heavily on email. In some cases, low-performing teams also reported experiencing more technology problems and frequently indicated that they lacked appropriate technical training. (Kindle Edition)

Curwood (2011) acknowledged that despite initiatives such as, "…the National Educational Technology Standards in the United States, technology integration is not a simple process" (p.68). The school culture contributes significantly to teachers'

perceptions of adopting the new technologies. Lewis (2004) explained two cultural shifts required for technology integration in a school,

> Most teachers will not persist in changing workplace norms unless there is a school culture in place that supports innovation and collaboration. Therefore, an adaptation of educational technology and professional community require a duo-cultural shift: 1) within schools away from isolation towards collaboration and innovation; 2) within the individual away from private practice towards collegiality and the sharing and exchange of ideas that is associated with professionalism (p. 14).

Problem Statement

Tremendous advancements in technology have created a flood of information sources. Although PLCs provide a foundation for team collaboration, technologies that can support teamwork are rarely used. Most collaboration is conducted without the assistance of technology. Dittman (2010) explained, "Over the last decade the defining factors and motivations behind how we work and how we learn have significantly and steadily moved toward a globalized network that encourages the sharing and creation of knowledge and information" (p. 195). Educators are overwhelmed by technological changes and are reluctant to integrate technology for collaboration; outdated techniques are used to lead PLCs, and staff development is conducted without hands-on technology.

CCSS requires educators to integrate technology in their lesson plans by using web-based resources and tools. CCSS mandates have increased the tension associated with and importance of professional development for all educators. Educators lack adequate time to prepare CCSS based lessons unless they deliberately concentrate on

working together. Robertson (2013) addressed the issue in a California based school, "teachers needed to have continuous access to a variety of information and resources about the CCSS. When new information and resources become available, teachers need to be able to access it" (p. 58). Online collaboration using a variety of communication and decision making applications holds promise for educators who work in PLCs.

Thompson, Kitchie, and Gagnon (2011) suggested that PLCs be replaced with Professional Learning Networks, which

> …simultaneously addresses and provides solutions to some of the frequently stated weaknesses of PLCs: insufficient time, resources, and space. It resolves these issues by communicating information, posting data, and providing professional development asynchronously, thus enabling the stakeholders to access it at their convenience, revisit it upon need, choose topics of interest, all while requiring no additional physical space or cost for resources. (WHY A PLN FOCUS? para 3)

Exploring new technologies and discovering resources available to educators are imperative, and conversations about technology integration are prevalent. Riddle (2012) believed that "changing the conversation means shifting the culture" (Web log post). Accordingly, it is pertinent to start the crucial conversations that will change the culture of 21st century PLCs and team collaborations to integrate the new millennium technologies.

Technological changes necessitate educators to reconvene and to realign their priorities. Patterson, Grenny, McMillan, and Switzler (2011) emphasized the need to find different ways to look at the issues,

> Just as the world is changing at frightening speed and has become increasingly and profoundly interdependent with marvelous and dangerous technologies, so, too, have the stresses and pressures we all experience increased exponentially. This charged atmosphere makes it all the more imperative that we nourish our relationships and develop tools, skills, and enhanced capacity to find new and better solutions to our problems. (Kindle Edition)

It is important to carefully examine the issues pertaining to technology integration. Technology plays a critical role in every aspect of today's education. It is used in instructional delivery, staff development, and teacher collaboration. Technologies for promoting effective teams, collaboration, and shared decision making have also been emerging. Although a variety of technology tools are available to teachers and the use of (a) technology in the classroom, (b) teacher training, and (c) teacher collaboration is rapidly increasing, a gap in current research exists on the topic of maximizing PLC collaboration through the use of technology, also referred to as technology integration. There is a need to comprehend the reasons behind the nonexistent use of technology in PLCs and also to examine the strategies that will overcome these limitations. Technology integration is central to building effective teams, promoting collaboration, and endorsing shared decision making, and therefore ascertaining how to effectuate it in schools is necessary through further research. In addition to the capacity to enrich the body of knowledge through researching the topic of effective technology in teacher collaboration, there is an urgent demand for recommendations that districts can implement to support their PLCs in today's technological age.

Purpose Statement

The purpose of this Delphi study was to identify the essential conditions (ISTE) required for technology integration in Professional Learning Communities for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by members of the joint Technology Leadership Network of the Riverside County Office of Education and San Bernardino County Superintendent of Schools, California.

Based on the International Society of Technology for Education (ISTE), 14 essential conditions to effectively leverage technology for learning are as follows:

1. Shared Vision
2. Empowered Leaders
3. Implementation Planning
4. Consistent and Adequate Funding
5. Equitable Access
6. Skilled Personnel
7. Ongoing Professional Learning
8. Technical Support
9. Curriculum Framework
10. Student-Centered Learning
11. Assessment and Evaluation
12. Engaged Communities
13. Support Policies
14. Supportive External Context

The emphasis of this study was to explore and identify the ISTE essential conditions supporting technology integration in PLCs. In this study, the prerequisites, the attributes, the factors, and the measures for implementing essential conditions that encourage the use of technology in PLCs were discerned. In addition, the TLN's perceptions of the prerequisites for teachers to lead implementation of essential conditions were sought.

Research Questions

1. What ISTE essential conditions need to be in place for technology integration in Professional Learning Communities for building effective teams, supporting collaboration, and endorsing shared decision making processes as perceived by Technology Leadership Network?
2. What are the most important ISTE essential conditions that promote the use of technology supporting collaboration, effective teams, and decision making as perceived by members of the Technology Leadership Network?
3. What are the prerequisites to implement the ISTE essential conditions for technology integration in Professional Learning Communities as perceived by the Technology Leadership Network?
4. What are the factors that successfully lead teachers to implement ISTE essential conditions in the Professional Learning Communities as perceived by the Technology Leadership Network?
5. What increases the effectiveness of implementing ISTE essential conditions for technology integration in the Professional Learning Communities as perceived by the Technology Leadership Network?

Significance

A computer was not long ago considered a luxury, but now the academic environment necessitates utilizing laptops, iPads, and tablets. Technology as a whole has evolved tremendously over the last 10 years, and cloud based technologies have experienced an especially emergent development. Cloud based technology has introduced a new concept of online collaboration, and now integration of technology is considered one of the essential tools for teamwork. Dittman (2010) believed that "The ability to work in a virtual team and collaborate in distributed settings is an important and necessary skill set for today's learners to be effective when participating in collaborative learning and virtual teams" (p. 196).

Educators are experimenting with the technology and new practices are surfacing to meet their needs, but the question still remains whether significant evidence exists to support the notion that certain technological practices promote collaborations, create effective teams, and endorse shared decision making amongst the educators to increase students' achievements. Dittman (2010) explored some of these factors, "There are multiple factors within a virtual team environment that inherently impact the collaborative success of virtual teams. These factors include time differences, mismatches in expectations, cultural differences, different levels of experience, and a lack of norms for communication (Munkvold & Zigurs, 2007)" (p. 197). The significance of this study lies in its specific focus on evidence that supports the effective and efficient use of technology during PLCs. The elements of technology that promote effective PLCs will also be explored in the study.

Definitions

Collaboration. A systematic process in which we work together, interdependently, to analyze and impact professional practice in order to improve our individual and collective results (Dufour, Dufour, & Eaker, 2002).

Collaborative Technologies. Online tools such as cloud based technology, wikis, blogs, SharePoint, office 365, Google Drive, LiveBinder, Symbolo, Edmodo etc., which support teachers to work in a PLC.

Decision Making Process. Decision making is a process of making a choice from a number of alternatives to achieve a desired result (as cited in Lunenburg, 2010).

Effective Teams. Effective teams are purpose driven, composed of diverse perspectives but ensure balanced roles, display mutual trust, hold each other accountable and engage in open and purposeful conflict (Derosa & Lepsinger, 2010).

Professional Learning Communities. Educators building a PLC recognize that they must work together to achieve their collective purpose of learning for all (Dufour, 2004).

Professional Learning Networks. An idea based on either online, face to face, or combined practices for collaborating in education (Thompson, Kitchie, and Gagnon, 2011).

Riverside County Office of Education (RCOE). Education service agency that supports the county's 23 school districts and provides directory guidance and resources for parents, faculty, and students and is located in California.

San Bernardino County Office of Education (SBCOE). The Office of the Superintendent provides educational leadership to the school districts in San Bernardino County

Technology. Computers, laptops, iPad, tablets, cell phones, and any other electronic devices with internet access

Technology Leadership Network (TLN). Its members consist of school-site based leadership working in the capacity of technology and curriculum leaders or technology coordinators

Technology Integration (TI). Using technology in PLCs for teamwork, collaboration, and decision making

Delimitations

Simon (2011) averred, "the delimitations are those characteristics that limit the scope and define the boundaries of your study" (p. 2). The researcher controls the delimitations and sets the confines of the study by making the intentional choices for the study. The Delphi study was limited to four conditions: (a) high school PLCs, (b) teacher access to technology and its integration for building effective teams, (c) promoting collaboration, and (d) endorsing shared decision making processes. The Riverside County Office of Education (RCOE) provides a forum to technology leaders of Riverside County and San Bernardino County through TLN, and the research was constricted to the members of TLN. TLN membership is open to the educators of RCOE and San Bernardino County Office of Education (SBCOE). The members are self-identified technology experts working in some capacity relevant to integration of technology in their respective organizations and are strong in the area of technology integration in their schools and districts.

Organization of the Study

The remainder of the research consists of Chapter 2-Review of Literature, Chapter 3-Methodology, Chapter 4-Research Findings, and Chapter 5-Conclusions, Implications, and Recommendations. Chapter 2 will include an examination of prior research and literature, which corroborates the necessity of further research on the topic. In Chapter 3, the rationale behind employing the Delphi technique for the research will be detailed, and the research findings will be reported in Chapter 4. Chapter 5 will encompass the research findings and the conclusions drawn based on those findings. It will also encompass the implications and recommendations for future research and will consist of appendices, tables, figures, and a bibliography.

CHAPTER TWO: REVIEW OF THE LITERATURE

Overview

Chapter 2 of this research consists of a literature synthesis pertinent to PLCs, effective teams, collaboration, decision making processes, and technology integration. So far, the literature has revealed the changing technology needs of the 21st century and the lack of time and resources for public school teachers to implement these changes. The review of the literature will begin with the overview of inconsistency between the technology need and available resources for the teachers. This chapter will look deeply into PLCs and the integration of technology for building effective teams, collaboration, and decision making processes.

Review of Literature

The discrepancy between technology advancement and technology integration in education is extensive. Despite the fact that the educators are required to use technology, the resources they have are outdated and insufficient. Romano (2003) highlighted the inconsistency in the use of technology in education and identified six primary obstacles hampering effective use of technology:

1. No common coherent vision of technology use in classroom
2. No convincing explanation how technology empowers teachers
3. Misconception about teacher's role in adapting technology
4. Critical significance of course specific software is marginalized
5. Ill-conceived, incompatible utilization strategies-little attempt to analyze and profit from failures
6. Leaders in education lack a full grasp of technology's capacity

Romano argued that notwithstanding the millions of dollars having been spent on technology, the gap between the technology's existence and its use is wide and hinders the process of school improvement (p. 2).

Educators are employing inefficient strategies when they use old technologies alongside the latest technologies the students use. Updating online assignments while taking student attendance, presenting a lesson on Smart Board, checking emails, drafting Dropbox lesson plans, and updating the website or SharePoint all require more than multitasking capabilities. Educators must possess exceptional organizational skill in addition to training in how to utilize the latest technologies. Regardless of large scale technological advancement, educators lack the necessary tools that would help them develop into effective professionals. Garland and Tadeja (2013) expounded, "… not all teachers, administrations, and learners have access to the new social networking tools. It is especially important for superintendents, principals, and technology coordinators to find ways to close the 'digital divide' between students in their districts" (p. 19). Continuous planning is fundamental to keep up with progressing technologies.

However, researchers so far have not probed technology integration in education and its effect on collaboration. Brown, Dennis, and Venkatesh (2010) recognized that "a model that integrates knowledge from technology adoption and collaboration technology research is lacking, a void that ..." (p.11) needs to be filled through extensive research focused on technology integration and collaboration. Scholars have frequently identified the need to investigate the employment of educational technologies. Pollard and Pollard (2004) consequently acknowledged, "for the last 20 years, government-funded policy reports have repeatedly identified the need for research on the effect of educational

technology on teaching, learning, and schools to substantiate increased technology funding" (p. 158).

This need also extends to PLCs. Research insufficiently addresses technology integration in PLCs and its effect on collaboration, decision making process, and team culture in education to evaluate educators' needs and performances. Thompson et al. (2011), proponents of transforming PLCs into PLNs and integrating technology in PLCs, declared that educators are becoming self-starters or technology users to form communities with common interests using tools such as Twitter, Facebook, Google, wikis, blogs, and websites. However, schools are missing a valuable opportunity to provide their staff and teachers with resources they need to succeed. Additionally, these self-starter communities do not collaborate to achieve school goals. Schools have a responsibility to support these teachers through providing a collaborative environment that supports building powerful institutions of learning (WHY A TECHNOLOGY FOCUS FOR A PLN? para1).

Professional Learning Communities

PLCs represent the core of any educational institute, and the success of any institute depends on how well its PLC is organized. PLCs lay the foundation for a school's three important components: (a) effective teams, (b) collaboration, and (c) decision making processes. In the 21st century, this is not possible without integrating technology (Thompson, Kitchie, & Gagnon, 2011, FOR A PLN, Para 1). Before further exploring the main components of PLCs and technology integration, it is appropriate to understand the meanings of PLCs.

Caine et al. (2010) defined PLCs in multiple ways:

- A group of interdependent educational professionals with a common purpose focused and committed to the learning of every individual to improve Student Achievement. (p. 48)
- A structure which allows teachers, staff, and administrators to effectively collaborate and share learned practices to address and reflect on core components of Curriculum, Instruction, and Assessments. (p. 48)
- A platform for teachers, staff, and administrators to come together to make data informed decisions and put in place interventions which impact student learning. (p. 48)
- A forum for professional growth that facilitates discussion and action around implementation and continuous learning. (p. 48)

The definition of PLCs is multifaceted, but no matter which definition a person employs, a PLC has one purpose: to serve our schools. Hord (2009) gave a simple definition of PLC, "the professional learning community models the self-initiating learner working in concert with peers" (p. 41). At its core, a PLC involves teachers working as a team with a singular focus: students' achievement and accountability. Blankstein, Cole, Houston, and Hope (2008) considered PLC members as all those with a line of accountability associated with classroom instruction (p. 29). Stoll and Louis (2007) elaborated, "sustainable professional learning communities concentrate on what matters. They preserve, protect and promote achievement and success in deep and broad learning for all, in relationships of care for others" (p. 185). A team of teachers working for the students' greater good and supporting each other while creating a positive school culture constitute several of the anticipated outcomes of PLCs. Hord (1997) affirmed, "the

literature indicates that professional learning communities produce positive outcomes for both staff and students" (p. 1).

Brodie (2014) offered leadership two pieces of advice that are imperative for successful PLCs, "… first, to establish a safe and challenging environment for collective enquiry; and second, to ensure that the community has the appropriate resources for learning" (p. 226). Stoll and Louis (2007), on the other hand, explored the options of PLCs beyond the typical data analysis,

> Strong and sustainable PLCs do not allow themselves to become fixated on raising test achievement scores, but also developing a strong focus on improving deep and broad learning beyond the basics. They engage in intelligent and ethical deliberations about what kind of learning counts as achievement. These deliberations include courageous questioning and even creative subversion of the mandates and measurement tools that diminish this deeper sense of achievement. (p.185)

Fullan (2008) implored PLCs to build school capacity and asserted the necessity of the full staff's collective power to improve student achievement (p. 3). However, maximizing the teachers' collective power requires collaboration, effective team work, and decision making processes, which demand ample time and sufficient amount of resources to bring the change. Blankstein et al. (2008) believed staff learning paves the way to student learning, and "as teaching staff learn new ways of delivering instruction, their pedagogy changes" (p. 28). The authors support the position that teachers' expertise is required to meet 21st century students' needs and to establish their college and career readiness. But teachers need sufficient training and appropriate tools to come prepared to

classrooms. Clark (2010) elaborated, "[the] key to the success of any intervention is the matching of the appropriate tool to the task at hand" (p. 2). In this case, the task at hand entails introducing teachers to modern ways of conducting PLCs, using the tools that can help teachers integrate technology while working in teams, collaborating, and making decisions for the greater good of students.

Maharajh et al. (2014) explored PLC outcomes and their power to change the PLCs when teachers (a) engage in thoughtful conversations, (b) observe and offer opinions, (c) develop curriculum and assessment as a team, (d) share materials and resources, and (e) mutually become involved in problem solving; all of these engender significant and continuous learning. Conversely, Pella (2011) requested more research that examines the ways in which teacher collaboration within a PLC can help them meet their students' learning needs. Easton (2012) believed effective PLCs emerge from within the PLC, when teachers' curiosity, pain, or data lead to purposeful deliberations for solutions to students' low performances. However, he added, "a professional learning community without *learning* is not effective" (p. 52).

Wright (2010) examined technology integration in PLCs, "we established professional learning groups and completely re-structured how we presented and learned the technology" (p. 141). There is a need to change how technology integration is addressed in PLCs. To take the concept of technology integration in PLCs further, the terms "flipped professional development" and "flipped classrooms" have been introduced. Conley (2013) contended, "the flipped professional development model is a good fit for staff development as we continue to be innovators and thinkers moving forward and trying to always meet the needs of our students" (p. 46). The concept of the

flipped classroom and now flipped professional development is built on the notion that it trains students and educators to use technology and to come prepared to a classroom, training, or both. Wright (2010) believed that to sustain technology in PLCs, "time to learn and time to 'make and take' are important to teachers who have busy schedules and limited release time" (p.145). Furthermore, Easton (2012) suggested that teachers share their feelings about PLC meetings through online surveys and later reflect, share, and discuss the results amongst the group of teachers (p. 52). These strategies will give a voice to teachers who are reluctant to speak out during PLC meetings.

The literature review reveals the absence of a definite plan or enough research to support what kind of technologies support effective PLCs; however, enough literature emphasizes the need for effective PLCs. It is not possible to run a successful PLC without technology. Although the importance of technology integration is understood, it is not clear what features of technology support teachers to function successfully when they are working as PLCs.

Effective Teams

The term *effective teams* is as common as the term PLCs in education, but team effectiveness is a subjective concept. The definition of an effective team depends on how the people working in a team feel about it. It is essential to have effective teams in place for the ongoing development of skills and interactions within teams that support school improvement. Therefore, with evolving technologies, the need for effective team culture is felt as much as the need for the new technology.

Harvey and Drolet (2006) expressed the need to create effective teams for a rich and effective organizational climate and stated, "team-building stresses strategies for welding capable individuals together into an effective and high functioning group" (p. 9).

Team effectiveness is reflected through the outcomes and job satisfactions of the team members. Chen, Wu, Yang, and Tsou (2008) indicated "an effective surrogate of measuring team effectiveness is a team's learning performance and satisfaction. Two major measures of team effectiveness include performance and attitudinal indicators" (p. 307). In other words, Chen et al. averred "the relationship between leadership effectiveness and team effectiveness is then a function of team trust" (p. 308). However, different researches have illustrated that building effective teams requires more than trust. Harvey and Drolet (2006, p. 14) introduced four categories and 17 characteristics of effective teams:

Purpose

1. common identity and tenets
2. common tasks
3. sense of potency/success

Composition

4. clear definition of team membership
5. recognition of individual contributions
6. balanced roles

Interactions

7. mutual trust
8. sense of relationship
9. open/direct conflict
10. common base of information
11. high level question-asking and listening

12. healthy level of stress

13. toleration of errors

14. flexibility and responsiveness

Structure and Context

15. clear understanding/acceptance of group structure

16. periodic attention to group maintenance

17. recognition/mitigation of outside forces

The four categories comprise the building blocks of effective teams, and the characteristics are necessary to configure the team. When it comes to technology integration, a sound team structure positively correlates to favorable perceptions of the team's effectiveness. Lepsinger and DeRosa (2010) said, "when the new virtual teams are formed, the most effective teams outline team goals and objectives immediately" (Key Challenges, Kindle Edition), and "the most effective virtual teams reassess goals as priorities shift over time" (Key Challenges, Kindle Edition). They also asserted, "the frequent change of team members makes it difficult to find the most effective ways to communicate with one another and to build relationships effectively" (Key Challenges, Kindle Edition), which also holds true for face to face teams. However, they warned about the potential negative role technology can play in virtual team performance, such as low-performing teams suffering from technology overload, which leads to communication problems and hinders performance. But the most important aspect of low performing teams is that "…they are less likely to match the technology to the task" (Lepsinger & DeRosa, 2010, Kindle Edition).

Teams must have a clear vision, clear goals, and a clear mission to accomplish their targets. McKee, Boyatzis, and Johnston (2008) believed that a team with an optimistic outlook of their course and destination, with the help of resonant relationships, can achieve their targets as well as bring out the best in each team member (Myth Three, Kindle Edition). Thompson et al. (2011) advised the following regarding technology integration, "After the team has been developed and the data collected and analyzed, it is necessary to consider national, state, or local mandates before moving on and finalizing any decisions"(Needs and Professional Development Needs, para 1). No clear guidelines exist that outline how to integrate technology in education, specifically in PLCs, which does present a problem. Some school districts have adopted multiple applications, such as Edmodo, Haiku, Google, Google Drive, Office 365, and OneDrive etc.; however, teachers are not trained to use any of these programs. This gives educators a mixed message, a dissonance of opinion, and an easy excuse to not to use technology at all. Lack of unison convolutes the situation for teachers who are trying to integrate technology in PLCs as well as in classrooms (Lepsinger and DeRosa, 2010, Well-Leveraged Technology, para 1, Kindle Edition.). It is imperative to have clear directions and vision for a team to achieve its targets.

Teachers either are unaware of TI tools or are dazed by the influx of information. Both deteriorate the effectiveness of the team, collaboration, and decision making in PLCs. Both also provide teachers a justification for a dismissive attitude towards adopting and learning new technologies to use as PLCs. It necessitates research that can provide evidence for supporting or eliminating the use of certain technologies based on experts' opinion in the field of educational technologies.

Collaboration

Collaboration, which requires educators to work in groups, constitutes an important aspect of working in a team. Lepsinger and DeRosa (2010) believed that "when a diverse group of individuals is asked to work together to accomplish shared objectives, it takes time to build an atmosphere of collaboration" (Lack of Cooperation, para1). Boughzala, de Vreede, and Limayem (2012) recognized that collaboration and decision making go side by side, but each individual's contribution is equally important,

> Collaboration efforts require information to generate effective outcomes. Information can be provided to a group, accessed by a group, or generated by it. Sometimes this information concerns a clear identification and definition of the problem the group is working on. Other times, it includes the information, knowledge, and expertise that individual group members bring to the table to engage in effective group decision making. (p. 722)

The last decade has ushered in great transformational changes in technology, including social media, digital information, wireless communications and instant access to global information. This decade has given emphasis to the necessity of life-long learning and continued professional development in all fields of endeavor. The structure of professional development has changed with the demand for collaboration and involvement of all stake holders. Brown, Dennis, and Venkatesh (2010) proposed that, "technologies that facilitate collaboration via electronic means have become an important component of day-to-day life (both in and out of the workplace)" (p. 11). At the beginning of the second decade of the 21st century, virtual collaboration has evolved tremendously, and cloud based technologies are now household names. Lepsinger and DeRosa (2010) suggested that,

> To put this brave new world in context, consider the fact that in the late 1980s and early 1990s, few people had heard of virtual teams. At that time only a small number of companies were even using them. Today, of course, companies big and small are using some form of virtual collaboration. (Introduction, para 1, Kindle Edition)

To make collaboration possible using technology, educators need to be proactive. Hoerup (2001) maintained, "success in integrating computer technology revolves around the teachers' innovativeness, their change agent contact, collaboration efforts, and the characteristics of innovations that affect the rate of adoption, such as compatibility, complexity, and operability…"(p. 15). When it comes to educators' roles in collaboration and technology integration, in addition to willingness to integrate technology, having adequate time is also critical. Lepsinger and DeRosa (2010) expressed, "when a diverse group of individuals is asked to work together to accomplish shared objectives, it takes time to build an atmosphere of collaboration" (para1, Lack of Cooperation). Building an atmosphere of collaboration not only requires time and resources, but it also requires commitment and task sharing. Hoerup stated, "collaboration constitutes a long-term responsibility and teachers must have a share in the decision-making processes" (p.15).

Thompson et al. (2011) suggested a few tools for collaboration, "With websites such as PBWorks and Google, creating a log or wiki for collaboration has never been easier. The benefits of using a wiki or blog are numerous. They offer a more developed method of schoolwide collaboration" (Stage 2: Wiki/ Blog Site, para 1). Shinsky and Stevens (2011) emphasized employing technologies that can help educators interact and work collaboratively

by utilizing specific online tools. The effort needs to be centered on activities that increase cohesiveness:

> A focus is on authentic, project-based activities which utilize technologies that promote active engagement, participation in groups, frequent interaction and feedback, and connection to real-world experts (Edutopia Staff, 2008; Reynolds & Caperton, 2009; Woo, Herrington, Agostinho, & Reeves 2007). Featured technology tools include Wikis, Discussion Board, Google Apps, and Wimba Classroom — all of which facilitate collaborative planning and learning, and the use of technology in a routine... (p. 196)

Garland and Tadeja (2013) connected collaboration with technology integration, "online communities allow educators to be life-long career professionals by enabling them to take online courses or workshops, access experts in their fields, obtain timely resources and research studies, and collaborate with their colleagues in designing digital age learnings" (p. 21). However, educators are reluctant to integrate technologies not only in their lesson plans, but also for collaboration. The reasons for the hesitation are many. Schrum and Levin (2009) propounded, "this is where a school leader must step in and develop a culture that promotes teachers' efforts to take leadership roles" (p. 113). Educators need the encouragement and support of their leaders to bring transformations to their organizations. Brettschneider (2009) stressed the role of leadership in team collaboration,

> The Collaboratory teams that have been most successful at sharing their learning with faculty outside the team—and getting those faculty on board with new instructional practices—tend to be those whose leaders find creative ways of working within their school's existing professional learning structure. (p. 4)

Wright (2010) underscored the paramount nature of sustainable professional development and ongoing collaboration with other teachers to continuously learn and adopt

new technologies for teaching (p. 141). Notwithstanding technology's significant role in collaboration, it is unclear what makes teachers integrate technologies for collaboration. To comprehend reasons behind the use of technology applications that teachers who work as PLCs perceive as most effective for supporting collaboration, it is crucial to continue exploring the topic.

Decision Making Process

Shared decision making process is integral for collaboration and effective teams; it is significant to understand the components of a decision making process. Lencioni (2011) attributed three decision making components to effective teams, "great teams make clear and timely decisions and move forward with complete buy-in from every member of the team, even those who voted against the decision" (p. 207). Teachers are the pivotal factors in determining student success, and they are also the leaders of the instructional process. Although technology integration is revolutionizing education, the decision making process is unclear to educators.

Lepsinger and DeRosa (2010) recommended that educators "clarify how decisions will be made within the team (that is, who needs to be involved in what kinds of decisions)" (Evaluate Your Responses, para 1). Hoerup (2001) identified the five stages in the decision-making process: (a) knowledge, (b) persuasion, (c) decision, (d) implementation, and (e) confirmation.

He further added, "this process takes time and the adopters may return to a prior stage if uncertainty forms after a decision is made. The adopter may especially return to the persuasion stage for confirmation of his or her choice to adopt or reject" (p. 7). It is pertinent to recognize that educators are autonomous in their classrooms and are required to make decisions in split seconds. Constraining their roles and limiting them to their

classrooms is favorable to neither them nor to their institutions. Suarez et al. (2013) discovered that, "empowering teachers and giving them decision-making opportunities improved their professional commitment (Bolger, 2005, as cited in Schrum & Levin, p. 103)" (p. 36). Suarez et al. further supported the concept of system change,

> The researcher found traditional bricks and mortar protocols were altered by the hybrid virtual learning and digitization of organizational practices and methods, thus prompting a systems change. A systems change is a shift in the way an organization processes and delivers services, including how it makes decisions. (p. 175)

Decision making process and collaboration complement each other; one is not complete without other. Boughzala et al. (2012) stressed the importance of collaboration, individual group members' expertise, and their effects on decision making, and Hoerup (2001) earlier maintained, "collaboration constitutes a long-term responsibility and teachers must have a share in the decision-making processes" (p.15). Along the same lines, Lepsinger and DeRosa (2010) stated, "These differentiators—commitment and engagement, shared processes for decision making, information flow, trust, and collaboration— are the most important components of optimal virtual team performance" (What Differentiates Top Virtual Teams?, Kindle Edition, para 2), but it is crucial to "clarify how decisions will be made within the team (that is, who needs to be involved in what kinds of decisions" (Evaluating Your Responses, Kindle Edition, para 2).

The decision making process is integral for effective teams and collaboration during PLCs. Thompson et al. (2011) advocated integrating technology, "Providing

teachers with access to a forum can give them a voice in the decision-making processes at a school [and] increase collaboration…" (Common Instructional Model, para 6). However, it is unclear what kind of technology contributes to a team's decision making process. If 21st century PLCs are integrating technology to make collaboration and decision making processes impeccable, then it is worth exploring what key elements promote the use of technologies to support stress-free and efficient decision making processes.

Technology Integration

Even though technology integration seems like a simple idea, in education the complexity of the matter is underrated. Insufficient time to implement, inadequate resources to implement, and teachers being overwhelmed by the influx of technology hinder technology integration in classrooms as well as in PLCs. Additionally, the last two years have seen a tremendous increase in cloud based technologies, apps, and upsurge of educational websites, an increase that does not help already overwhelmed teachers. There is a need to study the ongoing changes in and features of technology to recognize and separate the effective technology integration practices from the ineffective ones.

The American Association of Colleges for Teacher Education (AACTE) Committee on Innovation and Technology (2008) defined technology integration as the act of including technology in teaching. The new trends in technology, which have revolutionized the way communication occurs in second decade of the 21st century, are introducing concepts that are instrumental to each classroom and every institution. However, it is important to note that,

> There are several reasons why introducing technology complicates the process of teaching. There are social and institutional contexts that are unsupportive of teachers' efforts to integrate technology. Teachers have often been provided with inadequate training for this task. The diverse contexts of teaching and learning suggest that there is not "one way" that will work for everyone. (AACTE, 2008, p. 6)

A gap in the use of technology is evident in PLCs and in team collaborations. Schrum and Levin (2009) claimed, "changing the culture of a school is complex and challenging for many reasons. When the infusion of technology is also involved, then change is even more multifaceted" (p. 104). They further added "unfortunately, a great deal of professional development that has focused on technology has been ineffective" (p.107). It is crucial to understand that the 21st century educator is overwhelmed with all the changes happening in education. Educators lack time, resources, and support from school administrators; however, they are expected to keep up with the evolving educational environment. Hunt et al. (2013) expounded,

> Hew & Brush (2007) identifies the barriers that affect technology integration and outlines strategies to overcome them. The barriers are: (a) resources, (b) institution, (c) subject culture, (d) attitudes and beliefs, (e) knowledge and skills, and (f) assessment (p. 223). The following strategies were suggested to overcome the barriers: (a) having a shared vision and technology integration plan, (b) overcoming the scarcity of resources, (c) changing attitudes and beliefs, (d) conducting professional development, and (e) reconsidering assessments (Hew & Brush, 2007, p. 223). Additionally, the researchers discuss the knowledge gaps

related to technology integration and provide suggestions for future research. (p.17)

In addition, Hunt et al. (2013) also identified the major causes that contribute to the educators' reluctance to integrate technology in PLCs and in team collaborations and classified those factors as external and internal obstacles.

> In support of a professional community around technology integration, Ertmer (1999) identifies first and second order barriers teachers encounter when using technology in the classroom. The first order barrier is defined as "extrinsic" in which there is a lack of computers and software; insufficient time for planning; and lack of technical and administrative support. The second order barriers are defined as "intrinsic." This includes the teacher's beliefs about instruction, computers, established classroom practices, and an unwillingness to change. The conclusions from this research suggest a change in teacher preparation that incorporates ways in which technology can be integrated into teaching and learning. (p.17)

Furthermore, Shinsky and Stevens (2011) mentioned the multiple challenges that school districts face that hamper technology integration,

> School and district administrators are faced with a significant challenge as they lead efforts to implement various facets of technology throughout school and district settings exploring ways to improve student achievement; enhance student and staff skills; access information; create a strong infrastructure; engage the community, and prepare students to be productive citizens, employees, and leaders in the 21st Century. (p.195)

Morgenthal (2011) examined the possibilities "technology has allowed for the creation of learning environments that support anytime, anywhere access via web-based resources" (p. 1). However, technology is evolving quickly, and educators are having difficulty keeping up with the changes. Suarez et al. (2013) stated, "Like industry, education leaders have to cope with the ever-changing, technology-driven, work environment" (p. 24). Technological advancements have condensed the distances and have made access to information instantaneous. Putman, Ford, and Tancock (2012) explored the issue further and identified that "… recent technological advances have changed its form and function due to the advent of technology that allows anytime access to content and the enhanced ability to communicate" (p. 152).

Teachers must be prepared for the avalanche of technological changes if schools are to succeed. Pollard and Pollard (2004) uncovered in their research that technology was seen as a high priority area and perceived a need for research-based models for teacher training and professional development activities (p. 151). Clark (2010), however, asserted that meaningful integration of technology means to match the most effective tool with the most effective pedagogy so that the learning goals are met (p. 2). Lepsinger and DeRosa (2010) warned, "Although technology is the foundation that enables effective virtual collaboration, it doesn't guarantee successful virtual teams. Success requires using that technology to communicate effectively (and, preferably, to communicate without technology at times)" (Kindle Edition).

Thompson et al. (2011) recommended, "If your school is just beginning to adopt schoolwide goals, you might want to consider starting with Stage 1 of the technology integration plan" (Stage 1: E-mail Groups, para 1). By Stage 1, they meant using emails

for collaboration. Starting technology integration by using emails may seem outdated; however, some teachers are not even aware of all of email's uses and features. Such conditions evidence the need to probe the elements of technology that help teachers feel comfortable using it.

Summary

Despite extensive research in the areas of PLCs and its important components—effective teams, collaboration, and decision making processes—studies that examine technology's role in delegating these components in PLCs are scarce. In the 21st century, ignoring the role of technology integration in PLCs is adverse. Educators and society as a whole want students to be college and career ready and trained to integrate technology in their day to day lives, but on the other hand, technology integration is stagnant when it comes to education, schools, and teachers. "CA does not have adopted technology standards for teachers However, most districts … refer to the ISTE standards. ISTE has published standards for students, teachers, and administrators" stated Dennis Large, Director Educational Technology Services of Riverside County of Education (RCOE) (personal conversation, August 28, 2014). There is an urgent need to address the issue at all levels—state, county, and district. However, it is also important to acknowledge the overload of technology resources in education. Free apps, cloud spaces, educational websites, and many more components of technology can potentially lure teachers into a long scavenger hunt that can end in employing unproductive technology tools. Large volumes of emails crowd teachers' inboxes every day from advertisers tempting them to subscribe to their websites, and it is often difficult for teachers to separate fruitful technology from unproductive technology.

CHAPTER THREE: METHODOLOGY

Overview

This chapter outlines the methodology and processes imperative to conduct this study. This Structural Delphi study was designed to thoroughly examine the essential conditions for technology integration in PLCs that support teachers collaborating as effective teams. The Delphi technique was first devised by Rand Corporation in 1950, a consensus technique which falls under the classification of action research approaches (Vernon, 2009, p. 69). Stitt-Gohdes and Crews (2004) reviewed the three different models of Delphi techniques

> There are different structures within the Delphi method. Three include the Policy Delphi Model, the Trend Model (Turoff, 1970), and the Structural Model (Lendaris, 1980; Geoffrion, 1987)… Structural Modeling allows participants individually to express independent relationships/judgments, but they are all used to produce a group or whole model or system. This is supported by Helmer (1977) who notes that the Delphi is a useful communication method among an expert panel that in turn facilitates the formation of a group judgment. (p. 57)

This Delphi study involved exploring what ISTE essential conditions that TLN who worked as PLCs perceive as the most effective for technology integration that support teachers in decision making processes. The Delphi study data also illustrated the characteristics of an organization that promote the use of technologies that support teachers in PLCs. This chapter outlines the plan and structure of the study and how it was conducted. It includes the purpose statement, research questions, research design, description of the population, description of the sample, and the instruments being used.

Also, the data collection methods, data analysis techniques, and limitations of the study are stated.

Purpose Statement

The purpose of this Delphi study was to identify the essential conditions (ISTE) required for technology integration in Professional Learning Communities for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by members of the joint Technology Leadership Network of the Riverside County Office of Education and San Bernardino County Superintendent of Schools, California.

Based on the International Society of Technology for Education (ISTE), 14 essential conditions to effectively leverage technology for learning are as follows:

1. Shared Vision
2. Empowered Leaders
3. Implementation Planning
4. Consistent and Adequate Funding
5. Equitable Access
6. Skilled Personnel
7. Ongoing Professional Learning
8. Technical Support
9. Curriculum Framework
10. Student-Centered Learning
11. Assessment and Evaluation
12. Engaged Communities

13. Support Policies

14. Supportive External Context

The emphasis of this study was to explore and identify the ISTE essential conditions supporting technology integration in PLCs. In this study, the prerequisites, the attributes, the factors, and the measures for implementing essential conditions that encourage the use of technology in PLCs were discerned. In addition, the TLN's perceptions of the prerequisites for teachers to lead implementation of essential conditions were sought.

Research Questions

1. What ISTE essential conditions need to be in place for technology integration in Professional Learning Communities for building effective teams, supporting collaboration, and endorsing shared decision making processes as perceived by Technology Leadership Network?
2. What are the most important ISTE essential conditions that promote the use of technology supporting collaboration, effective teams, and decision making as perceived by members of the Technology Leadership Network?
3. What are the prerequisites to implement the ISTE essential conditions for technology integration in the Professional Learning Communities as perceived by the Technology Leadership Network?
4. What are the factors that successfully lead teachers to implement ISTE essential conditions in the Professional Learning Communities as perceived by the Technology Leadership Network?

5. What increases the effectiveness of implementing ISTE essential conditions for technology integration in the Professional Learning Communities as perceived by the Technology Leadership Network?

Research Design

Balasubramanian and Agarwal (2012) defined Delphi techniques as, "…a method for the systematic solicitation and collation of judgments on a particular topic through a set of carefully designed sequential questionnaires interspersed with summarized information and feedback of opinions derived from earlier responses"(p. 16). This Delphi study used a survey research design for its quantitative component, in which "…the investigator selects a sample of subjects and administers a questionnaire…" (McMillan & Schumacher, 2010, p. 22) to collect data. Creswell (2005) explained that in quantitative "…surveys, researchers typically measure the perceptions, attitudes, behaviors, or characteristics of a group" (as cited in Cook, 2008). It is a non-experimental research design, and it involves examining the relationship amongst different phenomena without the direct manipulation of conditions and or experiences (McMillan & Schumacher, 2010). For qualitative data collection, an explanatory design was used, "…quantitative data are collected first and, depending on the results, qualitative data are gathered second to elucidate, elaborate on, or explain the quantitative findings" (McMillan & Schumacher, 2010, p. 25). The Delphi study method was deemed appropriate for this research because it represented the research design that best led to identification and description of the essential conditions of technology that are most successful in creating effective teams, promoting collaboration, and shared decision making. Martin and Ritz (2012) stated that the Delphi study,

> …allows researchers to collect, review, analyze, and synthesize information from a recognized group of experts. Within the communication process, the type and amount of feedback is controlled by the researchers, as there is no planned interaction among the participants by the researchers. (p. 27)

A Delphi study gives researchers enough freedom to start with a broad theme and narrow it to specifics, staying within the guidelines the researcher constructed but structured by the expert participants' responses.

Population

Table 1 details the population for this study.

Table 1

Number of Public Schools and Number of Teachers in Riverside and San Bernardino County

County	Number of Districts	Number of Schools	Number of Teachers	Total Number of TLN Members
Riverside	23	478	17,914	
San Bernardino	34	535	17,688	
Total Number in California	1044	9919	283,836	250

The Riverside County Office of Education (RCOE) includes 23 school districts comprising 478 public schools. The San Bernardino County Office of Education (SBCOE) oversees 535 public schools under 34 school districts according to ed-data, an entity of the California Department of Education. McMillan and Schumacher (2010) defined a population as "a group of elements or cases, whether individuals, objects, or events, that conform to specific criteria and to which we intend to generalize the results

of the research" (p. 129). According to Hallowell and Gambatese (2010), in a Delphi study, "individuals are selected according to predefined guidelines and are asked to participate in two or more rounds of structured surveys" (p. 99). The selection of participants is imperative to the study, "since the Delphi technique focuses on eliciting expert opinions over a short period of time, the selection of Delphi subjects is generally dependent upon the disciplinary areas of expertise required by the specific issues" (Sandford & Chia-Chien, 2007, p. 3).

Based on the criteria, a population is selected to represent the individuals relevant to the research topic. The population for this study comprises certified school or school district staff—Technology Leadership Network members in RCOE and SBCOE who are or who had been engaged in formal or informal PLCs. "TLN is a regional group. We invited tech people from the districts in Riverside County and San Bernardino County... Also, TLN is not an "official" project of either county office" explained Dennis Large, Director Educational Technology Services of RCOE (personal conversation, August 28, 2014). Additionally, Jenny Thomas, Project Specialist, Digital Learning Services of SBCOE stated proudly,

> There are 250 members of our TLN listserv. All of these people receive the invitation to all TLN meetings. We average 40-50 people at our meetings, with approximately 35 core or "regulars" who attend most meetings…43 Districts from Riverside and San Bernardino Counties are represented. (J. Thomas, October 6, 2014)

She added, "We have members who are from Curriculum departments but respect the integration of technology into the curriculum and instruction. We have Ed Tech

specialists and information technology specialists" (J. Thomas, October 6, 2014). TLN's assistance was sought in this Delphi study to select the participants for the research. Usually, each school employs one technology coordinator who is responsible for overseeing the school's technology needs, including the needs of both teachers and students. School districts employ technology directors, coaches, and coordinators to oversee the needs of their districts. These technology experts are often members of TLN. TLN members are considered experts in the field and are supposed to evaluate, analyze, plan, and deliver the solutions to meet the district's and school's technology needs. A credentialed teacher usually holds this job, their credentials serving to help them identify both students' and staff's needs.

Sample

McMillan and Schumacher (2010) defined a sample as "…the group of subjects or participants from whom the data are collected is referred to as a sample" (p. 129). The sample size consisted of 18 members of the TLN in RCOE and SBCOE who worked throughout the two counties and who worked in PLCs of any form as well as experts in the area of technology integration for the purpose of collaboration. Patten (2009) averred, "when it is impractical to study an entire population, researchers draw a sample, study it, and infer that what is true of the sample is probably also true of the population" (p. 43). The TLN selection was purposive based on its members' expertise and was as naturalistic as possible. McMillan and Schumacher (2010) asserted, "site selection, in which a site is selected to locate people involved in a particular event, is preferred when the research focus is on complex , microprocesses" (p. 326). The purposeful selection of the TLN and its members was based on their familiarity with technology integration, and

the individuals were selected on the basis of their expertise in the area of use of technology. They represented their schools or school districts as technology coordinators, technology coaches, and or technology mentors. "Delphi panelists are typically selected, not for demographic representativeness, but for the perceived expertise that they can contribute to the topic" (Colton & Hatcher, 2004, p. 184). Furthermore, "The Delphi group size does not depend on statistical power, but rather on group dynamics for arriving at consensus among experts. Thus, the literature recommends 10–18 experts on a Delphi panel" (Balasubramanian & Agarwal, 2012, p. 18).

Methodology

The Delphi study consisted of three rounds of questions, Round 1 comprising one question rated on a 1-10 scale, Round 2 comprising four open ended questions, and Round 3 comprising one prompt rated on a 1-10 scale. The three rounds focused on determining the conditions essential for successful technology integration in PLCs that contribute to creating effective teams, promoting collaboration, and shared decision making. Qualitative and quantitative data were collected in the three rounds. The questionnaires explored prerequisites, factors, attributes, and measures necessary to implementing these conditions, and each implementation method's effectiveness in integrating technology in PLCs aimed at building effective teams, promoting collaboration, and endorsing shared data-based decision making. Kochman (1968) concisely explained the Delphi process, "the experimenters ask precisely worded questions, obtain answers, collate these, and feed them back on subsequent questionnaires" (p. 15). Magnuson (2013) added, "…the anonymity and lack of in-

person group dynamics of the Delphi are factors cited by a number of Delphi researchers who feel the process contributes to more thoughtful and deliberative analysis" (p. 56).

Instrumentation

Three rounds of Delphi research questions were designed to focus on the essential conditions addressed in the purpose statement and the research questions. The following 14 essential conditions outlined by the ISTE provided the standardized baseline for the questions (Appendix A).

Shared Vision: Proactive leadership in developing a shared vision for educational technology among all education stakeholders, including teachers and support staff, school and district administrators, teacher educators, students, parents, and the community

Empowered Leaders: Stakeholders at every level empowered to be leaders in effecting change

Implementation Planning: A systemic plan aligned with a shared vision for school effectiveness and student learning through the infusion of information and communication technology (ICT) and digital learning resources

Consistent and Adequate Funding: Ongoing funding to support technology infrastructure, personnel, digital resources, and staff development

Equitable Access: Robust and reliable access to current and emerging technologies and digital resources, with connectivity for all students, teachers, staff, and school leaders

Skilled Personnel: Educators, support staff, and other leaders skilled in the selection and effective use of appropriate ICT resources

Ongoing Professional Learning: Technology-related professional learning plans and opportunities with dedicated time to practice and share ideas

Technical Support: Consistent and reliable assistance for maintaining, renewing, and using ICT and digital learning resources

Curriculum Framework: Content standards and related digital curriculum resources that are aligned with and support digital age learning and work

Student-Centered Learning: Planning, teaching, and assessment centered around the needs and abilities of students

Assessment and Evaluation: Continuous assessment of teaching, learning, and leadership, and evaluation of the use of ICT and digital resources

Engaged Communities: Partnerships and collaboration within communities to support and fund the use of ICT and digital learning resources

Support Policies: Policies, financial plans, accountability measures, and incentive structures to support the use of ICT and other digital resources for learning and in district school operations

Supportive External Context: Policies and initiatives at the national, regional, and local levels to support schools and teacher preparation programs in the effective implementation of technology for achieving curriculum and learning technology (ICT) standards

Delphi Round 1 Question

On a scale of 1-10, which of the following ISTE essential conditions need to be in place to promote technology integration and its use in Professional Learning Communities for building effective teams, supporting collaboration, and endorsing shared decision making processes?

Delphi Round Two Questions

1. What prerequisites are necessary to create a shared vision for technology integration in Professional Learning Communities?
2. What are the attributes of empowered leaders that support technology integration in Professional Learning Communities?
3. What factors promote ongoing professional learning for technology integration in Professional Learning Communities?
4. What measures must be taken to ensure that the technology integrated into Professional Learning Communities is focused on student-centered learning?

Delphi Round Three Question

On a scale of 1-10, rate the effectiveness of the prerequisites, attributes, factors, and measures identified for each top-rated ISTE essential condition in Round 2.

Delphi Stages

Stage One

1. With the support of RCOE Director of Technology and Project Specialist, Digital Learning Services of SBCOE, the technology experts were identified using TLN members in RCOE and SBCOE.

All TLN members were sent an open invitation to sign up using an intake survey. Director of Technology of Riverside County Office of Education recommended specific members based on their expertise and experience. Eighteen TLN members were contacted, and out of these 18 TLN members, 14 members committed to participate in the three rounds of the Delphi study. Essential measures were taken to secure their support through an intake survey requesting them to provide the necessary information regarding their background, experience, and expertise.

Stage Two

1. A pilot test was developed and conducted to check the validity of the instruments, using the same population as that of the expert panel.
2. The questionnaire format was reviewed and questions were revisited and modified based on pilot test results and pilot test expert panel recommendations.

Stage Three

1. First round of Delphi study questionnaire was sent to 18 expert panel participants, a reminder email was sent, and the deadline was extended to increase the participation rate.
2. Experts' responses were compiled and analyzed based on the top four rated essential conditions.
3. The questionnaire including the four top-rated essential conditions for Round 2 was designed, modified, and approved by the dissertation committee.

Stage Four

1. Second round of research questions was sent to the 18 expert panelists.
2. Experts' responses were compiled, analyzed, and coded.
3. RQs for Round 3 were designed and modified.

Stage Five

1. Third round of research questions was sent.
2. Experts' responses were compiled and analyzed.

Stage Six

1. All the data was compiled, coded, and analyzed.
2. Results were published and shared.

Questionnaires were designed using a Google Form. The instrument used was three rounds of questionnaires, with Round 1 and Round 3 questions rated on a 1-10 scale. Round 2 consisted of four open ended questions and sought expert panels' detailed responses. Passmore, Dobbie, Parehman, and Tysinger (2002) stated, "Survey instruments, or questionnaires, are used to collect data about subjects' demographics, personal histories, knowledge, behaviors, and attitude" (p. 281). The purpose of Round 1 and Round 3 questionnaires was to gather quantitative data based opinions from experts in the field of education and to conclude how TLN members' perceptions of the technology integration relates to building effective teams, collaboration, and shared decision making in respect to ISTE essential conditions. Round 2 questionnaire probed further how TLN members perceive the role of 21st century technology in PLCs and their perceptions of the technology conditions essential for collaboration, effective teams, and shared decision making.

All three questionnaires are included in the appendices. Round 1 produced quantitative data ranking 14 essential condition on the scale of 1-10. The participants were sent the Round 2 of the questionnaire to explore the collected data further. The second round of questions was based on the participants' responses to the first round. The third round, the final round, of the questionnaire was conducted to explore the topic further and to narrow the research producing quantitative data.

Instrument Field Test and Validity

Test validity is required for test reliability. Test validity is the degree to which an instrument measures what it actually is supposed to measure. Venkatesh et al. (2013) explained, "Validity, in the context of a qualitative study, is defined as the extent to

which data are plausible, credible, and trustworthy, and thus can be defended when challenged" (p. 34). Data is reliable if the results are consistent over long periods of time. Test reliability is dependent on the test validity. A potential limitation of this study's questionnaires could lie in biases due to personal experiences, as the answers were based on TLN members' perceptions and were subjective due to their personal views. To establish the validity of the Delphi instrument, the research questions were reviewed and revised by the dissertation committee. The director of technology for Riverside County Office of Education's advice was sought for further clarity.

Pilot Test

One way to identify any potential problems with questionnaires or surveys is to pilot test the instrument. The final questionnaires were piloted using the same population as the Delphi research study, "Pilot tests help identify redundant or poor questions and provide an early indication of the reproducibility of the responses" (Passmore et al., 2002, p. 285). Based on pilot questionnaire responses, questions were reviewed, revised, and modified. For Round 1, the pilot test participants consisted of the same sample population of TLN members. Skulmoski, Hartman, and Krahn (2007) stated, "a pilot study is sometimes conducted with the goals of testing and adjusting the Delphi questionnaire to improve comprehension, and to work out any procedural problems. The researcher may also pre-test each subsequent questionnaire" (p. 4). In pilot test Round 1, RQ 1 and RQ 2 were explored, and a questionnaire requesting participants to rank the 14 essential conditions was sent to pilot test participants. Based on participants' opinions, definitions for all 14 essential conditions were added under each condition for clarity. The pilot test Round 1 responses were analyzed, and statistical data were used to create

Round 2 open ended questions. The pilot test panel suggested to only use four top rated essential conditions for the Round 2 open-ended qualitative questionnaire. More than four conditions were considered tedious and onerous. However, for Round 3, eight categories for each essential condition were considered reasonable for ranking on the scale of 1-10 questionnaire.

Data Collection

The Director of Technology of Riverside County Office of Education was contacted through an email for permission to conduct research using TLN, and appointment was sought (Appendix B). An abstract and an outline of the research was presented during one of the meetings (Appendix C). The purpose of the study was explained, and permission to conduct the research was requested. The Director of Technology granted permission to conduct the research and to present it to TLN members during one of their meetings. TLN members were requested to take part in three rounds of the Delphi Study during this meeting using Google Forms (Appendix D). The Director of Technology recommended the expert panel based on the criteria for expertise and experience relevant to technology integration and PLCs.

After Brandman University Institutional Review Board (BUIRB) approval and permission (Appendix E), each participant was contacted, and an invitation was sent that included the participant's bill of rights and request for informed consent through an email (Appendix F and Appendix G). Participants were assured of confidentiality, and all the information regarding confidentiality was sent in writing through emails and Google Forms. Participants' information was kept secured during and after the research and is not included in the published research.

The three round Delphi research was conducted, and the Round 1 and Round 3 collected data were based on a 1-10 scale, "…ranking ideas from most important to least important…" (McMillan & Schumacher, 2010, p.150) and produced ordinal quantitative data. Creswell (2012) highlighted the importance of data collection and data recording and expressed that, "it means gaining permissions, conducting a good qualitative sampling strategy, developing means for recording information both digitally and on paper, storing the data, and anticipating ethical issues that may arise" (p. 145). For the preliminary round, the responses based on the scale 1-10 were collected using Google Forms. The results from the first round were compiled, and the second round questions were created and modified. The second round of responses were reviewed, and the research topic was constricted. The last round of results was collected and analyzed using the statistical data analysis tools including mean, median, mode, and standard deviation.

Data Analysis

To distinguish the patterns in participants' responses, it was important to analyze the emerging themes of consensus and disagreements relevant to the research questions. The data produced from Round 1 and Round 3 questions for this study were purely quantitative and described TLN members' rated opinions about technology integration in PLCs. McMillan and Schumacher (2010) proposed, "Survey research is very popular in education, primarily for three reasons: versatility, efficiency, and generalizability (Schutt, 1996)" (p. 236), and "scales are used extensively in questionnaires because they allow fairly accurate assessment of beliefs or opinions" (p. 198). The quantitative data produced from the questionnaire was analyzed using statistical mean, median, mode, and

standard deviation. Magnuson (2013) wrote "…the anonymity and lack of in-person group dynamics of the Delphi are factors cited by a number of Delphi researchers who feel the process contributes to more thoughtful and deliberative analysis" (p. 56). Qualitative data were analyzed using spreadsheet, creating themes and color coding. The Round 2 data for this study were purely qualitative, and to acquire qualitative data, investigators and researchers ask open ended questions to reach the desired level of consensus (Sandford & Chia-Chien, 2007).

Limitations

The sample size of the research study comprised 14 TLN members from RCOE and SBCOE members and may not represent the views of the rest of the state teacher population. Additionally, responses to the questionnaire could have been subjective. Also, non-responsive questionnaires reduced the sample size and may not represent the whole population. Furthermore, it is virtually impossible to ensure that participants answer all questions honestly. Other important factors might be overlooked in the Delphi study design, which could affect the outcome of the study. Nworie (2011) said, "two of those criticisms include the lengthy time involved and the experience of the panelists" (p. 28).

The invitation was sent out to 250 TLN members to participate in the Delphi study. The Director of Technology of Riverside County Office of Education's assistance was requested to recommend TLN members for the expert panel. The Director of Technology provided a list of 18 members, and 14 out of 18 agreed to participate in the three rounds of the Delphi study. For Round 1, 12 out of 14 expert panelists responded to the questionnaire. The response rate for Round 2 and Round 3 was 10 out of 14

members. The TLN population at 250 and sample of 14, later reduced to 10 expert panelists, limited the ability to generalize the findings. However, Skulmoski, Hartman, and Krahn (2007) proclaimed,

> as the number of rounds increases and the effort required by Delphi participants, one often sees a fall in the response rate (Alexander, 2004; Rosenbaum, 1985; Thomson, 1985)" (p. 11), [but] where the group is homogeneous, then a smaller sample of between ten to fifteen people may yield sufficient results (p. 10).

Members of the TLN were not only homogeneous in the sense that all of them were affiliated with the same professional network, but all of them also had teaching experience. In addition, the entire expert panelist was working in some capacity relevant to technology, such as District Technology Director and/or District Technology Coach, etc.

Summary

The purpose of this chapter was to justify and explain the reason for selecting and implementing qualitative and quantitative research based on the Delphi study data collection technique. The chapter included the methodology description, including introducing and detailing the research methods, purpose statement, three rounds of research questions, research design, research methodology description, population and sample, instrumentation, field test and validity, data collection methods, data analysis, and study limitations. The Delphi research was selected to collect experts' opinions on technology integration in PLCs for increasing collaboration, team effectiveness, and decision making. In this study, the organizational characteristics that support the effective use of technology for collaboration, team effectiveness, and decision making in

PLC were also examined. The panel of experts for this Delphi study was selected based on their expertise in technology integration in education.

In this chapter, the Delphi technique for the research was discussed in detail including methodology description, instruments, and limitations. The research findings and data will be reported in Chapter 4 and will be analyzed. Chapter 5 will include the research findings and the conclusions drawn based on those findings and will also encompass the implications and recommendations for future research.

CHAPTER FOUR: RESEARCH, DATA COLLECTION, AND FINDINGS

Overview

Chapter 1 of this research consisted of a contextual framework relaying the importance of integrating technology in education. In chapter 2, the review of literature explored the role of technology integration in Professional Learning Communities (PLCs) and its influence on effective team building, collaboration, and decision making processes. Chapter 3 focused on the Delphi research design, methodology, population and sample size, instrumentation, and validity and reliability of the instruments. In chapter 4, a brief description of the research study will accompany the collected quantitative and qualitative data, including inductive and statistical analysis and representation of the data.

The emphasis of this study was to acquire evidence supporting the use of technology for PLCs. The study involved exploring the essential conditions of technology that encourage its use in PLCs and exploring how technology can efficiently be used to promote effective teamwork, collaboration, and decision making. In discussing the Delphi study method, Stitt-Gohdes and Crews (2004) proclaimed, "there are different structures within the Delphi method. Three include the Policy Delphi Model, the Trend Model (Turoff, 1970), and the Structural Model (Lendaris, 1980; Geoffrion, 1987)" (p.57). This study involved the Structural Delphi method, which "… allows participants individually to express independent relationships/judgments…" (p. 57), thus permitting the members of the Technology Leadership Network in the Riverside County Office of Education to give their individual opinions. Hatcher and Colton (2007) also advocated the Delphi study method, "It yielded rich qualitative and rigorous

quantitative data resulting in a content validated instrument, possibly resulting in a more in-depth content validation, applicable to educational ... research as well as bringing the tenets of andragogy into the 21st century" (p. 575). Hallowell and Gambatese (2010) further emphasized, "the Delphi method is a systematic and interactive research technique for obtaining the judgment of a panel of independent experts on a specific topic" (p. 99).

Purpose Statement

The purpose of this Delphi study was to identify the essential conditions (ISTE) required for technology integration in Professional Learning Communities for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by members of the joint Technology Leadership Network of the Riverside County Office of Education and San Bernardino County Superintendent of Schools, California.

Based on the International Society of Technology for Education (ISTE), 14 essential conditions to effectively leverage technology for learning are as follows:

1. Shared Vision
2. Empowered Leaders
3. Implementation Planning
4. Consistent and Adequate Funding
5. Equitable Access
6. Skilled Personnel
7. Ongoing Professional Learning
8. Technical Support

9. Curriculum Framework
10. Student-Centered Learning
11. Assessment and Evaluation
12. Engaged Communities
13. Support Policies
14. Supportive External Context

The emphasis of this study was to explore and identify the ISTE essential conditions that support technology integration in PLCs. In this study, the prerequisites, the attributes, the factors, and the measures for implementing essential conditions that encourage the use of technology in PLCs were discerned. In addition, the TLN's perceptions of the prerequisites for teachers to lead implementation of essential conditions were sought.

Research Questions

1. What ISTE essential conditions need to be in place for technology integration in Professional Learning Communities for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by Technology Leadership Network?
2. What are the most important ISTE essential conditions which promote the use of technology supporting collaboration, effective teams, and decision making as perceived by members of the Technology Leadership Network?
3. What are the prerequisites to implement the ISTE essential conditions for technology integration in the Professional Learning Communities as perceived by the Technology Leadership Network?

4. What are the prerequisites to successfully lead teachers to implement ISTE essential conditions in the Professional Learning Communities as perceived by the Technology Leadership Network?
5. What increases the effectiveness of implementing ISTE essential conditions for technology integration in the Professional Learning Communities as perceived by the Technology Leadership Network?

Research Methods and Data Collection Procedures

A Delphi study was deemed appropriate to obtain expert opinions regarding technology integration in PLCs. The Delphi technique does not require face to face interaction of the participants and is ideal for studies in which the research starts with a wide, open-ended research area and research questions and progressively gets narrowed to a specific topic based on expert participants' responses. Kochman (1968) elaborated, "The basic Delphi Technique obtains the consensus of panel of experts through the use of a series of questionnaires" (p.1). Individuals were selected according to pre-defined guidelines and were asked to participate in three rounds of structured questionnaires.

Population and Sample

Based on the predetermined criteria for a Delphi study, a population was selected to represent the individuals relevant to the research topic. The population for this study comprised certified school staff—TLN members in RCOE and SBCOE who were engaged in formal or informal PLCs. Nworie (2011) strongly believed,

> In a time of unprecedented change and developments in technology and rapid exploration of applicable pedagogy, decision making on technology acquisition and application, introduction of new teaching and learning methodology, or

determining issues that relate to the functions of educational technologists are possible areas that the Delphi Technique could be applied in educational technology research and practice. (p. 24)

In further explaining the Delphi method, Balasubramanian and Agarwal (2012) emphasized, "The Delphi group size does not depend on statistical power, but rather on group dynamics for arriving at consensus among experts. Thus, the literature recommends 10–18 experts on a Delphi panel" (p. 18). Based on the criteria, a research proposal was presented at one of the TLN's meetings, and an email invitation inviting 250 TLN members to take part in the Delphi research study followed the meeting. An expert panel of 18 members was sought; however, 14 members enlisted as expert panelists for the three rounds of the Delphi study.

Demographic Data

Table 2 lists the demographic data for this study.

Table 2

Demographic Data Including Teachers' Experience Relevant to Teaching, Professional Learning Communities, and Technology Leadership Network

	TLN Members	Expert Panel	Years as a Teacher	Years in PLCs	Years as a TLN Member
Total Number	250	14	>228	>137	>80

Presentation and Analysis of Data

Data is presented for each round separately starting from Round 1. Round 1 encompasses Research Questions (RQ) 1 and 2, and data generated from Round 1 is quantitative in nature. The participants rated the degree of importance of the ISTE's 14 essential conditions necessary for technology integration on scale of 1-10, 1 being *least*

important and 10 being *extremely important*. Round 2 required participants to respond to four open ended questions designed based on the top four essential conditions that the research participants rated, producing qualitative data that addressed RQs 3 and 4. In Round 3, RQ 5 was investigated through participants' rating the findings from Round 2, generating quantitative data. A brief synopsis of the phases and progression of the Delphi Study is shown in table 3.

Table 3

Synopsis of the Research Phases of the Delphi Study

Research Question	Delphi Round	Instrument Used	Data produced
1 2	1	One question ranked on scale of 1- 10	Quantitative
3 4	2	Four open-ended questions	Qualitative
5	3	Four questions ranked on scale of 1-10	Quantitative

Delphi Study Round One

Round 1 questionnaire was designed to answer (RQ) 1 and 2 (Appendix H).

1. What ISTE essential conditions need to be in place for technology integration in Professional Learning Communities for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by Technology Leadership Network?
2. What are the most important ISTE essential conditions which promote the use of technology supporting collaboration, effective teams, and decision making as perceived by members of the Technology Leadership Network?

Round 1 questionnaire: On a scale of 1-10, which of the following ISTE essential conditions need to be in place to promote technology integration and its use in Professional Learning Communities for building effective teams, supporting collaboration, and endorsing shared decision making processes?

1. **Shared Vision:** Proactive leadership in developing a shared vision for educational technology among all education stakeholders, including teachers and support staff, school and district administrators, teacher educators, students, parents, and the community
2. **Empowered Leaders:** Stakeholders at every level empowered to be leaders in effecting change
3. **Implementation Planning:** A systemic plan aligned with a shared vision for school effectiveness and student learning through the infusion of information and communication technology (ICT) and digital learning resources
4. **Consistent and Adequate Funding:** Ongoing funding to support technology infrastructure, personnel, digital resources, and staff development
5. **Equitable Access**: Robust and reliable access to current and emerging technologies and digital resources, with connectivity for all students, teachers, staff, and school leaders
6. **Skilled Personnel:** Educators, support staff, and other leaders skilled in the selection and effective use of appropriate ICT resources
7. **Ongoing Professional Learning:** Technology-related professional learning plans and opportunities with dedicated time to practice and share ideas

8. **Technical Support:** Consistent and reliable assistance for maintaining, renewing, and using ICT and digital learning resources
9. **Curriculum Framework:** Content standards and related digital curriculum resources that are aligned with and support digital age learning and work
10. **Student-Centered Learning:** Planning, teaching, and assessment centered around the needs and abilities of students
11. **Assessment and Evaluation:** Continuous assessment of teaching, learning, leadership, and evaluation of the use of ICT and digital resources
12. **Engaged Communities:** Partnerships and collaboration within communities to support and fund the use of ICT and digital learning resources
13. **Support Policies:** Policies, financial plans, accountability measures, and incentive structures to support the use of ICT and other digital resources for learning and in district school operations
14. **Supportive External Context:** Policies and initiatives at the national, regional, and local levels to support schools and teacher preparation programs in the effective implementation of technology for achieving curriculum and learning technology (ICT) standards

Data Analysis. The purpose of RQs 1 and 2 was to narrow the ISTE 14 essential conditions to the most important essential conditions as perceived by the TLN. In Round 1, participants rated the ISTE 14 essential conditions on a scale of 1-10, 1 representing *least important* and 10 representing *extremely important*. Participants were asked to rate the ISTE essential conditions needed to be in place for technology integration in Professional Learning Communities for building effective teams, promoting

collaboration, and endorsing shared decision making processes as perceived by Technology Leadership Network.

Fourteen expert panelists were sent the Round 1 survey and were instructed to read the ISTE essential conditions carefully and to rate them on the scale of 1-10. The expert panelists were advised that notwithstanding the apparent importance of all of the essential conditions, they were asked to rate the perceived degree of importance of each condition compared to other essential conditions. They were informed that their response average in Round 1 would determine the top rated essential conditions for Round 2. Twelve out of 14 participants responded to the survey, a response rate of 86%. A non-statistical overview of the quantitative data clearly illustrated the unison in expert panel members' opinions. The ranked values were clustered together, increasing the validity of the expert panel members' responses, which the statistical analysis of the data further confirmed (see table 4).

Table 4

ISTE Essential Conditions for Technology Integration in Professional Learning Communities Ranking Based on Mean

Round 1-ISTE Essential Conditions	Mean	Median	Mode	SD
Shared Vision	9.42	10	10	0.79
Ongoing Professional Learning	9.42	10	10	0.90
Empowered Leaders	9.00	9.5	10	1.21
Student-Centered Learning	9.00	9	10	1.21
Implementation Planning	8.92	9	9	0.79
Equitable Access	8.92	9	10	1.24
Assessment and Evaluation	8.92	9	9	1.00
Technical Support	8.75	9	10	1.29
Curriculum Framework	8.67	9	9	1.15
Support Policies	8.58	9	10	1.51
Skilled Personnel	8.50	8	8	1.17
Consistent and Adequate Funding	8.33	8.5	10	1.78
Engaged Communities	8.33	8.5	9	1.15
Supportive External Context	7.67	8	8	2.02

Note. N=12

Statistical analysis of Round 1. In Round 1, expert panelists rated the essential conditions listed in Table 3. The mean, median, mode, and standard deviation were calculated to find the central value of the accumulated data. As Nijs and Klausen (2013) explained, "Mean and median are both estimators of the central value of statistical distributions" (page number. 110). The expert panelist ratings of the ISTE 14 essential

conditions ranged between 3 and 10. The mean ratings of the ISTE essential conditions ranged between 9.42 and 7.67, giving a clear indication of the TLN member panelists' perceptions. The mean is the most frequently used average to find the balance point in a distribution; median, however, is defined as a middle score (Patten, 2009, p. 117). The standard deviation was sought to report the measure of variability, and it illustrated that the expert panelists' ratings were not that extreme, making the findings more reliable. "The larger the standard deviation the more variation there is in the scores. The smaller the standard deviation the closer the scores are grouped around the mean and the less variation" (Bsimmerok, APU website, retrieved Dec 13, 2014). SD varied from 0.74 to 2.02, demonstrating the range of variability of the expert panel members' responses from each other.

Shared vision and ongoing professional learning, both with a mean of 9.42 and median and mode at 10, were ranked the highest essential conditions necessary for technology integration in PLCs. The SD of the distribution was 0.79 and 0.90, respectively, a slight variance from the mean. The next two essential conditions, empowered leaders and student-centered learning, also aggregated the same mean of 9.0. Empowered leaders had a median of 9.5 and a mode of 10; however, the median for student centered Learning was 9.0 with a mode of 10. Both had a SD of 1.21, representing the small variance from the mean. The SD also showed the uniformity of opinion amongst the participants, increasing the reliability of the data. Table 5 further details the results from the Round 1 data.

Table 5

Frequency of the Responses-Analysis of the Fourteen ISTE Essential Conditions Based on Percent responded in Favor

Essential Condition	Frequency of Responses and Response Percentage for Each Ranking									
	Ranking									
	10	9	8	7	6	5	4	3	2	1
Shared Vision	7 58 %	3 25%	2 17%							
Ongoing Professional Learning	8 67 %	1 8%	3 25%							
Empowered Leaders	6 50 %	2 17%	2 17%	2 17%						
Student Centered Learning	5 42%	4 33%	2 17%		1 8%					
Implementation Planning	3 25%	5 42%	4 33%							
Equitable Access	5 42%	3 25%	3 25%		1 8%					
Assessment and Evaluation	4 33%	4 33%	3 25%	1 8%						

Frequency of the Responses-Analysis of the Fourteen ISTE Essential Conditions Based on Percent responded in Favor

Essential Condition	Frequency of Responses and Response Percentage for Each Ranking									
	Ranking									
	10	9	8	7	6	5	4	3	2	1
Technical Support	5 42%	2 17%	2 17%	3 25%						
Curriculum Framework	3 25%	4 33%	4 33%		1 8%					
Support Policies	5 42%	2 17%	1 8%	3 25%	1 8%					
Skilled Personnel	3 25%	2 17%	6 50 %		1 8%					
Consistent and Adequate Funding	5 42%	1 8%	2 17%	2 17%	1 8%	1 8%				
Engaged Communities	2 17%	4 33%	2 17%	4 33%						
Supportive External Context	2 17%	2 17%	4 33%	2 17%		1 8%		1 8%		

Analysis of Four Top-rated Essential Conditions. The above table shows the individual analysis of 14 essential conditions for technology integration in PLCs based on the responses in favor. Individual score analysis of one of the highest rated essential conditions (with a mean of 9.42 on the scale of 1-10) showed that seven out of 12 participants (58%) rated *Shared Vision* at 10, three out of 12 (25%) rated *Shared Vision* at 9, and two out of 12 (17%) rated *Shared Vision* at 8. Almost all of the participants considered *Shared Vision* an essential condition for technology integration in PLCs. All members rating *Shared Vision* at eight and above was a clear indication of the panel members' perceived significance of the condition in promoting technology integration.

The results for ongoing professional learning (a mean score of 9.42, the same as shared vision) demonstrated that the expert panel considered this condition equally important. The breakdown of the data revealed that 8 out of twelve (67%) participants rated *Ongoing Professional Development* at 10, one participant rated it at 9, and three participants rated it at 8. Similar to *Shared Vision*, all of the rankings were 8 and above for *Ongoing Professional Learning*, demonstrating all panel members' perceptions of this essential condition's significance in technology integration in PLCs.

Panel members rated the empowered leaders condition from 10 to 7, with a mean of 9.00. Six out of 12 (50%) panelists rated empowered leaders at 10, two rated it at 9, 2 rated it at 8, and two rated it at 7. The *Student-Centered Learning* essential condition closely followed the data trend of the empowered leaders essential condition, with the same mean of 9.0. Five out of 12 rated student-centered learning at 10, 4 rated it at 9, 2 rated it at 8, and one rated it at 6. Although the rankings were slightly different, the SD for student-centered learning was equal to that of the SD for empowered leaders at 1.21.

Based on statistical data analysis using mean, median, mode, and standard deviation, TLN expert panelists perceived shared vision, ongoing professional learning, empowered leaders, and student-centered learning as the top four essential conditions for technology integration in PLCs for building effective teams, promoting collaboration, and endorsing shared decision making processes. Although the remaining eight calculated means were very close to those of the top four ranked essential conditions and ranged between 8.92-7.67, during the field test it was decided that not more than four essential conditions would be used for Round 2 of the open ended questionnaire to explore the prerequisites for the ISTE essential conditions.

Delphi Study Round Two

Research Question Three and Four. The purpose of the Round 2 questionnaire was to acutely explore the answers to RQs 3 and 4 and to ascertain the prerequisites and factors that support the essential conditions for technology integration (Appendix I). Research questions 3 and 4 follow again here for review.

3. What are the prerequisites to implement the ISTE essential conditions for technology integration in the Professional Learning Communities as perceived by the Technology Leadership Network?

4. What are the factors that successfully lead teachers to implement ISTE essential conditions in the Professional Learning Communities as perceived by the Technology Leadership Network?

RQs 3 and 4 involved investigating the conditions that need to be present before the essential conditions can be implemented for technology integration. To explore RQs 3 and 4, Round 2 was determined to consist of four open ended questions to address the

top four ranked essential conditions established in Round 1. These open ended questions were derived from the quantitative data collected in Round 1. In Round 1, shared vision, ongoing professional learning, empowered leaders, and student centered learning emerged as the four highest ranked essential conditions for technology integration in PLCs. The four open-ended questions follow here:

1. What prerequisites are necessary to create a shared vision for technology integration in Professional Learning Communities?

2. What are the attributes of empowered leaders that support technology integration in Professional Learning Communities?

3. What factors promote ongoing professional learning for technology integration in Professional Learning Communities?

4. What measures must be taken to ensure that the technology integrated into Professional Learning Communities is focused on student-centered learning?

A Round 2 questionnaire link was sent to the 14 participants with the instructions. Ten out of 14 participants responded, a response rate of 71%. The expert panels' responses produced rich qualitative data, and the uniqueness of the responses broadened the focus of the study. The data involved inductive analysis, which as Thomas (2006) explained, " refers to approaches that primarily use detailed readings of raw data to derive concepts, themes, or a model through interpretations made from the raw data by an evaluator or researcher" (p. 238). The data were analyzed and coded for each open ended question asked in Round 2 using themes and categories. The emerging themes were categorized and narrowed to eight categories because "…most inductive studies

report between three and eight main categories in the findings (e.g., Campbell et al, 2003; Jain & Ogden, 1999, Thomas, 2003, p. 9). The smaller categories were encompassed into larger categories, and eight highly important categories were listed under the domain of prerequisites, attributes, factors, and measures necessary for technology integration of essential conditions.

Inductive Analysis. The following four tables represent the data that emerged from responses to Round 2's four questions exploring the four domains of (a) prerequisites necessary to create a shared vision, (b) attributes of an empowered leader, (c) factors promoting ongoing professional learning, and (d) measures to ensure focus on student centered learning. A word or a short phrase was used to express each important category under each question asked in Round 2. The categories were "created from actual phrases or meanings in specific text segments" (Thomas, 2006, p. 241) present in qualitative data. Even though the emerging themes sometimes sounded similar, the categories were labeled distinctively to preserve the authenticity of the participants' thoughts. The categories were listed in alphabetical order to establish equal importance of all eight categories under each domain (see table 6).

Table 6

Prerequisites Necessary to Create a Shared Vision for Technology Integration in Professional Learning Communities as Perceived by Technology Leadership Network

Category	Theme
Awareness	A minimal awareness of what is possible for technology integration, an overview or professional development seminar to highlight the best practices in technology integration.

Prerequisites Necessary to Create a Shared Vision for Technology Integration in Professional Learning Communities as Perceived by Technology Leadership Network

Category	Theme
Clarity	Clear goals and guidelines, understanding of the vision and needs, a system to adopt unified strategies through PLCs.
Consensus	An agreement that technology is a required component, must be done well to give student the best educational experience possible.
Conviction	A belief that all teachers can learn and use technology, would need access to the technologies, extensive training, and scheduled time for independent learning.
Informed Stakeholders	Informed stakeholders with agreed upon definitions of integration, an understanding of the importance of technology integration (from a learner's perspective)
Knowledge	Knowledge and understanding of how to use the technologies and how to apply any protocols for using the technologies. Teachers must feel confident and competent enough to use new technology effectively and frequently.
Resources	A commitment from the leaders to fund technology integration adequately.
Support	School wide support, trust, consensus, established regular communication between the stakeholders, and respecting everyone's voices and opinions.

Ten out of 14 expert panelists responded to Round 2 questions. Although each expert panelist shared a unique perspective on shared vision, all of them expressed a mutual understanding of the prerequisites necessary for ISTE essential conditions to be implemented. Once the emerging themes were separated and coded, categories started to emerge. Qualitative data were reanalyzed, and subcategories were embedded into main categories, thus increasing the depth and meaning of each main category. Frequently used key words such as awareness, clear goals, agreement, belief, informed stakeholders, knowledge, funding, and support lead to eight categories listed as awareness, clarity, consensus, conviction, informed stakeholders, knowledge, resources, and support, as seen in table 6 above. Now that the prerequisites necessary to create a shared vision for technology integration in PLCs have been discussed, Table 7 presents the attributes of empowered leaders that support technology integration in PLCs.

Table 7

Attributes of Empowered Leaders that Support Technology Integration in Professional Learning Communities as Perceived by Technology Leadership Network

Category	Theme
Delegate	Empowered leaders make and implement plans and assist others with plan implementation.
Inclusive	Respectful, create collaborative environment, creativity, innovators, open minded, coach attitude, permissive attitude to support exploration and innovation, create opportunities to share and learn from others, inclusiveness, and flexibility are their attributes.

Attributes of Empowered Leaders that Support Technology Integration in Professional Learning Communities as Perceived by Technology Leadership Network

Category	Theme
Innovative and Creative	Empowered leaders come up with creative solutions, chart new territories, and pilot innovative technology integration within their environments. They display willingness to pioneer with their own tech learning and willingness to find ways to support the pioneers on their staff.
Knowledgeable	They are trusted leaders, are well informed via current research and practice, and have knowledge of up to date best practices in technology and PLC practices.
Resolute	Leaders must be able to clear the technical, monetary, social, and emotional road blocks and marshal the resources needed to support technology integration and be willing to take risks and show solid direction.
Resourceful	Implement an extended shared vision built by the PLCs, see and understand the big picture, have a mental picture of the types of activities and learning experiences that are possible, and ensure the plan is feasible.
Skilled Communicator	The ability to communicate and share their vision and to be skilled communicators and professional development specialists.
Trusting	They believe that all teachers can learn and become confident and competent, that technology is not a replacement to teacher

Attributes of Empowered Leaders that Support Technology Integration in Professional Learning Communities as Perceived by Technology Leadership Network

Category	Theme
	instruction but rather a tool to aide instruction, and that the created vision is based on input from others and discussions.

Table 7 displays the data delivered in response to question requesting the attributes of empowered leaders. The uniqueness of the data that the expert panelists contributed provided ample attributes covering the domain of empowered leaders that supports the ISTE essential conditions. Again key phrases like "implement plans", "respect[ful] and inclusive", "creative solutions", "trusted and well informed", "able to clear road blocks", "mental picture of activities", "ability to communicate", and "belief in teachers" lead to the creation of eight categories.

Now that the attributes of empowered leaders have been discussed, table 8 presents the factors that promote ongoing professional learning for technology integration in PLCs.

Table 8

Factors Promoting Ongoing Professional Learning for Technology Integration in Professional Learning Communities as Perceived by Technology Leadership Network

Category	Theme
Best Practices	Ongoing and clear communication, professional norms of behavior, continued professional development...technology shifts so quickly, it's important to keep abreast of best practices of technology available.

Factors Promoting Ongoing Professional Learning for Technology Integration in Professional Learning Communities as Perceived by Technology Leadership Network

Category	Theme
Creativity, Rethinking, and Openness to Learn	Hands-on, perceived needs to use a tool to enhance job tasks requires creativity and rethinking of what students are capable of, ability to be vulnerable and accepting that you might not know everything and openness to learn from others.
Empowered Leadership	Having a "technology integration specialist" role for a member of the PLC would promote ongoing professional learning for technology integration within the PLC, must be relevant and driven by teacher and student needs.
Incentives and Recognition	Incentives work best; those participating must be recognized for their participation and their enthusiasm. It should not just be expected of them.
Resources and Support	This includes adequate funding support, teacher support, and equipment, plentiful opportunities for practice and reflection, access to new resources, and budget and leadership to go along with the shared tech vision.
Scheduled Time	A key factor is scheduling the time for teachers to play with new technology and to integrate it into lesson plans. Another is a structure within the school that allows for ongoing collaboration and communication.

Factors Promoting Ongoing Professional Learning for Technology Integration in Professional Learning Communities as Perceived by Technology Leadership Network

Category	Theme
Sharing Best Practices	Systems for sharing best practices such as "appy hour, tech Tuesdays", etc. that promote the use of technology, willingness to explore the use of technology by the PLC group.
SMART Goals	A supporting factor would be for the PLC to set a SMART goal for technology integration, promoting an ongoing, meaningful focus on technology integration within the PLC.

The themes derived from the data gathered for factors promoting online professional learning were listed under categories titled best practices; creativity, rethinking, and openness to learn; empowered leadership; incentives and recognition; resources and support; scheduled time; sharing best practices; and SMART goals. These categories were the essence of the aggregate data describing needs such as ongoing and clear communication, professional norms of behavior, continued professional development, a hands-on approach, using a tool to enhance job tasks, the technology being relevant and driven by teacher and student needs, those participating being recognized for their participation and their enthusiasm, adequate funding support, teacher support, equipment, scheduling the time for teachers, sharing best practices; and setting a SMART goal for technology integration.

Table 9 displays the data generated from the last question in Round 2: What measures must be taken to ensure that the technology integrated into Professional Learning Communities is focused on student-centered learning?

Table 9

Measures to Ensure that the Technology Integrated into Professional Learning Communities is Focused on Student-Centered Learning as Perceived by Technology Leadership Network

Category	Theme
Data Driven	PLC time should be focused on student achievement results and data, with all PLC work focused on improving student learning. Metrics need to be in place. Careful consideration must be in place to determine the social economic factors and language barriers that may be in place. Use data to see what is working for student learning.
Follow Up	Planning and follow-up, following the plan. The lesson/plan and outcome should be presented to the team for analysis of what went right and what went wrong and to examine the outcomes of the experience and what needs to be done differently next time.
Research Based	Design curriculum and technology integration around research based practices, provide improved access to technology for all students, provide ongoing professional development, and keep clear what the standards and learning objectives are trying to accomplish. Have the curriculum and technology integration reviewed by curriculum and technology steering committees.
Role of District Technology	Buy in from technology district leaders and site administration is essential. They must understand and give tech integration top

Measures to Ensure that the Technology Integrated into Professional Learning Communities is Focused on Student-Centered Learning as Perceived by Technology Leadership Network

Category	Theme
Leaders and Administration	priority on the campus and follow through to evaluate, redirect, and reflect all throughout the process to ensure they stay on course with their vision to stay focused on student-centered learning.
Shared Resources	Require sharing of resources and strategies in grade level teams to increase the bank of possible learning experiences. Open up requirements to allow for options in process and product for students that are made possible by technology.
SMART Goals	The use of SMART goals in the PLC process serves to focus a PLC's work on technology integration in student-centered learning. Review student-level data, which keeps the PLC grounded in meaningful, student-centered learning. Role of administrative leadership is critical for ensuring an appropriate and meaningful focus for the PLC.
Student Centered Technology Tools	Exploring technologies that students can use according to their liking, using technologies that promote student collaboration. Adapt student learning to technologies that students are using on a daily basis, using game based technologies. Start exploration of technologies with students in mind.

Measures to Ensure that the Technology Integrated into Professional Learning Communities is Focused on Student-Centered Learning as Perceived by Technology Leadership Network

Category	Theme
Teachers as Facilitators	Promote teachers to transition into a facilitator role. Include relevant stakeholders in planning, learning strategies that allow student exploration. Relax rules on assignments so that students can have more power of choice.

Data collected on measures to ensure focus on student centered learning were rich and extensive. The themes such as (a) PLC time should be focused on student achievement results and data, (b) planning and follow-up, (c) designing curriculum and technology integration around research based practices, (d) buy-in from technology district leaders and site administration, (e) require sharing of resources and strategies, (f) the use of SMART goals in the PLC process, (g) using technologies that promote student collaboration, and (h) promoting teachers to transition into a facilitator role were the key features of the data under this topic. The categories designed to highlight the emerging themes were data driven, follow up, research based role of district technology leaders and administration, shared resources, SMART Goals, student centered technology tools, and teachers as facilitators.

Analysis of Interconnectivity of Data. Even though the qualitative data for Round 2 produced a variety of themes and categories, the cohesion and interconnectedness of the thoughts was manifest. A general perception after analyzing the data was that expert panelists' opinions built on each other rather than disagreed with

each other. To elucidate the findings, the categories were placed in a table to discern the interconnectivity. The themes were linked to see the interconnectivity of data between the four domains of prerequisites necessary to create a shared vision, attributes of empowered leader, factors promoting ongoing professional learning, and measures to ensure focus on student centered learning (see table 10).

Table 10

Round 2 Four Domains and Their Categories

Prerequisites Necessary to Create a Shared Vision	Attributes of Empowered Leaders	Factors Promoting Ongoing Professional Learning	Measures to Ensure Focus on Student Centered Learning
Awareness	Delegate	Best Practices	Data Driven
Clarity	Inclusive	Creativity, Rethinking, and Openness to Learn	Follow Up
Consensus	Innovative and Creative	Empowered Leadership	Research Based
Conviction	Knowledgeable	Incentives and Recognition	Role of District Technology Leaders and Administration
Informed Stakeholders	Resolute	Resources and Support	Shared Resources
Knowledge	Resourceful	Scheduled Time	SMART Goals
Resources	Skilled Communicator	Sharing Best Practices	Student Centered Technology Tools
Support	Trusting	SMART Goals	Teachers as Facilitators

The categories of resources, resolute, resources and support, and shared resources shared a common theme consecutively reported by different participants, “a commitment from

the leaders to fund technology integration adequately", "Leaders must be able to clear the technical, monetary, social, and emotional road blocks and marshal the resources needed to support technology integration and must be willing to take risks, a solid direction", "This includes adequate funding support, teacher support, and equipment, plentiful opportunities for practice and reflection, access to new resources, and budget and leadership to go along with the shared tech vision", and "require sharing of resources and strategies in grade level teams to increase the bank of possible learning experiences. Open up requirements to allow for options in process and product for students which are made possible by technology". Although these responses were recorded under different domains, the unison in perspective was evident.

Under categories of skilled communicator, empowered leadership, and teachers as facilitators, expert panelists emphasized the role of teachers in technology integration. The emerging themes "the ability to communicate and share their vision, [being] skilled communicators and professional development specialists", "having a 'technology integration specialist' role for a member of the PLC would promote ongoing professional learning for technology integration within the PLC. Relevant and driven by teacher and student needs", and "promote teachers to transition into a facilitator role, include relevant stakeholders in planning, learning strategies that allow student exploration, relaxing rules on assignments so that students can have more power of choice", although reported by different participants, clearly showed the interconnectivity of the data across the four domains.

Uniformity of ideas was also observed in three out of four domains for Round 2 under the categories support, inclusive, and best practices, and expert panelists repeatedly

emphasized the collective thoughts such as “School wide support, trust, consensus, established regular communication between the stakeholders, respecting everyone's voices and opinions”, “respect, create a collaborative environment, creativity, innovators, open minded, coach attitude, permissive attitude to support exploration and innovation, create opportunities to share and learn from others, inclusiveness, and flexibility are their attributes,” and “ongoing and clear communication, professional norms of behavior, continued professional development...technology shifts so quickly, it's important to keep abreast of best practices of technology available”.

Categories of knowledge, innovative and creative, and scheduled time under the domains of prerequisites for shared vision, attributes of empowered leaders, and factors prompting ongoing professional learning consecutively revealed these findings, “Knowledge and understanding of how to use the technologies, how to apply any protocols for using the technologies, Teachers must feel confident and competent enough to use new technology effectively and frequently”, “Empowered leaders come up with creative solutions, chart new territories, and pilot innovative technology integration within their environments. Willingness to pioneer with their own tech learning and the willingness to find ways to support the pioneers on their staff”, and “A key factor is scheduling the time for teachers to play with new technology and integrate it into lesson plans, a structure within the school that allows for ongoing collaboration and communication”.

Data from the clarity and resourceful, which appear to be two different categories under two different domains, echoed the same concept, “Clear goals and guidelines, understanding of the vision and needs, a system to adopt unified strategies through PLCs”

and “an extended shared vision built by the PLCs, see and understand the big picture, a mental picture of the types of activities and learning experiences that are possible, the plan is feasible”.

Conviction and trusting, two separate categories reported under prerequisite for shared vision and attributes of empowered leaders, were successively reported by different participants, “A belief that all teachers can learn and use technology, would need access to the technologies, extensive training, and scheduled time for independent learning” and “They believe that all teachers can learn and become confident and competent, that technology is not a replacement to teacher instruction but rather a tool to aide instruction, the created vision is based on the input and discussions”. All of these responses reiterated the same concept.

Delphi Study Round Three

Research Question Five. Round 3 addressed RQ5 and was focused on the benefits and effectiveness of the preconditions analyzed in Round 2 (Appendix J).

5. What preconditions increase the effectiveness of implementing ISTE essential conditions for technology integration in the Professional Learning Communities as perceived by the Technology Leadership Network?

Round 3 Questionnaire. The purpose of RQ 5 was to narrow the preconditions found in Round 2 and to highlight the categories identified under the domains of prerequisites for shared vision, attributes of empowered leaders, factors necessary for ongoing professional development, and measures focused on student centered learning. A comprehensive prompt was drafted to address all four domains:

On a scale of 1-10, rate the effectiveness of the prerequisites, attributes, factors, and measures identified for each top-rated ISTE essential condition in Round 2 for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by Technology Leadership Network.

This prompt was segmented into four components to address the four main domains used in Round 2 to explore the preconditions for the four highest ranking essential conditions in Round 1.

1. On a scale of 1-10, rate the effectiveness of the prerequisites necessary for shared vision for technology integration.
2. On a scale of 1-10, rate the effectiveness of the attributes of empowered leaders supporting technology integration.
3. On a scale of 1-10, rate the effectiveness of the factors promoting ongoing professional learning for technology integration.
4. On a scale of 1-10, rate the effectiveness of the measures for technology integration focused on student centered learning.

These prompts required the expert panelists to rate the preconditions on the scale of 1-10. Under each precondition the eight unique categories were listed. The data produced were quantitative in nature.

Round 3 Data Analysis. Round 3 generated quantitative data based on expert panelists' ranking of the categories found in Round 2. The ranking was on the scale of 1-10, 1 representing *least important* and 10 representing *extremely important*. The Round 2 questionnaire was sent out to 14 expert panelists. Out of 14, 10 responded to the Round 2 questionnaire, a response rate of 71%. The following eight tables represent the

quantitative data based on participants' perceptions of the effectiveness of the categories found under the four preconditions. The mean, median, mode, and SD were calculated to analyze the central tendency of the data. The first table for each precondition showed the mean, median, mode, and SD. The second table for each precondition illustrated the frequency of responses for each ranking and the percentage of responses for each ranking.

Table 11

Round 3, Prerequisites Necessary to Create a Shared Vision as Perceived by the Technology Leadership Network

Prerequisites	Mean	Median	Mode	SD
Resources	8.9	9	9	0.99
Support	8.9	9	10	1.29
Clarity	8.8	9	10	1.03
Awareness	8.6	9	10	1.58
Informed Stakeholders	8.6	9	10	1.65
Conviction	8.5	9.5	10	1.90
Consensus	8.4	8.5	8	1.78
Knowledge	7.8	8	8	1.87

Note. N=10

The above table depicts the categories recognized in Round 2 under the precondition of prerequisites necessary to create a shared vision. The categories in alphabetical order were awareness, clarity, consensus, conviction, informed stakeholders, knowledge, resources, and support. The table shows the values in descending order for the mean. According to the expert panelists, resources, support, clarity, awareness, and

informed stakeholders were the highest ranked prerequisites for ISTE essential conditions for technology integration. Resources and support both had means of 8.9 and both ranked first, but their standard deviations were .99 and 1.29, respectively. Similarly, the median for both was 9, but the mode varied, 9 for resources and 10 for support. Clarity, with mean of 8.8 and a SD of 1.03, was ranked second. Awareness and informed stakeholders tied for third place, both with a mean of 8.6, and their standard deviations were 1.58 and 1.65, respectively. Additionally, both had a median of 9 and a mode of 10. Conviction, consensus, and knowledge respectively had means of 8.5, 8.4, and 7.8 and standard deviations of 1.9, 1.78, and 1.87, ranking them fourth, fifth, and sixth. The medians for last three categories were 9.5, 8.5, and 8 with medians of 10, 8, and 8 respectively.

Table 12

Frequency of the Responses and the Percentage of Responses- Analysis of the Prerequisites Necessary to Create a Shared Vision as Perceived by the Technology Leadership Network

Category	Frequency of Responses and Response Percentage for Each Ranking									
	Ranking									
	10	9	8	7	6	5	4	3	2	1
Resources	3 30%	4 40%	2 20%	1 10%						
Support	4 40%	3 30%	2 20%		1 10%					
Clarity	3 30%	3 30%	3 30%	1 10%						
Awareness	4 40%	2 20%	2 20%		2 20%					
Informed Stakeholders	5 50%		3 30%		2 20%					
Conviction	5 50%	1 10%	1 10%	1 10%	1 10%	1 10%				
Consensus	3 30%	2 20%	4 40%				1 10%			
Knowledge	3 30%		3 30%	2 20%		2 20%				

The above table illustrates the data to show the frequency of the responses for each ranking. Out of 80 responses for prerequisites for shared vision, only 15 responses were at or less than 7, leaving 65 responses at a rank of 8 or above. More than 81% of the responses were towards the higher end of the ranking scale, displaying strong opinion regarding the eight prerequisites for shared vision. Conversely, 19% of the data leaned towards the middle, between the ranks of 7 and 4. None of the participants rated any category below 4, showing the perceived importance of the shared vision prerequisite. Now that the prerequisites have been displayed, table 13 depicts the data gathered from the prompt addressing attributes of empowered leaders supporting technology integration.

Table 13

Round 3, Attributes of Empowered Leaders as Perceived by the Technology Leadership Network

Attributes	Mean	Median	Mode	SD
Trusting	9.3	9.5	10	0.95
Inclusive	8.8	9	9	1.23
Resolute	8.7	9.5	10	1.57
Knowledgeable	8.7	8.5	10	1.25
Skilled Communicator	8.7	9	9	1.06
Delegate	8.6	9	9	1.07
Resourceful	8.6	8	8	1.07
Innovative and Creative	7.9	8	8	1.10

Note. N=10

The categories recognized in Round 2 under the precondition of attributes of empowered leaders in alphabetical order were delegate, inclusive, innovative and creative, knowledgeable, resolute, resourceful, skilled communicator, and trusting. The table shows the categories sorted in descending order for mean. The expert panelists rated trusting, inclusive, resolute, knowledgeable, and skilled communicator as the highest prerequisites for ISTE essential conditions for technology integration. Respectively, trusting and inclusive had means of 9.3 and 8.8 and ranked first and second, and the standard deviations were .95 and 1.23, respectively. Resolute, knowledgeable, and skilled communicator all tied for third, each with a mean of 8.7. Their standard deviations were hardly close, with relatively different values of 1.57, 1.25, and 1.06, respectively. Their medians ranged between 9.5, 8.5, and 9, and their modes were 10, 10, and 9, respectively. Delegate and resourceful, both with means of 8.6 and a SD of 1.07 were next. However, delegate had a median and mode at 9, but the median and mode for resourceful was 8. Innovative and creative placed last with a mean of 7.9 and SD of 1.10. Its median and mode both were at 8. Table 14 displays the frequency of the response analysis for the attributes of empowered leaders domain.

Table 14

Frequency of the Response Analysis for the Attributes of Empowered Leaders as Perceived by the Technology Leadership Network

Category	Frequency of Responses and Response Percentage for Each Ranking									
	Ranking									
	10	9	8	7	6	5	4	3	2	1
Trusting	5 50%	4 40%		1 10%						
Inclusive	3 30%	4 40%	2 20%		1 10%					
Resolute	5 50%	1 10%	1 10%	2 20%	1 10%					
Knowledgeable	4 40%	1 10%	3 30%	2 20%						
Skilled Communicator	2 50%	5 40%	1 10%	2 20%						
Delegate	2 20%	4 40%	2 20%	2 20%						
Resourceful	3 30%	1 10%	5 50%	1 10%						
Innovative and Creative	1 10%	1 10%	5 50%	2 20%	1 10%					

The data for empowered leaders repeated the same pattern as the data for shared vision. Sixty-five out of eighty responses (81%) were at 8 or higher, and 19% of the responses were below eight. However, all of the remaining 15 responses were ranked 6 or 7, and none of the responses were below 6. Again the data were clustered towards the higher end of the rating scale, showing the consensus amongst the expert panelists. Now that the attributes for empowered leaders domain has been covered, table 15 shows the data for the ongoing professional learning prompt.

Table 15

Round 3, Factors Promoting Ongoing Professional Learning as Perceived by the Technology Leadership Network

Factors	Mean	Median	Mode	SD
Creativity, Rethinking, and Openness to Learn	8.8	9	9	1.23
Resources and Support	8.6	9	10	1.35
Sharing Best Practices	8.6	9	9	1.26
Best Practices	8.6	8.5	8	1.17
Scheduled Time	8.5	8.5	10	1.51
Empowered Leadership	8.4	8	10	1.51
SMART Goals	8.1	8	8	1.2
Incentives and Recognition	6.7	7	7	2.21

Note. N=10

The highest ranked category in Round 3 was creativity, rethinking, and openness to learn under the factors promoting ongoing professional learning. Its mean was 8.8, and the SD was 1.23. The median and mode both were 9. Although creativity, rethinking, and openness to learn was ranked the highest category, the SD was on the higher end, showing slight variation in the opinions of the expert panelists. Three categories tied for the second highest ranking: resources and support, sharing best practices, and best practices. All three categories had the same mean value of 8.6. However, their standard deviations were 1.35, 1.26, and 1.17, respectively. Resources and support had a median and mode of 9 and 10 (respectively), sharing best practices had a median and mode of 9, and the median and mode for best practice were 8.5 and 8, respectively. Scheduled time was ranked third in importance and scored a mean of 8.5 and a SD of 1.51. The median for scheduled time was 8.5, and the mode was 10. For the last three rankings, empowered leadership, SMART Goals, and incentives and recognition had means of 8.4, 8.1, and 6.7 and standard deviations of 1.51, 1.2, and 2.21, respectively. Table 16 further details the data for the ongoing professional learning domain.

Table 16

Frequency of the Response Analysis for the Factors Promoting Ongoing Professional Learning as Perceived by the Technology Leadership Network

Category	Frequency of Responses and Response Percentage for Each Score									
	Ranking									
	10	9	8	7	6	5	4	3	2	1
Creativity, Rethinking, and Openness to Learn	3 30%	4 40%	2 20%		1 10%					
Resources and Support	3 30%	3 30%	2 20%	1 10%	1 10%					
Sharing Best Practices	3 30%	3 30%	1 10%	3 30%						
Best Practices	3 30%	2 20%	3 30%	2 20%						
Scheduled Time	4 40%	1 10%	2 20%	2 20%	1 10%					
Empowered Leadership	4 40%		3 30%	2 20%	1 10%					
SMART Goals		4 40%	5 50%			1 10%				
Incentives and Recognition	1 10%	1 10%	2 20%	2 20%	1 10%	1 10%	1 10%	1 10%		

Categories under ongoing professional learning produced data different from the previous domains. Out of 80 responses, 49 were at 8 or above, representing 61 % of the responses towards the higher end of the scale. The rest of the responses were at 7 through 3, the lowest responses so far. At 30%, an increase in middle and lower end responses was evident. Incentives and recognition had the most scattered data, with one response each at 10, 9, 6, 5, 4, and 3. The frequency of responses for rankings 8 and 7 was 2. Apparently, the category was disputed amongst the expert panelists. The data for the final prompt, measures to ensure focus on student centered learning, are addressed in table 17.

Table 17

Round 3, Measures to Ensure Focus on Student Centered Learning as Perceived by the Technology Leadership Network

Measures	Mean	Median	Mode	SD
Teachers as Facilitators	9.7	10	10	0.48
Role of District Technology Leaders and Administration	9.2	9.5	10	1.03
Student Centered Technology Tools	9	9.5	10	1.33
Follow Up	8.7	9	10	1.16
Data Driven	8.4	8.5	9	1.26
Research Based	8.3	8	8	1.42
SMART Goals	8	8.5	9	1.56
Shared Resources	8	8.5	9	1.41

Note. N=10

Under measures to ensure focus on student centered learning as perceived by the TLN, teachers as facilitators was ranked highest with a mean value of 9.7 and a SD of 0.48, showing agreement between the expert panelists. The median and mode each received a score of 10. The category role of district technology leaders and administration was ranked second with a mean of 9.2 and a SD of 1.03. Its median was 9.5, and its mode was 10. Student centered technology tools placed third with a mean of 9 and a SD of 1.33. Follow up, data driven, and research based had means of 8.7, 8.4, and 8.3 and standard deviations of 1.16, 1.26, and 1.42, respectively. Follow Up had median and mode at 9 and 10, data driven had a median and mode of 8.5 and 9, and research based had both a median and mode of 8. SMART goals and shared resources both had means of 8, but their standard deviations were 1.56 and 1.41, respectively. Both had the same medians and modes—8.5 and 9, respectively. Table 18 gives further details of the data gathered for measures to ensure focus on student centered learning.

Table 18

Frequency of the Response Analysis for the Measures to Ensure Focus on Student Centered Learning as Perceived by the Technology Leadership Network

Category	Frequency of Responses and Response Percentage for Each Ranking									
	Ranking									
	10	9	8	7	6	5	4	3	2	1
Teachers as Facilitators	7 70%	3 30%								
Role of District Technology Leaders and Administration	5 50%	3 30%	1 10%	1 10%						
Student Centered Technology Tools	5 50%	2 20%	2 20%		1 10%					
Follow Up	3 30%	3 30%	2 20%	2 20%						
Data Driven	2 20%	3 30%	3 30%	1 10%	1 10%					
Research Based	2 20%	2 20%	5 50%			1 10%				
SMART Goals		5 50%	3 30%	1 10%			1 10%			
Shared Resources	1 10%	4 40%	1 10%	2 20%	2 20%					

The responses for student centered learning ranged from 10-4. Sixty-four out of 80 responses were ranked between 10 and 8, exactly 80% of the responses. The remaining 20% of responses were ranked between 7 and 4 (16 out of 80 responses). None of the responses were below 4. Again the data leaned towards the higher end of the ranked scale, representing agreement between the expert panelists.

Analysis of Interconnectivity of Data. The top-three ranked categories from all four domains (prerequisites necessary to create a shared vision, attributes of empowered leaders, factors promoting ongoing professional learning, and measures to ensure focus on student centered learning) revealed an overall consensus.

Categories Ranked First. The categories ranked first were resources (tied for first among all prerequisites), support (tied for first among all prerequisites), trusting (first among all attributes of empowered leaders), creativity, rethinking, and openness to learn (first among all factors promoting ongoing professional learning), and teachers as facilitators (first among all measures to ensure student centered learning). Some of the themes these categories included were:

"A commitment from the leaders to fund technology integration adequately". "School wide support, trust, [and] consensus, established regular communication between the stakeholders,[and] respecting everyone's voices and opinions".

"They believe that all teachers can learn and become confident and competent, that technology is not a replacement to teacher instruction but rather a tool to aide instruction, and that the created vision is based on the staff and parents' input".

"Hands-on, perceived need to use a tool to enhance job tasks, require creativity and rethinking of what students are capable of, [and]ability to be vulnerable and accepting that you might not know everything and openness to learn from others".

"Promoting teachers to transition into a facilitator role, include relevant stakeholders in planning, learning strategies that allow student exploration, [and] relaxing rules on assignments so that students can have more power of choice".

Categories Ranked Second. Categories ranked second under the four domains were clarity (prerequisites), inclusive (attributes), resources and support (factors), sharing best practices (factors), best practices (factors), and role of district technology leaders and administration (measures). Expert panel opinion for these conditions was as follows:

"Clear goals and guidelines, understanding of the vision and needs, a system to adopt unified strategies through PLCs".

"Respect, collaborative environment creativity, innovators, open minded, coach attitude, permissive attitude to support exploration and innovation, create opportunities to share and learn from others, openness, inclusiveness, flexibility, and willing to take risks are their attributes".

"This includes adequate funding support, teacher support, equipment, plentiful opportunities for practice and reflection, access to new resources, [and] budget and leadership to go along with the shared tech vision".

"Systems for sharing best practices such as appy hour, tech Tuesdays, etc., promoting the use of technology, willingness to explore the use of technology by the PLC group".

"Ongoing and clear communication, professional norms of behavior, continued professional development...technology shifts so quickly, it's important to keep abreast of best practices of technology available".

"Buy-in from technology district leaders and site administration is essential. They must understand and give tech integration top priority on the campus and follow through to evaluate, redirect, and reflect all throughout the process to ensure they stay on course with their vision to stay focused on student-centered learning".

Categories Ranked Third. Awareness (prerequisites), informed stakeholders (prerequisites), knowledgeable (attributes), resolute (attributes), skilled communicator (attributes), scheduled time (factors), and student centered technology tools (measures) were ranked third highest in the third round of the Delphi study. Themes under each category as described by the expert panelists were:

"A minimal awareness of what is possible for technology integration, an overview or professional development seminar to highlight best practices in technology integration".

"Informed stakeholders with agreed upon definitions of integration, an understanding of the importance of technology integration (from a learner's perspective)".

"Leaders must be able to clear the technical, monetary, social, and emotional road blocks and marshal the resources needed to support technology integration".

"The ability to communicate and share their vision, skilled communicators and professional development specialists".

"A key factor is scheduling the time for teachers to play with new technology and integrate it into lesson plans, a structure within the school that allows for ongoing collaboration and communication".

"Exploring technologies that students can use according to their liking, using technologies that promote student collaboration. Adapt student learning to technologies that students are using on a daily basis, using game based technologies, [and] start exploration of technologies with students in mind".

Key Findings

Delphi Round 1

Delphi expert panelists ranked 14 ISTE essential conditions on the scale of 1 to 10. The data produced were quantitative in nature, and the top four conditions were:

1. shared vision
2. ongoing professional learning
3. empowered leaders
4. student-centered learning

Delphi Round 2

The above mentioned top four essential conditions were used to ask four open ended questions that led to eight categories, producing qualitative data under each domain of the essential conditions.

Prerequisites necessary to create a shared vision consist of these eight categories: (a) awareness, (b) clarity, (c) consensus, (d) conviction, (e) informed stakeholders, (f) knowledge, (g) resources, and (h) support.

Attributes of empowered leaders led to the following categories: (a) delegate, (b) inclusive, (c) innovative and creative, (d) knowledgeable, (e) resolute, (f) resourceful, (g) skilled communicator, and (h) trusting.

Factors promoting ongoing professional learning consists of the following categories: (a) best practices, (b) creativity, rethinking, and openness to learn, (c) empowered leadership, (d) incentives and recognition, (e) resources and support, (f) scheduled time, (g) sharing best practices, and (h) SMART goals.

Measures to ensure focus on student centered learning included the following categories: (a) data driven, (b) follow up, (c) research based, (d) role of district technology leaders and administration, (e) shared resources, (f) SMART goals, (g) student centered technology tools, and (h) teachers as facilitators.

Delphi Round 3

In Round 3, the categories under each domain were ranked on the scale of 1-10, generating quantitative data. Under prerequisites necessary to create a shared vision, the top rated three categories were:

- resources, support
- clarity
- awareness

For attributes of empowered leaders, the top ranked categories are as follows:

- trusting
- inclusive
- resolute, knowledgeable, skilled communicator

The top three categories for factors promoting ongoing professional learning were:

- creativity, rethinking, and openness to learn
- resources and support, sharing best practices, best practices
- scheduled time

The top three categories for measures to ensure focus on student centered learning were:

- teachers as facilitators
- role of district technology leaders and administration
- student centered technology tools

Summary

Chapter 4 included the data collected based on the five research questions. The research method and data collection, the population and the sample size, the demographic data, and the data and analysis of data were presented in detail. The data were collected using the structured Delphi study consisting of three rounds; Round 1 and Round 3 generated quantitative data, and Round 2 produced qualitative data. Round 1 required the expert panelists to rate the ISTE 14 essential conditions on the scale of 1-10, 1 being *least important* and 10 being *extremely important*. Fourteen expert panelists signed up to take part in this study, and 12 responded to the first round of the Delphi study. Based on their responses, the four top rated ISTE essential conditions were selected for the second round of open ended questions.

For the second round of the Delphi study, participants were asked to respond to four open ended question based on their perceptions regarding preconditions including prerequisites for shared vision, attributes of empowered leaders, factors for ongoing professional learning, and measures focused on student centered learning. Ten out of 14

participants responded in Round 2. The qualitative data collected in Round 2 were coded and categorized, leading to eight categories under each precondition. These categories were the focus of the Delphi study Round 3, in which participants were asked to rank the categories for their effectiveness on the scale of 1-10. The data produced were quantitative in nature and revealed the perceptions of the TLN regarding the ISTE essential conditions and the preconditions necessary to create the essential conditions for technology integration in PLCs.

CHAPTER FIVE: FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Overview

This Delphi study involved exploring the TLN's perceptions of the ISTE essential conditions necessary for technology integration. Chapter 1 of this study contained information on the background of technology integration in PLCs and its present state. In chapter 2, the literature review focused on PLCs, effective teams, collaboration, effective decision making processes, and technology integration. Chapter 3 encompassed the methodology, population selection, sample size, instrumentation, and data collection. The data collected from three rounds of the Delphi study were presented and analyzed in chapter 4. Chapter 5 presents an overview of the purpose statement, research questions, and methodology. Unexpected and major findings are also discussed in detail, and future research recommendations are presented in this chapter. Chapter 5 will be summed up with implications of the data presented in chapter 4 and conclusions drawn from the data.

Purpose Statement

The purpose of this Delphi study was to identify the essential conditions (ISTE) required for technology integration in Professional Learning Communities for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by members of the joint Technology Leadership Network of the Riverside County Office of Education and San Bernardino County Superintendent of Schools, California.

Based on the International Society of Technology for Education (ISTE), the 14 essential conditions to effectively leverage technology for learning are as follows:

1. Shared Vision

2. Empowered Leaders
3. Implementation Planning
4. Consistent and Adequate Funding
5. Equitable Access
6. Skilled Personnel
7. Ongoing Professional Learning
8. Technical Support
9. Curriculum Framework
10. Student-Centered Learning
11. Assessment and Evaluation
12. Engaged Communities
13. Support Policies
14. Supportive External Context

The emphasis of this study was to explore and identify the ISTE essential conditions that support technology integration in PLCs. In this study, the prerequisites, the attributes, the factors, and the measures for implementing the essential conditions that encourage the use of technology in PLCs were discerned. In addition, the TLN members' perceptions of the prerequisites for teachers to lead implementation of essential conditions were sought.

Research Questions

1. What ISTE essential conditions need to be in place for technology integration in Professional Learning Communities for building effective teams, supporting

collaboration, and endorsing shared decision making processes as perceived by Technology Leadership Network?

2. What are the most important ISTE essential conditions which promote the use of technology supporting collaboration, effective teams, and decision making as perceived by members of the Technology Leadership Network?
3. What are the prerequisites to implement the ISTE essential conditions for technology integration in the Professional Learning Communities as perceived by the Technology Leadership Network?
4. What are the prerequisites to successfully lead teachers to implement ISTE essential conditions in the Professional Learning Communities as perceived by the Technology Leadership Network?
5. What increases the effectiveness of implementing ISTE essential conditions for technology integration in the Professional Learning Communities as perceived by the Technology Leadership Network?

Major Findings

Major findings discovered during data collection relevant to the research questions are presented in this section. The major findings build on the interconnectivity between the literature review, research questions, and collected data. Findings will be discussed under the heading of each research question, triangulating with the literature review.

Research Questions 1 and 2

1. What ISTE essential conditions need to be in place for technology integration in Professional Learning Communities for building effective teams, supporting

collaboration, and endorsing shared decision making processes as perceived by Technology Leadership Network?

2. What are the most important ISTE essential conditions which promote the use of technology supporting collaboration, effective teams, and decision making as perceived by members of the Technology Leadership Network?

During Round 1, expert panelists were asked to rank the ISTE essential conditions that need to be in place to promote technology integration and its use in PLCs for building effective teams, promoting collaboration, and endorsing shared decision making processes on a scale of 1-10.

Delphi Round 1. Delphi expert panelists ranked 14 ISTE essential conditions on the scale of 1-10. The data produced were quantitative in nature, and the top four conditions were:

- shared vision
- ongoing professional learning
- empowered leaders
- student-centered learning

Literature Review Triangulation. In the literature reviewed, shared vision was suggested as a strategy to overcome barriers that affect technology integration (Hunt, R., & Luetkehans, 2013, p. 17). Lepsinger and DeRosa (2010) also emphasized teams' having a vision to achieve their targets. Saurez (2013) believed in empowering teachers, and Saurez's conclusion agrees with the findings from this study described for empowered leaders for ISTE essential conditions: stakeholders at every level empowered to be leaders in effecting change. PLCs and structured professional learning were

frequently cited and emphasized in Chapters 1 and 2 and provided the background and foundation for the research. ISTE ongoing professional learning was explained as technology-related professional learning plans and opportunities with dedicated time to practice and share ideas. The expert panel ranking ongoing professional learning as a top four essential condition for technology integration in PLCs corroborates the research findings with the literature review. Ongoing professional learning was deemed important because it facilitates student centered learning (Blankstein, 2008). To achieve student centered learning, Fullan (2008) asserted the need for full staff power (p. 3). Shinsky and Stevens (2011) also mentioned the importance of student-centered learning, defined as "…exploring ways to improve student achievement; enhance student and staff skills; access information; create a strong infrastructure; engage the community, and prepare students to be productive citizens, employees, and leaders in the 21 century" (p. 195).

Research Questions 3 and 4

3. What are the prerequisites to implement the ISTE essential conditions for technology integration in the Professional Learning Communities as perceived by the Technology Leadership Network?
4. What are the prerequisites to successfully lead teachers to implement ISTE essential conditions in the Professional Learning Communities as perceived by the Technology Leadership Network?

Delphi Round 2. The top four essential conditions mentioned in Round 1 were used to ask four open ended questions, which led to 32 categories—eight categories under each domain of the essential conditions. This produced qualitative data.

The prerequisites necessary to create a shared vision consisted of these eight categories: (a) awareness, (b) clarity, (c) consensus, (d) conviction, (e) informed stakeholders, (f) knowledge, (g) resources, and (h) support.

Attributes of empowered leaders led to the following categories: (a) delegate, (b) inclusive, (c) innovative and creative, (d) knowledgeable, (e) resolute, (f) resourceful, (g) skilled communicator, and (h) trusting.

Factors promoting ongoing professional learning consisted of the following categories: (a) best practices, (b) creativity, rethinking, and openness to learn, (c) empowered leadership, (d) incentives and recognition, (e) resources and support, (f) scheduled time, (g) sharing best practices, and (h) SMART goals.

The categories for measures to ensure focus on student centered learning were: (a) data driven, (b) follow up, (c) research based, (d) role of district technology leaders and administration, (e) shared resources, (f) SMART goals, (g) student centered technology tools, and (h) teachers as facilitators.

These categories under each domain of essential conditions were extracted from the expert panels' open ended responses. The detailed responses were coded and, important themes were highlighted to create the categories. The subcategories were compressed under similar categories to narrow the findings.

Research Question 5

5. What increases the effectiveness of implementing ISTE essential conditions for technology integration in the Professional Learning Communities as perceived by the Technology Leadership Network?

Delphi Round 3. In Round 3, the categories under each domain were ranked on the scale of 1-10, generating quantitative data. Under prerequisites necessary to create a shared vision, the top three rated categories were:

- resources, support
- clarity
- awareness

Resources repeatedly surfaced in the literature review. Resources and scarcity of resources was a main issue that was perceived to hinder technology integration. In this study, expert panelists identified resources as a prerequisite for shared vision, but they did not rank it high enough to be recognized as an essential condition for technology integration. Providing support was considered integral for school improvement, so the research findings supported the literature review in this regard. Clarity and awareness, although a new finding in Round 2, was considered vital for shared vision in Round 3.

For attributes of empowered leaders, the top ranked categories are as follows:

- trusting
- inclusive
- resolute, knowledgeable, skilled communicator

Trust was identified as one of the top rated attributes of empowered leaders. Trust was also acknowledged in the literature review as a significant component of effective teams and decision making processes. The expert panel's identifying trust as a top ranked attribute of empowered leaders confirmed the literature review findings. Although inclusive, resolute, knowledgeable, and skilled communicator were introduced

for the first time during this research in Round 2, those attributes were identified as two of the top ranked attributes for empowered leaders.

The top three categories for factors promoting ongoing professional learning were:

- creativity, rethinking, and openness to learn
- resources and support, sharing best practices, best practices
- scheduled time

It is interesting to note that creativity was recognized in the literature review, but rethinking and openness to learn were new terms the expert panelists introduced. Sharing best practices and best practices emerged as new categories even though practices was mentioned in the literature review while discussing PLCs, collaboration, decision making, and technology integration. Also, scheduled time was a new category the expert panelists introduced in Round 2, despite the fact that time was a significantly used term during the literature review.

For measures to ensure focus on student centered learning, the top ranked categories were:

- teachers as facilitators
- role of district technology leaders and administration
- student centered technology tools

Teachers as facilitators was also a new term introduced in this research in Round 2, and it ranked highest in Round 3. However, the role of teachers and administrators surfaced numerous times in the review of literature. Students were mentioned throughout chapter 2, although student centered technology tools emerged as a new category that the

expert panel introduced in Round 2, and it ranked as one of the highest categories in Round 3.

Unexpected Findings

Based on the ISTE, out of 14 essential conditions to effectively integrate technology for learning, two important essential conditions are consistent and adequate funding and technical support. These two essential conditions are commonly considered integral in educational settings for technology integration, but expert panelists did not form the same opinion in Round 1. This seemed unusual at the time; however, in Round 2, resources and support emerged as integral themes. This clarified the notion that resources and support are important, but as preconditions or prerequisites for technology integration and not as essential conditions.

Conclusions

This Delphi study was designed to identify the essential conditions (ISTE) required for technology integration in PLCs for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by members of the joint TLN of the RCOE and SBCOE, which are both in California.

This research unveiled that shared vision, ongoing professional learning, empowered leaders, and student-centered learning are the most significant top four essential conditions necessary for technology integration in PLCs. The top three ranked prerequisites for the four identified essential conditions are presented in table 19.

Table 19

Four Top Rated Essential Conditions and Their Three top Rated Preconditions

Essential Conditions	Preconditions		
	Ranked First	Ranked Second	Ranked Third
Shared Vision	Resources Support	Clarity	Awareness
Ongoing Professional Learning	Creativity, Rethinking, and Openness to Learn	Resources and Support	Sharing Best Practices, Best Practices,
Empowered Leaders	Trusting	Inclusive	Resolute, Knowledgeable, Skilled Communicator
Student Centered Learning	Teachers as Facilitators	Role of District Technology Leaders and Administration	Student Centered Technology Tools

1. For shared vision, it is paramount to (a) have sufficient resources for technology integration, (b) ensure that technology is relevant, (c) have ongoing support for teachers, (d) have clarity of vision and mission of the organization in reference to technology, and (e) possess awareness of PLCs' needs and requirements.
2. For ongoing professional learning, the required prerequisites for technology integration were (a) creativity and innovation, (b) rethinking and openness to learn new skills, (c) resources to support professional learning, (d) teacher leaders practicing best practices, and (e) sharing best practices.
3. The following attributes of empowered leaders emerged: they trust their peers, they are inclusive and share their power, they are resolute in their decisions for

the greater good of their people, they display organization and technology integration, they are knowledgeable, and they are skilled communicators.

4. Achieving student centered learning necessitates that (a) teachers take the role of facilitators, (b) the role of district technology leaders and administration is identified in making integral decisions, and (c) student centered technology tools are identified and adopted as needed.

Implications for Action

A transformational change plan is recommended as a result of the research findings. The experts in the field of technology and education affirmed the ISTE essential conditions required for technology integration, and now it is crucial to use the findings from this Delphi study to leverage technology integration in educational settings. The transformational change plan for technology integration consisting of four stages was constructed to incorporate the four top-rated essential conditions in PLCs and to add other essential conditions as needed. To implement the ISTE essential conditions, a rain drop-ripple effect change model was designed and will be used. This change model is based on the notion that a single drop of rain may start a ripple effect, creating concentric circles rippling out of the locus point; a need for transformation can be a single drop of rain initiating a cycle of change. This change model is appropriate if the intended purpose of the change is to amplify and be ongoing. The rain drop-ripple effect change model consists of the following six phases; see figure 1 for a visual representation:

Rudimentary-Phase 1: Need for change is realized

Inference-Phase 2: A dynamic specific change is identified

Progression-Phase 3: Strategic plan is laid out and change is introduced

Presentation-Phase 4: The change plan is initiated and roles are assigned

Leverage-Phase 5: Change is tracked, monitored, and supported

Explicit-Phase 6: Divergent behaviors are explicitly sought, course corrections are applied

Figure 1. Rain Drop-Ripple Effect Change Model

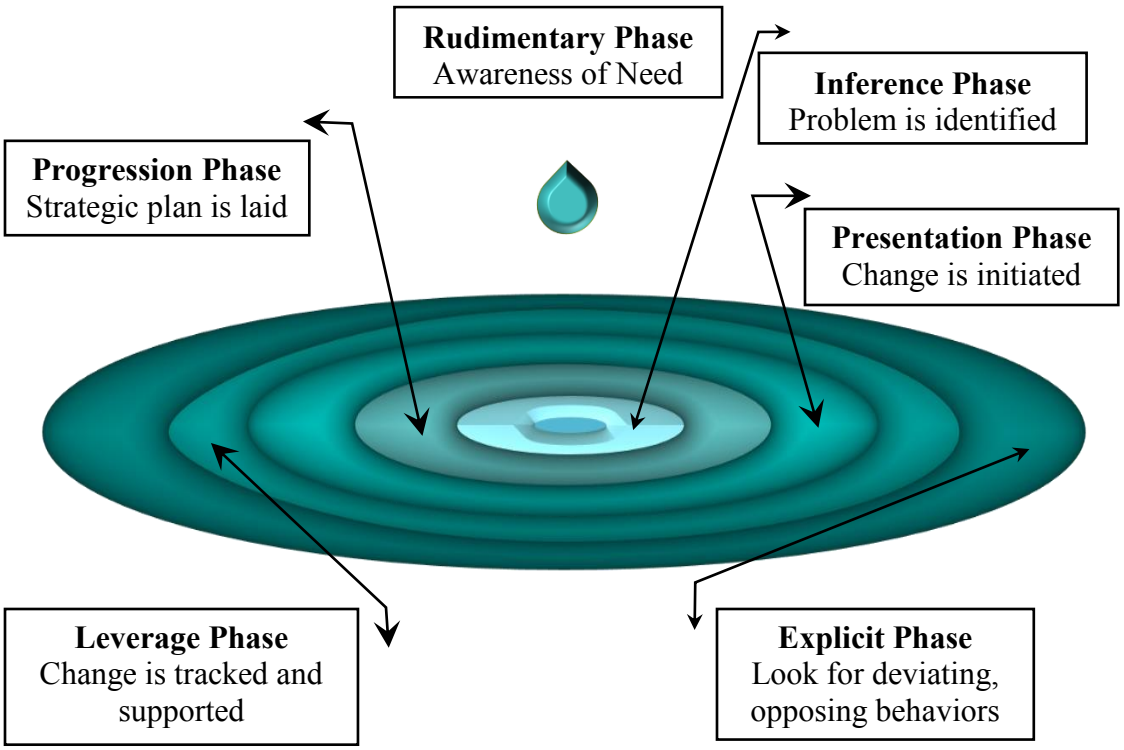

Figure 1 visually represents all six phases of the change model: rudimentary, inference, progression, presentation, leverage, explicit.

Rudimentary-Phase 1

A need for change is realized, like a first drop of rain, and a necessity for technology integration in PLCs is felt. Common Core State Standards and Smarter Balanced Assessments are acknowledged as change drivers.

Inference-Phase 2

In the inference phase, a first of the concentric ripple of change rippling out of the locus point, a dynamic change identified as a shared vision for technology integration is recognized, and awareness is created through appreciative inquiry, need assessment surveys, and internal and external scans. Common Core State Standards and Smarter Balance Assessment Consortium requirements serve as change drivers. Required initiatives and layered activities based on the essential conditions and preconditions that the expert panelists identified are outlined in the following figure.

Figure 2. Implementation Strategies for a Shared Vision

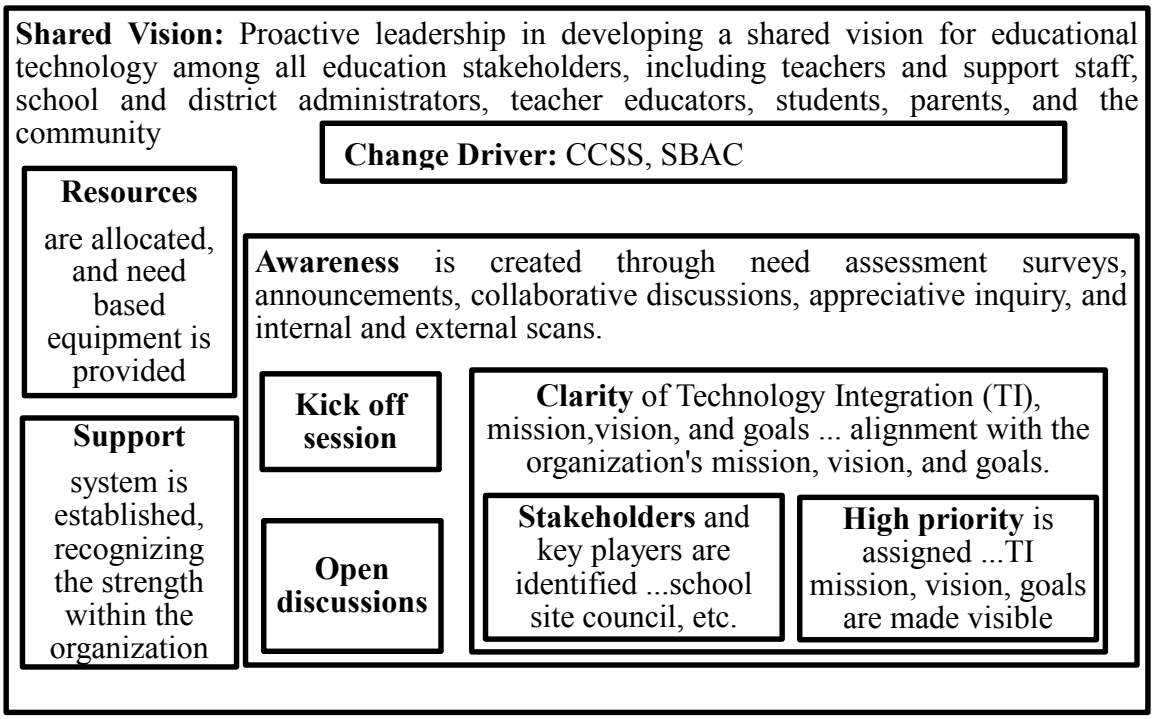

Figure 2 details the components of the strategies for implementing a shared vision.

Perception-Phase 3

The perception phase is essential for establishing the foundation for the change plan. In this phase, the strategic plan is laid out, concentric ripples start forming and

spreading out, and change is introduced. The emphasis is on ongoing professional learning, and creativity, rethinking, and openness to learning is welcomed. A think-tank is established for ongoing innovation and invention and for generating creative ideas. Non-traditional professional development plans such as flipped professional development are introduced (see figure 3)

Figure 3. Implementation Strategies for Ongoing Professional Learning

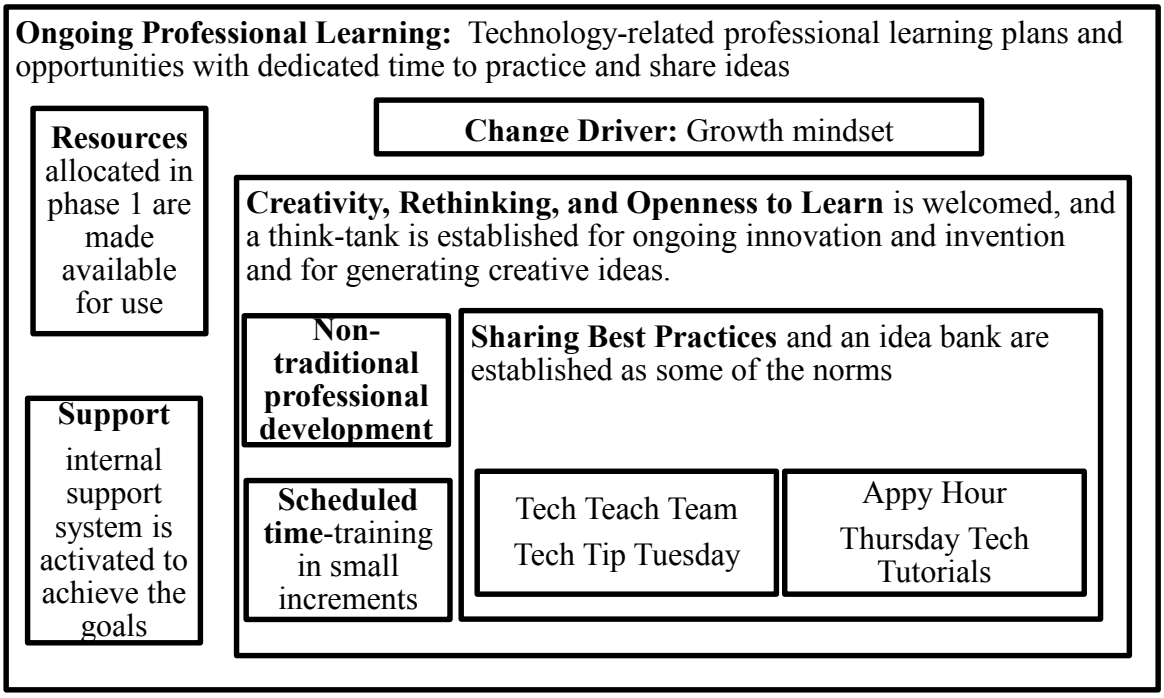

Figure 3 displays the specific strategies that can lead to implementing ongoing professional learning in PLCs.

Presentation-Phase 4

The change process is initiated, ripple effect of change spreads out, and roles are assigned in the presentation phase. In addition, teachers are empowered with leadership roles, and team building activities are introduced to build an effective and strong team. A trusting and inclusive environment is created for building effective teams, promoting collaboration, and decision making. A communication plan is discussed and

implemented, internal and external scans are initiated, and collaborative discussions are encouraged (see figure 4)

Figure 4. Implementation Strategies for Empowered Leaders

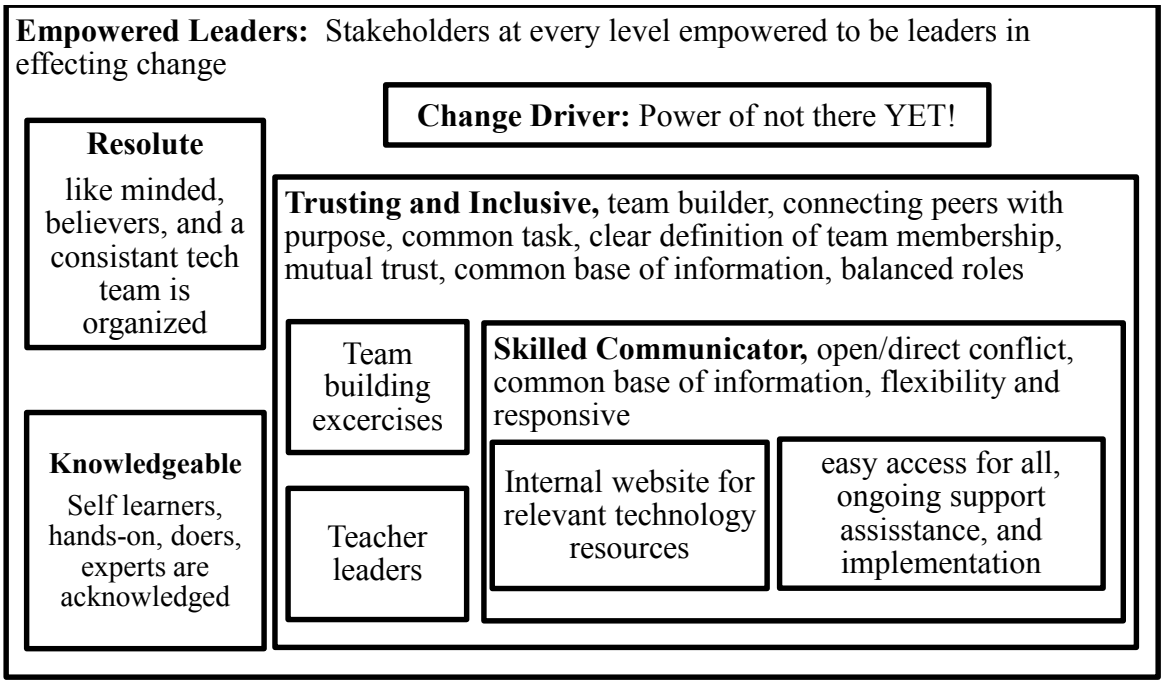

Figure 4 details the steps to implement strategies that produce empowered leaders.

Leverage-Phase 5

The leverage phase focuses on tracking the progress, supporting the empowered leaders, and monitoring the change. The main purpose is to determine if the planning, teaching, and assessment are centered on the needs and abilities of students. The role of district technology leaders and administration is crucial in this phase. Identifying the political power of, forming alliances, support, coalitions, and connections with, and recognizing and mitigating outside forces are also critical (see figure 5).

Figure 5. Implementation Strategies for Student Centered Learning

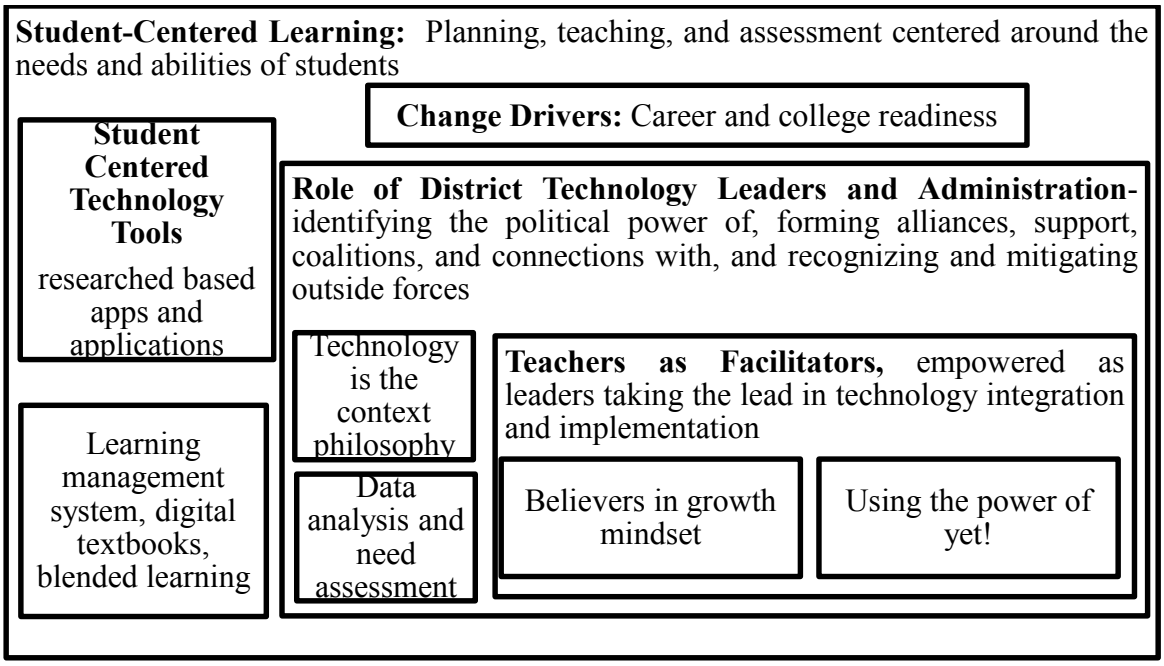

Figure 5 illustrates the specific steps the model advises to ensure student centered learning in PLCs.

Explicit-Phase 6

Looking for deviating, opposing behaviors, and course corrections are the key components of this phase. This phase provides the opportunity to go back and review the last five phases and analyze if the change plan was able to create a shared vision amongst the team members. This phase also affords the opportunity to assess if ongoing professional learning is foremost for the team, if the leaders are empowered at all levels, and if the change is centered on student success. Explicit measures must be taken to ensure that the team is moving in the right direction.

Four Initiators of Change Model and Primary Effect Analysis. In phase 6, it is also important to analyze why the change was successful or why it failed. To analyze the primary effect of the change, four initiators of the change are suggested.

1) **Crown Formation.** When a rain-drop hits a water surface, sometimes it creates a large splatter due to its high velocity. It is called crown formation. It is an instantaneous impact and may not last long. Similarly, a change might be an instantaneous success when introduced, but it may or may not last depending on the internal and external factors of an organization. Change leaders need to be aware of the environment and the factors impacting the change.

2) **Multiple Ripple Effect.** In educational settings, usually multiple projects and changes are taking place, similar to multiple rain-drops and multiple ripples on the surface of the water. A change leader not only needs to be aware of all these changes but must also consider the impact of these changes on the transformational change plan. Too many changes happening at the same time might negatively affect the advocated change and actually terminate it.

3) **Pot/Potter Wheel Formation.** Rain-drops falling at the right velocity coupled with water with the right surface tension form a shape on the surface of the water that looks like a pot. When the change is well thought, it is just like the process of pot being formed on a potter wheel. Even if the change is not successful at the first attempt, it will be an ongoing process. A change leader, like a good potter, will keep on shaping the pot until the organization reaches the desired state.

4) **Back-jet Effect.** When the surface tension of the water is strong, it stretches up, captures the rain-drop, and will bring it down. It is called back-jet effect. With the implemented change, this will be the most common effect in school districts and schools where educators have strong negative opinions and voices about the change. The negativity can be prevalent enough to bring the change down with it.

In such cases, change leaders need to establish a strong foundation before they introduce a change.

Recommendations for Further Research

Recommendations for further research entail answering the following questions:

1. What are some of the major hindrances to technology integration in PLCs?
2. What are some of the major issues hindering technology integration inside a classroom?
3. What is the role of teacher leaders in accelerating technology integration inside a classroom?
4. What are the roles of the district and school leaders in technology integration in PLCs and classrooms?
5. What measures are necessary to facilitate a smooth integration of technology in a classroom?
6. How can a technology integrated (flipped) professional development model be implemented in a traditional PLCs?
7. What are some of the fundamental changes that need to be in place to integrate technology in an educational organization?
8. How can ISTE standards for administrators, teachers, and students leverage technology integration in 21st century classrooms?
9. What are the implications of the ISTE standards in 21st century blended learning classrooms?
10. What is the role of technology coordinators and technology coaches in creating an environment conducive for technology integration?

11. Is there a significant difference in technology integration in Professional Learning communities at elementary, middle, and high school levels?

Concluding Remarks and Reflections

Twenty-first century schools, classrooms, and professional developments are interwoven with one common theme: technology. Technology is not a separate component of PLCs or classroom instruction anymore but is embedded in collaborative activities and in daily lesson planning. New learning paradigms require that infused context, teaching, learning, curriculum, and digital technology be embedded together. Learning is not restricted to traditional textbooks, the four walls of classrooms, a six period schedule, and/or eight hours of a school day (Talbert, 2015). Talbert stated that technology is a context we are living in; it is not only a tool any more.

Technology integration in education is an enormous change, a bequest of the 21st century, and is here to stay. ISTE standards provide recommendations and guidelines for administrators, teachers, and students, and they also provide essential conditions that offer necessary guiding principles to create a strong infrastructure to leverage technology in academic organizations. Technology integration is indispensable for PLCs to build effective teams, collaboration, and decision making; however, it is not possible unless PLCs have a deliberate shared vision, embedded ongoing professional learning, empowered leaders at all levels, and data driven student centered learning.

A shared vision cannot merely be a written statement in the organization's documents and displayed on its walls and websites. A shared vision must be mutually agreed-upon beliefs that effective teams practice without any effort on a daily basis. Ongoing professional learning must happen naturalistically as well, during

collaborations, discussions, meetings, and daily conversations and in libraries, staff lounges, and classrooms. A forum to share their thoughts freely without ramifications transforms the teachers into empowered leaders. If the focus is student centered learning, then it is imperative that data driven decision making processes are emphasized, which will prepare students for college and for their careers. The prerequisites for essential conditions, if addressed properly, can provide the strong foundation required for technology integration in PLCs. Yet, the change needs to come within one's self, and educators as lifelong learners are the right people to integrate this change.

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APPENDICES

Appendix A

Connected learning.**Connected world.**

March 3, 2015

Amna Ahmad
Doctoral Candidate
Brandman University, Irvine
22787 Mesa Springs Way
Moreno Valley, CA 92557
aahmad@mvusd.net

Dear Ms. Ahmad:

Thank you for your request for permission to use the ISTE Standards Essential Conditions for your doctoral and academic research for Brandman University.

We are pleased to grant you permission to use the ISTE Standards Essential Conditions under the following terms:

1. This permission allows you to use the ISTE Standards Essential Conditions as requested for your dissertation and in all copies to meet university requirements, including University Microfilms edition.

2. This permission is non-transferable. Though this permissions allows you to use the ISTE Standards Essential Conditions in your research, it does not authorize others to utilize the ISTE Standards Essential Conditions in any projects separate from yours.

3. There will be a standard credit to our material, including the copyright and usage information below.

4. In lieu of a fee please have a copy of your dissertation and any other published research sent to ISTE Attn: Permissions Fulfillment, 180 West 8th Ave. Suite 300 Eugene, OR 97401 (accompanied by a copy of this letter) or in electronic format to Mindy Frisbee, mfrisbee@iste.org.

5. No other rights are granted with this request.

Thank you for your interest in the International Society for Technology in Education. Please don't hesitate to contact me if you have any questions.

Sincerely,
Sarah Stoeckl
International Society for Technology in Education

Appendix B

Letter to Director of Technology Riverside

RE: Permission to Conduct Delphi Research Study Using Technology Leadership Network

Dear Mr. Large:

I am writing to request permission to conduct a research study at Riverside County Office of Education using its Technology Leadership Network. I am currently enrolled in the Doctorate of Education in Organizational Leadership at Brandman University in Irvine, CA, and am in the process of writing my doctorate research. The study is entitled Teachers Perception of Integration of Technology in Professional Learning Communities.

I hope that the RCOE administration will allow me to recruit members of TLN for my research. If approval is granted, participants will complete the survey for initial selection round. Based on their responses twelve to twenty five PLN members will be contacted to participate in three rounds of Delphi Study, each round consisting of three to four open ended/Likert scale question. It should not take more than twenty minutes to answer the questions.

The survey results will be compiled for the dissertation and individual results of this study will remain absolutely confidential and anonymous. Should this study be published, only compiled results will be documented. No costs will be incurred by either RCOE or the individual participants.

Your approval to conduct this research will be greatly appreciated. I will follow up with a telephone call next week and would be happy to answer any questions or concerns that you may have at that time. I am also willing to meet at your convince.

You may contact me at my email address: [redacted] My cell phone # is [redacted]

Thank you,

Amna Ahmad

Appendix C

Abstract Send to Research Participants

Abstract of Dissertation

A Delphi Study: Technology Leadership Network's Perceptions of Essential Conditions for Technology Integration in Professional Learning Communities

By Amna Ahmad

Purpose: The purpose of this Delphi study is to identify the essential conditions (ISTE) required for technology integration in Professional Learning Communities for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by members of the joint Technology Leadership Network of the Riverside County Office of Education and San Bernardino County Superintendent of Schools, California.

Methodology: A Delphi Study will be conducted to collect the experts' opinion of the members of the Technology Leadership Network in Riverside County Office of Education. This Delphi study is designed to thoroughly examine the essential conditions of technology that help teachers work in PLCs by collaborating as effective teams. For the purpose of Delphi study, a three round electronic survey will be conducted to collect Technology Leadership Network members' perceptions of the ISTE essential conditions required for technology integration in Professional Learning Communities for building effective teams, promoting collaboration, and endorsing shared decision making processes.

Your Role: I am inviting you to participate in three rounds of scaled and open ended online questionnaires as a part of Delphi study during the month of November and December 2014. Each round will take approximately 15-20 minutes to complete. Rounds will be administered in increments of 7-10 days. You will have the opportunity to respond to each round at your own convenience during the designated time. Participants will be offered $10 optional gift card at the end of the third round of Delphi Study. You may elect to accept or to reject the $10 gift card if you so choose. I am requesting you to follow the given link and submit your name, email, and information relevant to your experiences in an intake survey.

http://goo.gl/forms/3B47M1klqU

Appendix D

Letter of Invitation to Research Participants

Participation and Information Request to Technology Leadership Network Members

I am a doctoral candidate at Brandman University, Irvine in Organizational Leadership in Education and employed at the Moreno Valley Unified School District. I am conducting a Delphi research study to identify the essential conditions (ISTE) required for technology integration in Professional Learning Communities for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by members of the joint Technology Leadership Network of the Riverside County Office of Education and San Bernardino County Superintendent of Schools, California.

I am inviting you to participate in three rounds of scaled and open ended online questionnaires as a part of Delphi study during the month of November and December 2014. Each round will take approximately 15-20 minutes to complete. Rounds will be administered in increments of 7-10 days. You will have the opportunity to respond to each round at your own convenience during the designated time. Participants will be offered $10 optional gift card at the end of the third round of Delphi Study. You may elect to accept or to reject the $10 gift card if you so choose.

To participate in this research, follow the following link and sign up by taking a brief survey: http://goo.gl/forms/VdPHYHKGTu

I am requesting you to follow the given link and submit your name, email, and information relevant to your experiences in an intake survey. If you agree to participate, you will be send an Informed Consent and Research Participant's Bill of Rights accompanied with a first round of survey. Be assured that your participation will be voluntary and confidential. Teachers', schools', districts', and countys' names will not be reported in the findings.

I would be more than happy to answer any questions. Please contact me at aahmad@mvusd.net or amnakahmad@gmail.com. Your participation and time in this research study is greatly appreciated.

Sincerely,

Amna K Ahmad

Appendix E

Brandman University Institutional Review Board Approval

BRANDMAN University

BRANDMAN UNIVERSITY INSTITUTIONAL REVIEW BOARD

IRB Application Action – Approval

Date: October 11, 2014

Name of Investigator/Researcher: Amna K. Ahmad

Faculty or Student ID Number: _____

Title of Research Project:

A Delphi Study: Technology Leadership Network Perceptions of Essential Conditions for Technology Integration in Professional Learning Communities

Project Type: ☑ New ☐ Continuation ☐ Resubmission

Category that applies to your research:

- ☑ Doctoral Dissertation EdD
- ☐ DNP Clinical Project
- ☐ Masters' Thesis
- ☐ Course Project
- ☐ Faculty Professional/Academic Research
- ☐ Other: _____

Funded: ☑ No ☐ Yes _____
(Funding Agency; Type of Funding; Grant Number)

Project Duration (cannot exceed 1 year): October 11, 2014-March 1, 2015

Principal Investigator's Address: _____

Email Address: _____ Telephone Number: _____

Faculty Advisor/Sponsor/Chair Name: Dr. La Faye Platter

Email Address: _____ Telephone Number: _____

Category of Review:

☐ Exempt Review ☑ Expedited Review ☐ Standard Review

Appendix F

Bill of Rights

BRANDMAN UNIVERSITY INSTITUTIONAL REVIEW BOARD

Research Participant's Bill of Rights

Any person who is requested to consent to participate as a subject in an experiment, or who is requested to consent on behalf of another, has the following rights:

1. To be told what the study is attempting to discover.

2. To be told what will happen in the study and whether any of the procedures, drugs or devices are different from what would be used in standard practice.

3. To be told about the risks, side effects or discomforts of the things that may happen to him/her.

4. To be told if he/she can expect any benefit from participating and, if so, what the benefits might be.

5. To be told what other choices he/she has and how they may be better or worse than being in the study.

6. To be allowed to ask any questions concerning the study both before agreeing to be involved and during the course of the study.

7. To be told what sort of medical treatment is available if any complications arise.

8. To refuse to participate at all before or after the study is started without any adverse effects.

9. To receive a copy of the signed and dated consent form.

10. To be free of pressures when considering whether he/she wishes to agree to be in the study.

If at any time you have questions regarding a research study, you should ask the researchers to answer them. You also may contact the Brandman University Institutional

Review Board, which is concerned with the protection of volunteers in research projects. The Brandman University Institutional Review Board may be contacted either by telephoning the Office of Academic Affairs at (949) 341-9937 or by writing to the

Vice Chancellor of Academic Affairs
Brandman University
16355 Laguna Canyon Road
Irvine, CA, 92618

Appendix G

Informed Consent Form

BRANDMAN UNIVERSITY
16355 LAGUNA CANYON ROAD
IRVINE, CA 92618

Principal Investigator: Amna K. Ahmad

Background:
You are being invited to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please take the time to read the following information carefully. Please ask the researcher if there is anything that is not clear of if you need more information.

Purpose of Study:
The purpose of this Delphi study is to identify the essential conditions (ISTE) required for technology integration in Professional Learning Communities for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by members of the joint Technology Leadership Network of the Riverside County Office of Education and San Bernardino County Superintendent of Schools, California.

Study Procedure:
Your expected time commitment for this study is:
10-20 minutes based on expert panel response time

Stage One:
a) First round of electronic questionnaire will require the participants to rate the level of importance of essential conditions required for technology integration.

Stage Two:
a) Second round of open ended research questions will be based on the responses collected from round one. It will require of participants to type in their answers.

Stage Three:
a) Third round of electronic questionnaire will require the participants to rate the level of importance of the findings in round two.

Risks:
The risks of this study are minimal. The identity of all participants will be anonymous and secure. Only email addresses of participants will be required for electronic survey.

Benefits:
Participants may be benefit from $10 electronic gift card. The information obtained from this study may help the educators, schools, and school districts to select the suitable technology methods and essential conditions to integrate technology in their Professional Learning Communities. It may also help the schools, and school districts to introduce the essential conditions to support the integration of technology in their organizations.

Confidentiality:
For the purposes of this Delphi study your comments will be anonymous and only visible to the researcher. Every effort will be made by the researcher to preserve your confidentiality.

Notes, interview transcriptions, and transcribed notes and any other identifying participant information will be kept in an electronic folder and personal possession of the researcher. When no longer necessary for research, all materials will be deleted.

The researcher and the members of the researcher's committee will review the researcher's collected data. Information from this research will be used solely for the purpose of this study and any publications that may result from this study.

Participants may decline to answer any or all questions and they may terminate their involvement at any time if you choose. If the study design or the use of the data is to be changed, participants will be so informed and may consent re-obtained.

Person to Contact:
Should you have any questions about the research or any related matters, please contact the researcher at amnakahmad@gmail.com.

Institutional Review Board:
If you have questions regarding your rights as a research subject, or if problems arise which you do not feel you can discuss with the Investigator, please contact the

Brandman University
Institutional Review Board Office,
Executive Vice Chancellor of Academic Affairs,
16355 Laguna Canyon Road,

Irvine, CA 92618
(949) 341-7641

Voluntary Participation:
Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you do decide to take part in this study, you will be asked to sign a consent form. If you decide to take part in this study, you are still free to withdraw at any time.

Unforeseeable Risks:
There may be risks that are not anticipated. However every effort will be made to minimize any risks.

Costs to Subject:
There are no costs to you for your participation in this study

Compensation:
As an incentive for time in completing the three-round questionnaires the participants may expect a $10 gift card. Additionally, participants will be provided research study findings regarding essential conditions necessary for technology integration.

Consent:
By checking yes in this form, I confirm that I have read and understood the information and have had the opportunity to ask questions (You do not need to print and sign the form. Checking yes will be suffice as your informed consent). I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form (you may print this page for your record). I voluntarily agree to take part in this study.

Appendix H

Delphi Study Round-one Questionnaire

Google Forms URL: http://goo.gl/forms/A2C6DE59bB

A Delphi Study: Technology Leadership Network's Perceptions of Essential Conditions for Technology Integration in Professional Learning Communities

Delphi Study Round-one Questionnaire

Instructions: In the first round of this Delphi study, the fourteen essential conditions outlined by International Society for Technology in Education (ISTE) provide the standardized baseline for the question.

This round ask the participants to determine the degree of importance of the essential conditions listed. Each essential condition is stated as defined by ISTE. It is up to participants to rate the essential conditions based on their perceptions. Although all essential conditions may appear to be extremely important, participants' rating will determine the most important essential conditions necessary for technology integration in Professional learning Communities.

Round-one Question: On a scale of 1-10 and 10 being extremely important, which of the following ISTE essential conditions need to be in place for technology integration and to promote its use in Professional Learning Communities for building effective teams, supporting collaboration, and endorsing shared decision making processes?

1.Shared Vision*Required

Proactive leadership in developing a shared vision for educational technology among all education stakeholders, including teachers and support staff, school and district administrators, teacher educators, students, parents, and the community

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

2. Empowered Leaders*Required

Stakeholders at every level empowered to be leaders in effecting change

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

3. Implementation Planning*Required

A systemic plan aligned with a shared vision for school effectiveness and student learning through the infusion of information and communication technology (ICT) and digital learning resources

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

4. Consistent and Adequate Funding*Required

Ongoing funding to support technology infrastructure, personnel, digital resources, and staff development

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

5. Equitable Access*Required

Robust and reliable access to current and emerging technologies and digital resources, with connectivity for all students, teachers, staff, and school leaders

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

6. Skilled Personnel*Required

Educators, support staff, and other leaders skilled in the selection and effective use of appropriate ICT resources

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

7. Ongoing Professional Learning*

Technology-related professional learning plans and opportunities with dedicated time to practice and share ideas

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

8. Technical Support* Required

Consistent and reliable assistance for maintaining, renewing, and using ICT and digital learning resources

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

9. Curriculum Framework*Required

Content standards and related digital curriculum resources that are aligned with and support digital age learning and work

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

10. Student-Centered Learning*Required

Planning, teaching, and assessment centered around the needs and abilities of students

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

11. Assessment and Evaluation*Required

Continuous assessment of teaching, learning, and leadership, and evaluation of the use of ICT and digital resources

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

12. Engaged Communities*Required

Partnerships and collaboration within communities to support and fund the use of ICT and digital learning resources

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

13. Support Policies*Required

Policies, financial plans, accountability measures, and incentive structures to support the use of ICT and other digital resources for learning and in district school operations

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

14. Supportive External Context*Required

Policies and initiatives at the national, regional, and local levels to support schools and teacher preparation programs in the effective implementation of technology for achieving curriculum and learning technology (ICT) standards

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Appendix I

Delphi Study Round-two Questionnaire

http://goo.gl/forms/g2Gf4Oh1Ic

A Delphi Study: Technology Leadership Network's Perceptions of Essential Conditions for Technology Integration in Professional Learning Communities

Delphi Study Round Two Questionnaire

Instructions: Based on the round one responses, the four top rated ISTE essential conditions for the technology integration in Professional Learning Communities for building effective teams, collaboration, and shared decision making are as follow:

1) Shared Vision: Proactive leadership in developing a shared vision for educational technology among all education stakeholders, including teachers and support staff, school and district administrators, teacher educators, students, parents, and the community

2) Ongoing Professional Learning: Technology-related professional learning plans and opportunities with dedicated time to practice and share ideas

3) Empowered Leaders: Stakeholders at every level empowered to be leaders in effecting change

4) Student Centered Learning: Planning, teaching, and assessment centered around the needs and abilities of students

It is important to identify the prerequisites, attributes, factors, and measures necessary to implement these essential conditions for technology integration in Professional Learning Communities.

As an expert in your field, please respond to these four open-ended questions and explain your perception of prerequisites, attributes, factors, and measures integral for technology

integration in Professional Learning communities. Essential condition and terms are defined for each question.

1) What prerequisites are necessary to create a Shared Vision for technology integration in Professional Learning Communities?*Required

A Prerequisite is defined as something that you officially must have or do before you can have or do something else (Merriam-Webster, 2014).

2) What are the attributes of Empowered Leaders that support technology integration in Professional Learning Communities?*Required

An attribute is defined as to consider as a quality or characteristic of the person, thing, group (Dictionary.com, 2014).

3) What factors promote Ongoing Professional Learning for technology integration in Professional Learning Communities?*Required

A factor is defined as something that helps produce or influence a result: one of the things that cause something to happen (Merriam-Webster, 2014).

4) What measures must be taken to ensure that the technology integrated into Professional Learning Communities is focused on Student-Centered Learning?*Required

Measures is defined as a plan or course of action taken to achieve a particular purpose (Oxforddictionaries.com, 2014).

Appendix J

Delphi Study Round-three Questionnaire

A Delphi Study: Technology Leadership Network's Perceptions of Essential Conditions for Technology Integration in Professional Learning Communities

Delphi Study Round-three Questionnaire

Instructions: In the first round of this Delphi study, the fourteen essential conditions outlined by the International Society for Technology in Education (ISTE) provide the standardized baseline for the question.

In round-two, we narrowed down to ISTE's four essential conditions and looked into the prerequisites for Shared Vision, attributes of Empowered Leaders, factors promoting Ongoing Professional Development, and measures necessary for Student Centered Learning.

Round-three is based on your expert opinion and your cumulative responses. This round is designed after analyzing and coding the collected data and based on emerging themes. In this round you will rate the eight emerging themes under prerequisites, attributes, factors, and measures identified for each top-rated ISTE essential condition in round two.

Based on your responses, emerging themes are categorized and are defined for clarity using words frequently used in organizational and educational settings. Although all prerequisites, attributes, factors, and measures are equally important, rank them on the scale of 1-10 based on your perception and understanding. Thank you

Round-Three Question

On a scale of 1-10, rate the effectiveness and benefits of the prerequisites, attributes, factors, and measures identified for each top-rated ISTE essential condition in round two

for building effective teams, promoting collaboration, and endorsing shared decision making processes as perceived by Technology Leadership Network.

On a scale of 1-10, rate the effectiveness and benefits of the prerequisites necessary for Shared Vision for Technology Integration

Awareness*Required

A minimal awareness of what is possible for technology integration, an overview or professional development seminar to highlight the best practices in technology integration.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Clarity*Required

Clear goals and guidelines, understanding of the vision and needs, a system to adopt unified strategies through PLCs.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Consensus*Required

An agreement that technology is a required component, must be done well to give student the best educational experience possible.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Conviction*Required

A belief that all teachers can learn and use technology, would need access to the technologies, extensive training, scheduled time for independent learning.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Informed Stakeholders*

Required

Informed stakeholders with agreed upon definitions of integration, an understanding of the importance of technology integration (from a learner's perspective).

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Knowledge*Required

Knowledge and understanding of how to use the technologies, how to apply any protocols for using the technologies, Teachers must feel confident and competent enough to use new technology effectively and frequently.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Resources*Required

A commitment from the leaders, to fund technology integration adequately.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Support*Required

School wide support, trust, consensus, established regular communication between the stakeholders, Respecting everyone's voices and opinions.

1	2	3	4	5	6	7	8	9	10

least important	○	○	○	○	○	○	○	○	○	○	extremely important

On a scale of 1-10, rate the effectiveness of the Attributes of Empowered Leaders Supporting Technology Integration.

Delegate*Required

Empowered Leaders make and implement plans, assist others with plan implementation.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Inclusive*Required

Respect, create collaborative environment, creativity, innovators, open minded, coach attitude, permissive attitude to support exploration and innovation, create opportunities to share and learn from others, inclusiveness, and flexibility are their attributes.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Innovative and Creative*Required

Empowered Leaders come up with creative solutions, chart new territories, and pilot innovative technology integration within their environment. Willingness to pioneer with their own tech learning and the willingness to find ways to support the pioneers on their staff.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Knowledgeable*Required

They are trusted leaders, well informed via current research and practice, knowledge of up to date best practices in technology and PLC practices.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Resolute*Required

Leaders must be able to clear the technical, monetary, social, and emotional road blocks and marshal the resources needed to support technology integration, willing to take risks, a solid direction.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Resourceful*Required

An extended shared vision built by the PLCs, see and understand the big picture, a mental picture of the types of activities and learning experiences that are possible, the plan is feasible.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Skilled Communicator*Required

The ability to communicate and share their vision, skilled communicators and professional development specialist.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Trusting*Required

They have a belief that all teachers can learn and become confident and competent, that technology is not a replacement to teacher instruction, rather a tool to aide instruction, the created vision is based on the input and discussions.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

On a scale of 1-10, rate the effectiveness of the Factors Promoting Ongoing Professional Learning for Technology Integration.

Best Practices*Required

Ongoing and clear communication, Professional norms of behavior, continued professional development...technology shifts so quickly, it's important to keep abreast of best practices of technology available.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Creativity, Rethinking, and Openness to Learn*Required

Hands-on, perceived needs to use a tool to enhance job tasks, require creativity and rethinking of what students are capable of, ability to be vulnerable and accepting that you might not know everything and openness to learn from others.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Empowered leadership*Required

Having a "technology integration specialist" role for a member of the PLC would promote ongoing professional learning for technology integration within the PLC. Relevant and driven by teacher and student needs.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Incentives and Recognition*Required

Incentives work best, those participating must be recognized for their participation, their enthusiasm. It should not just be expected of them.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Resources and Support*Required

This includes adequate funding support, teacher support, equipment, plentiful opportunities for practice and reflection, access to new resources, budget and leadership to go along with the shared tech vision.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Scheduled Time*Required

A key factor is scheduling the time for teachers to play with new technology and integrate into lesson plans, a structure within the school that allows for ongoing collaboration and communication.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Sharing Best Practices*Required

Systems for sharing best practices such as "appy hour, tech Tuesdays", etc., promoting the use of technology, willingness to explore the use of technology by the PLC group.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

SMART Goals*Required

A supporting factor would be for the PLC to set a SMART goal for technology integration, promoting an ongoing, meaningful focus on technology integration within the PLC.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

On a scale of 1-10, rate the effectiveness of the Measures for Technology Integration focused on Student Centered Learning.

Data Driven*Required

PLC time should be focused on student achievement results and data, with all PLC work focused on improving student learning. Metrics need to be in place. Careful consideration must be in place to determine the social economic factors and language barriers that may be in place. Use data to see what is working for student learning.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Follow Up*Required

Planning and follow-up, following the plan, the lesson/plan and outcome should be presented to the team for analysis of what went right, what went wrong, examine the outcomes of the experienced, what need to be done differently next time.

1	2	3	4	5	6	7	8	9	10

least important	○	○	○	○	○	○	○	○	○	○	extremely important

Research Based*Required

Design curriculum and technology integration around research based practices, provide improved access to technology for all students, provide ongoing professional development, keeping clear what the standards and learning objectives are trying to accomplish, reviewed by curriculum and technology steering committees.

1 2 3 4 5 6 7 8 9 10

least important	○	○	○	○	○	○	○	○	○	○	extremely important

Role of District Technology Leaders and Administration*Required

Buy in from technology district leaders and site administration is essential. They must understand and give tech integration top priority on the campus and follow through to evaluate, redirect and reflect all throughout the process to ensure they stay on course with their vision to stay focused on student-centered learning.

1 2 3 4 5 6 7 8 9 10

least important	○	○	○	○	○	○	○	○	○	○	extremely important

Shared Resources*Required

Require sharing of resources and strategies in grade level teams to increase the bank of possible learning experiences. Open up requirements to allow for options in process and product for students which are made possible by technology.

1 2 3 4 5 6 7 8 9 10

least important	○	○	○	○	○	○	○	○	○	○	extremely important

SMART Goals*Required

The use of SMART goals in the PLC process, serve to focus a PLC's work on technology integration on student-centered learning. The review of student-level data keeping the PLC grounded in meaningful, student-centered learning. Role of administrative leadership is critical for ensuring an appropriate and meaningful focus for the PLC.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Student Centered Technology Tools*Required

Exploring technologies that students can use according to their like, using technologies that promote student collaboration. Adapt student learning to technologies that students are using on a daily basis, using game based technologies, Start exploration of technologies with students in mind.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important

Teachers as Facilitators*Required

Promoting teachers to transition into a facilitator role, Include relevant stakeholders in planning, learning strategies that allow student exploration, relaxing rules on assignments so that students can have more power of choice.

	1	2	3	4	5	6	7	8	9	10	
least important	○	○	○	○	○	○	○	○	○	○	extremely important