AN EXAMINATION OF HOW SCHOOL SITE-BASED PROFESSIONAL LEARNING
COMMUNITIES (PLCS) PROMOTE TECHNOLOGY INTEGRATION IN MIDDLE
SCHOOL SCIENCE CLASSROOMS

by

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ABSTRACT

The purpose of this study was to examine how site-based Professional Learning Communities (PLCs) promote technology integration for middle school science classrooms. It also examined the opinions of instructional coaches as PLC facilitators and teachers regarding PLCs and technology integration by teachers. The conceptual framework for this study focused around Kurt Lewin’s (1951) change management process, changing as three steps (CATS) or functionally known as unfreeze-change-refreeze. The three research questions for the study examined how site-based Professional Learning Communities promote technology integration in the middle school science classroom, instructional coaches’ opinions of how Professional Learning Communities help teachers integrate technology into their curriculum, and teachers’ opinions of how Professional Learning Communities help with technology integration in their curriculum.

The researcher found PLCs to be an effective catalyst in promoting technology integration in the middle school science classroom. Specifically, this study revealed the PLC structure plays an important role in sustainability, and how the process engages teachers in educational initiatives specific to their school and populations. The PLC structure and process directly affected culture and building interpersonal relationships, student learning to help enhance academic progress, and professional learning in providing opportunities for teacher growth and development. This study provides schools interested in installing a PLC insight into process, structure, facilitation, and tools to prepare and support technology integration in classroom instruction.
DEDICATION

In memory of my father

Bruce Bray

You were always my biggest supporter and best friend
You always used your wisdom for good
You were selfless, putting others first, especially me
If I am remembered as being a fraction of the man you were, it would be an honor

I love you dad…
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This process has been such a rewarding experience for me. I have learned so much about myself through this process. I have learned it is okay to put something down, take a breath, and grind it out, gaining knowledge from each decision. I have learned to be thankful. Thankful for the opportunity. Thankful for my amazing chair, Dr. Margaret Rice; her continued guidance and support made me feel more like a family member than another one of her doctoral students. Dr. Vivian Wright, I will never forget the conversation we had walking back from lunch that sparked this journey for me; thank you. Dr. Mayben, you always made the hardest challenges seem easy to overcome through your advice and guidance. Dr. Mendiola, thank you for believing in me from our first encounter. Dr. Benson, thank you for your early guidance, as it helped me stay focused on what was important.

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CHAPTER I

INTRODUCTION

Traditional expectations of students’ engagement can no longer be assumed in today’s classrooms. Students are immersed in technology and media in most aspects of their lives except for the classroom (Lemley, Schumacher, & Vesey, 2014). Students who fill our schools across the country have not lived in a time where email, texting, social media, and the Internet did not exist.

Today’s students—K-12 through college—represent the first generations to grow up with this new technology. They have spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age. (Prensky, 2001, p. 3)

Ironically, if you walk into many of schools in America, you would not see classrooms that reflect these common technology tools that our students generally use every day outside of school (Baylor & Kim, 2008; Cubukcuoglu, 2013; Office of Educational Technology, 2017).

Schools lag behind in technology integration for several reasons, including budget restraints, underdeveloped educational technology training programs, and leadership’s late adoption of technology (Beglau et al., 2011; Lawless & Smolin, 2007; Yu & Okojie, 2017). Although challenges exist, educators’ attention and curiosity for technology integration and instructional technology have fueled an explosion of local, state, and national technology conferences. “Edtech” represents investments of over 2.3 billion dollars from institutional investors such as venture capitalists, angel investors, and philanthropic foundations looking to capitalize on the surge of interest and potential benefits to students K-12 education (EdSurge
Moreover, technology tools that schools can use to promote personal accountability not only allow students to track their progress, but in the K-12 environment, allow parents to become part of their child’s learning through communication and easy online private access of assignments and assessments. Students being aware of expectations and consequences will lead to success and reflection around objectives (Moore, 2013).

Research shows when instructors engage students in K-12 by increasing the use of technology, school discipline problems decrease (Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011). Students who have opportunities to use a device, such as a computer or iPad, have a much deeper information base than students lacking opportunities (Warschauer, 2007).

This ongoing access to tools for gathering and analyzing information brought about five important changes in instruction: It facilitated (1) more just-in-time learning; (2) more autonomous, individualized learning; (3) a greater ease of conducting research; (4) more empirical investigation; and (5) more opportunities for in-depth learning. (Warschauer, 2007, p. 2516)

In addition, digital practices in the classroom create positive social learning opportunities. Students having access to devices supports learning and encourages the important social aspect today’s students gravitate toward. Social interactions foster a stronger cognitive change, allow students to work through conflicts by having multiple points of view, and increase a student’s level of engagement (Goel, Johnson, Junglas, & Ives, 2010). Recent studies point out concerns over the supply of skills, specifically those education-related skills, in the U.S. labor force (Cappelli, 2015).

**Digital Technology is the New Paradigm**

Historically, educational technology has had an adoption problem: the nature of technology requires its users to embrace it in order to realize the benefits it holds. While our society has experienced a technological transformation over the last 30 years, many of our
teachers have not. Tools teachers use in today’s classrooms are roughly the same as those used by who came before them (Cuban, 2001). In 2017, the U.S. Department of Education, Office of Educational Technology’s National Education Technology Plan (NETP) detailed many of the initiatives that call for technology integration. The plan outlines how advanced technologies used in our daily personal and professional lives should be reflected in our educational system as tools for improving student learning, accelerants for quickening the adoption process for effective practices, and creating a focus and standards for using data and information for continuous improvement of student learning (Office of Educational Technology, 2017).

The federal government has enacted several educational initiatives to help strengthen these mandates, including The Every Student Succeeds Act (ESSA), Race to the Top (RTT), The No Child Left Behind Act (NCLB), The Individuals with Disabilities Education Improvement Act (IDEA), and the American Recovery and Reinvestment Act (ARRA), which included the Race to the Top (RTT) Competition (Kennedy & Datnow, 2011). In addition to these federal mandates, teachers are required to address state technology standards, College and Career Readiness Standards (CCRS) Standards, literacy and writing anchor standards, and the World Class Instructional Design and Assessment (WIDA) English Language Proficiency (ELP) standards. AdvancED, one of the largest non-profit educational accreditation organizations in the world, has several requirements for technology outlined in their AdvancED Performance Standards to which schools must adhere to. AdvancED standard 3.5 requires institutions to integrate digital resources into classroom instruction, learning, and operations for the purposes of improving professional practice for teachers, student performance, and organizational effectiveness (AdvancED Education, Inc., 2018).
According to Dede (2007), “The characteristics of students are changing, as their usage of technology outside of academic settings shapes their learning styles, strengths, and preferences” (p. 11). Therefore, the first time a student submits work electronically should not be alongside their first college experience. Creating digital content is an everyday part of many of our students’ lives outside the schoolhouse doors. Our ancestors would be confused with our lifestyles in comparison with theirs. Mitchell (2003) described the lifestyle of our youth today as “electronic nomads wandering among virtual campfires” (as cited in Dede, 2007, p. 13). Our youth of today would “see prior generations as hapless prisoners of geography, trapped in the limits of a single physical location” (Dede, 2007, p. 13).

The idea of integrating technology is not a new one. There have been several new technologies that held promise in changing instructional practices. In 1910, the first school used motion pictures and in 1917 the Chicago schools organized a department exclusive to visual education (Cuban, 1986). On May 25, 1953, KUHY began broadcasting, marking the birth of classroom television (Cuban, 1986). The difference between the promise these early forms of instructional technologies held and current instructional technology expectations of today is the ties they have to policy and legislation. In 1986, Congress asked the Office of Technology Assessment (OTA) to document technology use in schools, thus leading the way to the first large-scale investigation of educational technology and technology integration (Bebell, Russell, & O'Dwyer, 2004). The No Child Left Behind Act of 2001 (Public Law No: 107-110) required all recipients of federal technology grants to invest a minimum of 25% of the awarded funds in professional development related to technology integration (Bebell, O'Dwyer, Russell, & Tao, 2007). In 2010, the Secretary of Education Arne Duncan wrote to the members of Congress to present the nation’s new plan for technology integration:
I am presenting you with the Administration’s National Education Technology Plan, *Transforming American Education: Learning Powered by Technology*. The plan calls for applying the advanced technologies used in our daily personal and professional lives to our entire education system to improve student learning, accelerate and scale up the adoption of effective practices, and use data and information for continuous improvement. (Office of Educational Technology, 2010, p. v)

In 2017, Secretary of Education John King proclaimed the continued expectations on educators in the 2017 National Education Technology Plan Update, in order “to realize fully the benefits of technology in our education system and provide authentic learning experiences, educators need to use technology effectively in their practice” (Office of Educational Technology, 2017, p. 3).

It is important to recognize that teachers possess varying levels of technology skills and knowledge. Because of this, some teachers serve as their local school tech support due to their high level of technology knowledge, while others seek tech support from their peers due to their disinterest in, or lack of, technology knowledge. It is unfair to quantify/qualify teachers on a better/worse scale of technology knowledge without recognizing all teachers have individual strengths and weaknesses, but for the task of integrating technology, it is important to either possess the knowledge, or the drive and time to learn the skills it takes to put technology integration into practice (Ertmer & Ottenbreit-Leftwich, 2010; National Staff Development Council, 2008). Brush and Hew’s (2007) study found teachers would not attempt any activities that involved technology until they participated in basic skill development to build confidence in classroom use.

These requirements on school systems and teachers have put a strain on the ability to stretch human capital and funding resources. This dilemma for training contributes to the continual degradation of one of our most precious educational commodities, time. Educators are required to find the time to incorporate a multitude of new and existing initiatives that are
required of them by a range of educational agencies from the federal government to their local school administration. Because of this, educators are challenged with meeting the demands of curriculum, special education, and ELL standards (Cifuentes, Maxwell, & Bulu, 2011; Collinson & Cook, 2000; Darling-Hammond, 1999; Hsu, 2016).

**Professional Learning Communities (PLCs)**

As educators in the K-12 environment are faced with ever-increasing expectations through various reform efforts, it is important for schools to build a mechanism through which to work. One way leaders help educators work toward this is through professional learning communities. In order to bridge current challenges, school systems have embraced reform, and work hard to build a capacity for on-going teacher professional development (Beavers, 2001). To address various mandates, staff development needs, and local system initiatives, Professional Learning Communities (PLCs) are used by many schools. “The idea of a professional learning community (PLC) is one well worth pursuing as a means of promoting school and system-wide capacity building for sustainable improvement and pupil learning” (Bolam et al., 2005, p. i).

PLCs work hand-in-hand with professional development that is collaborative, facilitated by its members, and focused on classroom strategies while being data driven (DeFour, DeFour, Eaker, Many, & Mattos, 2016). As an educator, it is a great multipurpose way to incorporate the tenets of a good PLC such as shared values and vision, teachers having a collective responsibility for students’ learning, and a place to build trust and respect while supporting each other (Bolam et al., 2005). For the purpose of this study, a PLC is defined as a community of educators who work collaboratively and meet with a common purpose, reflective of the specific needs within their school, to support student learning.
Professional learning communities create an environment to address the demands of a school by designating time specifically for organizational development. Historically, the institution of education from the early 1900s has mimicked industry, even in its formation. The practice of Organization Development (OD) is used in business as a catalyst for change as organizations empower corporate self-development and renewal (Fullan, Miles, & Taylor, 1980). Education began adopting organizational development in the mid-1960s, looking for ways to make organizational improvements. One of the earliest examples of substantive work done for organizational development in schools occurred in 1967 when researchers began working with the University of Oregon to study elementary and middle schools’ work around school change (Fullan et al., 1980). Their research identified several conditions important in the operations of organizational development within the educational environment (Fullan et al., 1980).

Rosenholtz and Simpson (1990) advocated for collaborative teacher development rather than isolated teacher learning. From their perspective, isolation is an impediment to learning and collaboration is a catalyst for shared growth and innovation. The professional learning community construct aids an organization in undergoing change on macro (organization) and micro (strategy or method) levels. The organization creates and shares large scale goals and objectives, with independent schools within the system, and implements a model that is reflective of their working environment. Research concluded that professional development, as part of an overall school reform effort, is more effective than in isolation, such as in a traditional one-time workshop (Darling-Hammond & Richardson, 2009). Having ongoing professional development inside the PLC structure will help overcome barriers to success and contribute to the change process (Fullan, 2007).

When teachers are asked to use technology to facilitate learning, some degree of change is required along any or all of the following dimensions: (a) beliefs, attitudes, or
pedagogical ideologies; (b) content knowledge; (c) pedagogical knowledge of instructional practices, strategies, methods, or approaches; and (d) novel or altered instructional resources, technology, or materials. (Ertmer & Ottenbreit-Leftwich, 2010, p. 258)

Functionally, PLCs have three main purposes: ensuring that students learn, having a culture of collaboration, and focusing on results (DuFour, 2004b). The first purpose, ensuring students learn, puts the focus on learning rather than teaching (DuFour, 2004b). Prior to instruction, teachers focus on what they want students to learn. Teachers dig deeply into instructional practices and strategies, assessment design, lesson planning, and technology integration with their main focus on results. The second purpose, creating a culture of collaboration, supports Rosenholtz and Simpson’s (1990) idea of learning together rather than in isolation. In collaborative teams, teachers learn together and from each other in order to achieve a collective purpose. DuFour (2004b) explained, as teachers work together through questions that promote deeper learning with a focus on results, they are promoting a collaborative culture while creating opportunities to evaluate their effectiveness. This new reflective structure that focuses on improving student outcomes becomes the new standard goal of everyone in the school. In a PLC, teachers participate in a continual cycle where they identify students’ post-instruction achievement levels and work to establish goals to address deficiencies. The benefits of a high functioning PLC only come with high functioning teacher members. Schools do not simply PLC, meaning that a PLC is not a program and cannot be purchased. It is an endless process that can create a lasting impact on the school and the teachers who embrace it (DuFour, DuFour, Eaker, Many, & Mattos, 2016). Schools must install, monitor, nurture, reexamine, and sustain their PLC through the framework of change established by Kurt Lewin’s (1951) change management process; unfreeze-change-refreeze. For PLCs to be successful, teachers from different backgrounds and skillsets must come together for a common purpose.
Historically, education by design isolates teachers. They are departmentalized into a classroom, often by grade level and content. As a result of PLCs, teachers who have worked in isolation are now working with others in a collaborative environment. It is important that teachers trust each other and the principal if they are to be frequently working with each other (Rosenholtz & Simpson, 1990). Ultimately, PLCs create an environment for educators to incorporate “shared values and vision; collective responsibility for pupils’ learning; . . . individual and collective professional learning . . . trust, respect, and support” (Bolam et al., 2005, p. iii).

**Instructional Coaches as PLC Facilitators**

Some PLC models include a facilitator to help move teachers from members to leaders (Annenberg Institute for School Reform, 2004; Kopcha, 2010). As the PLC matures it becomes the new normal or new standard practice of how teachers work to ensure the focus is on learning. PLC facilitators can help build effective social capital to bring teachers together as team members. Social capital, as defined by Dr. Carrie Leana of the University of Pittsburgh, refers to the quality of the interaction and relationships among teachers in a department or school (Leana, 2011). A PLC facilitator focused on ensuring effective facilitation, not just assembling a team and leaving them to their own devices, can make the difference between success and failure (Venables, 2018).

A PLC facilitator needs to be someone who understands the key elements of teaching and learning. The use of an instructional coach to serve as the PLC facilitator can be an important catalyst because they understand the direction of the system and have local knowledge of the school(s) they serve. Traditionally, instructional coaches are the most experienced and accomplished educators among their peers. They possess credibility with both teachers and
administrators for which they work and have the ability to perform multiple roles while simultaneously working one-on-one with teachers within the big picture of the professional development efforts within their school (Pennsylvania Institute for Instructional Coaching, 2017). Inan and Lowther (2010) found teachers who were supported by a mentor or coach were positively affected in their belief of technology use and were more likely to use technology in their curriculum.

**Statement of the Problem**

School level administrators are tasked with funneling educational requirements from various levels of supervision; from central office, State Department of Education, and Federal mandates, to building-level teachers. In addition to initiatives from within the system in which they work, teachers have their own requirements based on a multitude of agencies that require schools to implement various strategies and practices within their daily duties and responsibilities. When evaluating at a typical workload, it is hard to fully grasp all that is required of teachers. They are continually asked to change and adjust the way they go about their professional duties, teaching methods, and instructional practices to adequately meet the expectations of the various levels of supervision and mandates that are required of them. For schools to accept the commitment to integrate technology and engage students in a 21st century classroom, one must understand how to empower teachers with the skills, confidence, and support to make the hard changes in their classrooms.

The current state of technology integration is not as bright as the promise of the technology itself. Integration of technology in the classroom has proven to be difficult because teachers’ skill levels are varied and inconsistent. For teachers to teach in a way that is reflective of the expectations set in policy and legislation, they need help understanding specifically how to
use technology to facilitate meaningful learning where their instruction and learning objectives promote students to construct deep and connected knowledge and apply their lesson to real world situations (Ertmer & Ottenbreit-Leftwich, 2010). The PLC model allows schools to create the vehicle that takes ideas to practice.

**Statement of Purpose**

The purpose of this study was to examine how site-based PLCs promote technology integration for middle school science classrooms. It also examined the opinions of instructional coaches as PLC facilitators and teachers regarding PLCs and technology integration by teachers.

**Significance of the Study**

This study builds on the body of literature around the topics of using professional learning communities to help teachers integrate technology into their class lessons. This study looked specifically at how frequency of meeting, scheduling, meeting norms, and the use of an instructional coach as a facilitator, support outcomes. This study explored the challenges and potential ways to help create an environment that produces an increase in technology integration for student use. This study may help guide a school’s PLC management practices and help develop processes for facilitators to encourage meaningful PLC engagement and outcomes.

**Research Questions**

1. How do site-based Professional Learning Communities promote technology integration in the middle school science classroom?

2. What are instructional coaches’ opinions of how Professional Learning Communities help teachers integrate technology into their curriculum?

3. What are teachers’ opinions of how Professional Learning Communities help with technology integration in their curriculum?
Conceptual Framework

One of the primary functions of a professional learning community (PLC) is to engage teachers in professional development as a way for the organization to embrace and prepare for the reforms in the educational environment (Watson, 2014). The work teachers go through within the PLC creates a new or enhanced pedagogical approach to teaching and learning. These changes within the organization are thought out and deliberate, a movement toward the conceptualized pedagogy representing the inclusion of the totality of reform expectations and practices that encourage 21st century learning for all students. To make these complex changes, an organization has to reflect where they are and plan a course to where they want to be, resulting in new norms for the organization. The conceptual framework for this study was focused around Kurt Lewin’s (1951) change management process, changing as three steps (CATS), or functionally known as unfreeze-change-refreeze. “Kurt Lewin is widely considered the founding father of change management, with his unfreeze-change-refreeze or ‘changing as three steps’” (Cummings, Bridgman, & Brown, 2016, p. 34). Cummings et al.’s (2016) research illustrated the progression change management has undergone overtime as researchers built upon Lewin’s foundational work (Cummings et al., 2016). The chart is shown in Figure 1. For organizational change, the first step is to understand the behaviors of the organization. Schools are educational organizations made up of many components, mainly individuals connected and organized by departments, tasks, and functions (Langmeyer and others, 1969). It is important to understand organizations operate in multiple domains and goals should be reflective of each domain independently, meaning due to the complexities of the educational organization, goals need to be thought out and individualized (Ostroff & Schmitt, 1993).
When schools begin the process of evaluating the necessity for continuous professional development for teachers through a PLC model, a new dynamic is created for teachers and leadership. Once an organization has planned for their desired outcomes (unfreeze), the new norms are introduced in the PLC environment and processes are established (change), those new norms become normal operating procedures and the organization focuses their efforts on supporting these new norms (refreeze) through the work done within PLCs. Unfreezing an

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**Figure 1.** CATS as a grand foundation illustrates the progression change management has undergone over time built upon Lewin’s foundational work. (Cummings et al., 2016, p. 42)
organization’s present systems is initiated by exposing poor performance caused by the existing systems which requires a change in the organization to eliminate the causing threats (Dudar, Scott, & Scott, 2017; Fullan, 2007; Schein, 1990). Within the current school environment, the barriers holding back technology integration must be identified and acknowledged as threats to the progress mandated by local, state, and federal educational authorities. Step two, change, requires participants to accept a new pedagogy which includes technology. This change in mindset occurs through obtaining reinforcing evidence supporting the eventual exemplar teaching pedagogy (Dudar et al., 2017; Leithwood & Strauss, 2009). Refreezing the new normal process takes time, practice, feedback, and reflection (Dudar et al., 2017; Leithwood & Strauss, 2009). The PLC environment is the vehicle that makes change possible in schools.

**Methods**

The primary purpose of this study was to examine the opinions of how site-based PLCs promote technology integration for middle school science teachers. It also examined the opinions of instructional coaches as PLC facilitators and teachers regarding PLCs and technology integration by teachers. This research used a qualitative analysis approach. This method allowed the researcher to collect, analyze, and interpret qualitative data in the natural setting where teachers work, the social PLC environment (Elliott; 2018; Maxwell, 2013).

The researcher’s intent was to gain a richer understanding of the various aspects that encompass the relationships, work, and beliefs teachers formulate within the process of learning in the PLC environment and whether it translates into technology integration. To construct the interpretations of these relationships, the researcher collected data using surveys, interviews, and observations. The surveys helped rate teacher’s beliefs and opinions of how they feel PLCs contribute to their ability to integrate technology (Patten, 2011). The observations in PLC
meetings as well as in teachers’ classrooms helped the researcher to detail the inner workings of the PLC, conditions that exist that enabled or discouraged growth, and whether learning translated into practice. Interviews with the instructional coaches were used to explain and support how PLCs promote and support teachers to integrate technology in middle school science classes.

**Assumptions**

The following assumptions were made about the research:

1. Teachers met as teams with their instructional coaches with a focus on instructional planning and practices.
2. Teachers who participated in responding to the survey did so in a professional manner.
3. The instructional coaches accurately described their opinions of how PLCs help teachers integrate technology into their curriculum.

**Limitations**

There were limitations of this study. Those limitations reflect the sample as it was a convenience sample. The population was limited to the middle school science teachers and instructional coaches, all who worked within the three schools selected and within the same school system. This school system was selected because the educators practice professional learning communities as a function of their local school system mandates and have done so for several years. Thus, results from this study may only be generalized to 6th through 8th grade science teachers in the participating schools.

Another limitation to this study comes from the self-reporting data from instructional coach’s interview responses and science teacher’s survey results from interview questions. The
researcher assumed all survey and interview participants provided honest responses. These responses reflected their opinions, which may differ from what actually occurred.

**Operational Definition of Terms**

In this study, the following terms were used.

*21st Century Skills.* For students to be prepared and competitive in the 21st Century, students need to develop a set of skills that focus on critical thinking, communication, collaboration, creativity, and innovation, while working with information, media, and technology (Eduventures, Inc., 2010; The Partnership for 21st Century Learning, 2018).

*Agentic Engagement.* Agentic engagement is the way students contribute to the flow of their instruction by personalizing and enhancing the lesson and the conditions under which they learn. Students feel prepared to help make both the teacher and their own progress more manageable and productive (Reeves & Tseng, 2011).

*Collaboration.* Collaboration for the purposes of PLCs, is when two or more people become interdependent around goals of improving teaching and learning with shared purpose, support, and assistance (Bolam et al., 2005).

*Educational Technology.* Educational Technology is defined as applying processes and the most current tools, computers and other electronic devices, to address current educational needs and problems (Cifuentes et al., 2011).

*First Order Change.* First order changes are “minor alterations” within our teaching practices or pedagogy.

*Instructional Coach.* An instructional coach is someone whose primary responsibilities are to bring evidence-based practices into classrooms by working with and supporting teachers (Pennsylvania Institute for Instructional Coaching, 2017).
Interpersonal Relationship. Interpersonal relationship is a close association between two or more individuals in an environment who share common goals, respect each other’s opinions, and have a developed trust and transparency (Management Study Guide, 2019).

Organizational Development (OD). Organizational Development (OD) “is a change strategy for organizational self-development and renewal” in business, public agencies, and schools (Fullan et al., 1980, p. 8).

Pedagogy. Pedagogy is one’s teaching approach or practice. It is defined by the Merriam Webster Dictionary as “the art, science or profession of teaching.”

Professional Learning Communities (PLCs). For the purpose of this study, a PLC is defined as a community of educators who work collaboratively and meet with a common purpose, reflective of the specific needs within their school, to support student learning.

Self-Efficacy. “Self-efficacy is defined as personal beliefs about one’s ability to perform actions at desired levels” (Hsu, 2016, p. 31).

Second Order Change. Second order change is systematic in nature and involves primary shifts in the way people recognize themselves within a situation, or even bigger, the world (Paredes, 2011). This level of change causes foundational and structural changes in teaching practices (Ertmer, 1999).

Social Capital. Social capital refers to the quality of the interaction and relationships among teachers in a department or school (Leana, 2011).

STEAM. STEAM is built on the STEM programs and includes arts integration. STEAM involves science, technology, engineering, art, and mathematics in a cross-curricular project based educational approach to learning (The Center of Standards and Assessment Implementation, 2019).
Technology Integration. Technology integration occurs when technology becomes a seamless part of a lesson that is strengthened or made possible by its use, all while keeping the focus of the lesson on learning (Cifuentes et al., 2011).

TPACK. The TPACK framework for teacher knowledge is described in detail as a complex interaction among three bodies of knowledge: content, pedagogy, and technology. The interaction of these bodies of knowledge, both theoretically and in practice, produces the types of flexible knowledge needed to successfully integrate technology use into teaching” (Koehler, Mishra, & Cain, 2013 p. 13).

Summary

This dissertation includes five chapters. Chapter I contains an introduction, statement of the problem, statement of purpose, significance of the study, conceptual framework, and research questions. Chapter II reviews the professional literature related to this study. In Chapter III, the research methodology details the setting, participants, instrumentation, data collection, and data analysis. Chapter IV discusses the findings of the study and Chapter V consists of the discussion of the findings, implications, conclusions, and future research.
CHAPTER II

REVIEW OF RELATED LITERATURE

School reform is a mainstay in the US educational system. Educational mandates to improve schools and increase academic success are at all levels of authority from the federal government to the building level principal. What educators have found hard to accomplish is true change, fundamental change, that leads to a shift in thinking and how classrooms and schools operate (Cuban, 2013). For our schools to experience this real change, lasting change, we need to recognize how organizational change occurs, the mechanism(s) that can act as the catalyst of change and recognize what “change” our schools need (DuFour et al., 2016).

The literature review discusses the impact professional learning communities (PLCs) have on school change. “For nearly a century and a half, US reformers . . . sought a second-order or fundamental change in pedagogy’” (Cuban, 2013, p. 112). Unfortunately, what has occurred over time is a manipulation of reform innovations to fit within teachers’ current pedagogy (Cuban, 2013). Cuban (2013) noted since the late 19th Century, there have been instructional changes in the classrooms, but there has not been a transformational change in teaching to alter a teacher’s approach to classroom instruction. Classic images of students in rows and the teacher in the front of the room lecturing represents the model for an industrial society, that has been mostly unchanged for the past century (Herold, 2015; Voogt & Pelgrum, 2005).

This chapter examines how the process of professional development through on-site professional learning communities impacts teachers and instruction. Beginning with early research in organizational change (Ertmer, 1999; Fullan et al., 1980; Paredes, 2011; Langmeyer
and others, 1969; Senge, 1990) that led to professional learning communities within schools to act as a catalyst for change (Blackley, Moro, & Sheffield, 2018; Bolam et al., 2005; Davies & Merchant, 2009; DuFour, 2004a; Hawley, Rosenholtz, Goodstein, & Hasselbring, 1984; Hord, 2009; Knezek & Voogt, 2008; Rosenholtz & Simpson, 1990; Talbert, 2010). As technology became an integral part of our society, various governing bodies of education began mandating technology become integrated in our educational system. The literature review also examines research into the benefits and barriers of technology integration (Bauer & Kenton, 2005; Castro & Santos, 2011; Cifuentes et al., 2011; Cubukcuoglu, 2013; Hsu, 2016; Knezek & Voogt, 2008; The Partnership for 21st Century Learning, 2018; Yu & Okojie, 2017). Finally, this chapter details how an instructional coach facilitating professional learning communities can impact technology integration into the middle school science classrooms (Giamellaro & Siegal, 2018; Kopcha, 2010).

School Change—A Mechanism to Navigate the Path of Change

In the mid-1960s, education began adopting organizational development concepts from business and industry as ways to make improvements in the K-12 environment. In 1967, researchers at the University of Oregon began working with elementary and middle schools to make substantive organizational development changes inside their schools (Fullan et al., 1980). Researchers studied how change in procedures, processes, and norms within the school system led to an improved quality of life for the individuals of the school as well as the school system while focusing on educational issues (Fullan et al., 1980).

Langmeyer and others (1969) conducted a review of organizational change in schools. They concluded schools operate as organic entities that are perpetually being influenced by internal and external forces. This state of being causes school processes to be continually in
motion. An early look at research around the social aspects of education described schools as highly interactive social systems where each part works in conjunction with the next in complex and dynamic ways that are all interrelated (Hawley et al., 1984). To manage these conditions, schools need to have a mechanism for filtration. Schools must have procedures for evaluating and accepting new ideas to try in the classroom and a way to preserve those innovations that are successful to be considered truly an adaptive school (Langmeyer and others, 1969). What is known for effective school change is the school must have the capacity to do things a new way in order to find success (Langmeyer and others, 1969).

Peter Senge (1990), the founder of the Society for Organizational Learning, described a learning organization where its people are constantly working to achieve their planned results; create innovative thinkers where ideas are valued and nurtured, where collaboration and continually learning work in lockstep for the betterment of the goals and objectives of the organization. The bridge between accepting new ideas and putting them into practice is the vehicle that allows for distribution of ideas, practice without fear of negative teacher evaluation, guidance with implementation, and reflection to help with improvements; that vehicle is the on-site professional learning community.

**Kurt Lewin’s Change Management Process**

Kurt Lewin’s Theory of Change, consisting of three stages—unfreeze, change and refreeze—is a complex approach to organization change. The first stage of this process, *unfreeze*, requires leadership to evaluate the organizational process. In a secondary school, these processes include instructional practices, teacher development, and defining the direction all with student outcomes in mind. Research on building level change in K-12 supports stage one, unfreezing of current norms by establishing a sense of urgency for change (Thorton, Usinger &
Sanchez, 2019). Lewin’s theory addresses the emotional challenges that arise upon accepting the urgent need for change, describing how resistance to change is a social and emotional reaction to prevent change, and how not equal, but additional force is required to overcome or unfreeze the current norms and practices (Bargal & Burnes, 2017). Schein (1990) explained that leadership can “unfreeze” the organization’s current systems by emphasizing its threats and weaknesses to its overall goals and objectives, while encouraging the belief that the new processes and procedures are not only possible, but will produce the desirable outcomes.

Once the direction and desired outcomes have been planned for and processes and procedures have been developed to support the required changes, the organization moves to stage two, change, where these changes are implemented and begin to occur. Change is a journey that involves the members of the organization understanding the need for change and beginning to work within the new processes and procedures. Members of the organization begin learning and gaining knowledge to support the changes. Members are also building trust for one another and strengthening their psychological safety (Dudar et al., 2017).

The final stage of organizational change according to Lewin is refreezing. The organization’s new processes and procedures have been institutionalized and represent the new norms for the organization (Bargal & Burnes, 2017). It is important for an organization to pay attention to the personal and individual needs of their members, as change is hard and feedback and acknowledgment for exhibiting behaviors that are aligned with the organization’s goals should be facilitated (Dudar et al., 2017).

**Progression of Change**

With the end in mind, it becomes clear what changes need to be made, although the path to get there is not a straight line, the shortest distance between two points, but an erratic path, one
that will allow for growth through learning rather than instant perfection (Cuban, 2013). Change is not easy and to be lasting, change needs to be defined.

Paredes (2011) described the difference between first and second order change in a school or school system. He described first order change as “minor alterations” within our teaching practices or pedagogy. First order change leaves the foundational beliefs unchanged, only making adjustments in effectiveness and efficiency (Ertmer, 1999). Second-order change is change on a very deep level. It involves primary shifts in the way we recognize ourselves within a situation, or even larger, the world (Paredes, 2011). This level of change causes foundational and structural change in teaching practices or illuminates an unwillingness to accept or utilize technology (Ertmer, 1999).

In order to realize real second order change within a school, an environment that is nonjudgmental, personal, systematic, and emergent must be created. Second order change has to be systematic in nature (Paredes, 2011). The very process of meeting to reflect on improving current practices is a paradigm shift from the isolation model. Change is delicate and aggressive, the irony of change is it affects the very people who initiated it (Paredes, 2011). Paredes (2011) went on to discuss the personal nature of teaching. As teachers work to create second order change in their teaching practices, the change must add value to their instruction and outcomes. This value is personal to each teacher and their reactions will be extremely personal, sometimes they may reveal insecurities they hold within an array of issues (Paredes, 2011).

Furthermore, teachers need a chance to explore the change through discussion and collaboration in a nonjudgmental environment (Paredes, 2011). By providing teachers a platform for group discussion to reflect on their thoughts and feelings regarding the changes in their practices, encourages fellowship and builds a comfort level for expression (Paredes, 2011).
Lewin’s theory of change points out how group interactions are an effective means to bring about changes in individuals (Bargal & Burnes, 2017). When change is introduced into a school, whether it be altering current processes or adding new processes, resistance to that change will occur. In fact, resistance is part of the change process. Resistance is a response of a system trying to maintain its current goals and objectives (Senge, 1990). Over time, teachers will build a stronger commitment and a loyalty to the process that leads to second order change (Paredes, 2011). As teachers move their practice from where they were to where they want to be, they experience a shifting of realities that caused the change, that shift is second order change (Paredes, 2011).

**Technology Integration**

The Partnership for 21st Century Learning was one of the first organizations in the United States to promote skills students need to be successful in the changing landscape of education and the workforce (Knezek & Voogt, 2008; The Partnership for 21st Century Learning, 2018). Integrating technology into education focuses on improving teaching and learning, while enhancing the learning environment to align with the needs of society; specifically, workforce expectations (Eduventures, Inc., 2010; Kim & Baylor, 2008; Knezek & Voogt, 2008). The U.S. Department of Education released an update to their 2016 National Educational Technology Plan that outlined the expectations for technology use in education through the reauthorization of the Elementary and Secondary Education Act (ESEA) and Every Student Succeeds Act (ESSA). The plan recognized benefits of technology in today’s classroom and beyond. With today’s technology, learners can to tap into resources and expertise anywhere on the globe (Office of Educational Technology, 2017). Technology can level the playing field for students by increasing access to quality educational resources and materials. Simply put,
technology as a tool can make the job of learning more accessible and engaging, resulting in producing a higher quality product (Knezek & Voogt, 2008).

Research has shown that the more teachers use technology, the more they recognize and value the effects technology has on student learning and engagement (Eduventures, Inc., 2010). Cuban (2001) outlined three goals of technology integration: increase efficiency, connect learning to real life, and prepare students for their future workplace. One way to recognize a lesson has been enhanced because technology was seamlessly integrated is when students are focused on learning objectives and the lesson would have not been possible without the technology (Cifuentes et al., 2011). Integrating technology into teaching takes advantage of building on already present skills and behaviors students have in their intensive interactions with technology and an opportunity to extend learning outside the walls of the schoolhouse (Cubukcuoglu, 2013). Active use of technology prepares students for their future workplace. Some examples of active use of technology include coding, immersive simulations, media production, interaction with experts, web and mobile design, and peer-to-peer collaboration (Office of Educational Technology, 2017).

A 2-year study on technology integration found when teachers had time designated to learn how to integrate technology into their instruction, three trends surfaced: a higher use of technology during instruction, an increase in active cognitive engagement by students, and a shift away from teacher-directed to more student-centered instruction occurred (Cifuentes et al., 2011). Professional development, specifically for teachers learning to incorporate technology, should encourage confidence and provide opportunities to add technology practices to their pedagogy (Blackley et al., 2018; Davies & Merchant, 2009; Knezek & Voogt, 2008). Okojie and Yu (2017) conducted a study of 313 teachers from schools across the southern US to investigate
teachers’ perceptions of the connection between technology integration and pedagogy knowledge. The data illustrated the need for teachers to be provided support during training. Technology integration training for teachers should focus on basic usage skills, pedagogical practices, and should include just-in-time job-embedded professional support (Cubukcuoglu, 2013; Office of Educational Technology, 2017). Research showed teachers who attend on-site technology integration education move toward higher adoption stages (Christensen, 2002).

Unfortunately, although personal technology use is up, instructional technology use is stagnant (Ertmer & Ottenbreit-Leftwich, 2010; Yu & Okojie, 2017). Teachers lack an understanding of pedagogy as related to the foundations of integrating technology effectively, even when they have the technology and support (Kim & Baylor, 2008; Yu & Okojie, 2017). One of the most difficult things to do is to ask someone who is uncomfortable or disinterested in a topic to make it a priority in their daily activities (Dooner, Mandzuk, & Clifton, 2007; Kim & Baylor, 2008; Yu & Okojie, 2017). Teachers who continue to teach with traditional strategies tend not to recognize the benefits of integrating technology into their teaching practices (Cubukcuoglu, 2013). Research showed the more students value technology within their daily instruction, the higher anxiety levels teachers report supporting ongoing, on-site continuing education for technology integration (Blackley et al., 2018; Christensen, 2002). Teacher training for the purposes of technology integration should have an element addressing teacher motivations and attitudes (Blackley et al., 2018; Kim & Baylor, 2008; Llorens, Salanova, & Grau, 2002). Teachers reported they are positively influenced to use technology in the classroom when leadership is supportive of and a whole school technology usage policy is in effect (Cubukcuoglu, 2013).
Technology Integration Barriers

Teachers face barriers that lead either to a failure to incorporate, or an abandonment of the use and integration of technology. Teachers have multiple barriers to integrating technology into their teaching practices including time, beliefs, access, professional development, and culture (Kopcha, 2010). Barriers to integration can be classified in the same terms as change, first-order barriers and second-order barriers (Ertmer, 1999). First-order barriers simply refers to those obstacles that are external or superficial to teachers (Ertmer, 1999). First-order barriers are easy to recognize and eliminate, as they are typically a lack of a resources such as time, equipment, and support, whereas second-order barriers are more difficult to overcome due to the change in closely held beliefs that would be required to eliminate the barrier (Ertmer, 1999). The depth of change overcoming a second-order change could range from teacher-student roles, pedagogical beliefs, and classroom management reforms, to insecurities with technology knowledge (Ertmer, 1999). These barriers have complex relationships that are entangled between teachers’ motivation, beliefs, skill level, and schools’ culture, resources, and support levels (Ertmer, 1999). Each teacher situation is complex and, for example, once a first-order barrier is resolved, a second-order barrier may surface (Ertmer, 1999). The complexity of barriers can be equal to the complexity of the person experiencing them (Ertmer, 1999).

First-Order Barriers

The three most common first-order barriers that hold back teachers are the lack of time, access to technology, and being provided little or no support (Castro & Santos, 2011; Ertmer & Ottenbreit-Leftwich, 2010; Hsu, 2016; Yu & Okojie, 2017). Unfortunately, due to these barriers, teachers often fail to realize those benefits technology offers to students when integrated into their instruction (Brinkerhoff, 2006). Ultimately, a lack of time and support are barriers that hold
teachers back from integrating technology (Butzin, 2001; Cuban et al., 2001; Karagiorgi, 2005; Kim & Baylor, 2008; Kopcha, 2012; National Staff Development Council, 2008). One of the biggest factors that kept teachers from integrating technology into the classroom was a lack of time (Bauer & Kenton, 2005; Hsu, 2016). Teachers need time to learn to explore technologies and develop curricular activities with their peers if they are to be successful (Ertmer, 1999; Yu & Okojie, 2017). Teachers reported the need for time to explore technology integration and planning outside of their regular classroom instruction time (Cifuentes et al., 2011).

Teachers need time to sufficiently plan for technology integration or integration is done to integrate, not as an added value to a lesson through technology. Access to technology can be frustrating for teachers if they are must overcome obstacles to use the technology. Teachers who experience computer labs in various states of repair, hidden access issues such as scheduling a lab around several teachers’ schedules, and simply the disruption of introducing technology to students consider all these to be disincentives to integrating technology (Blackley et al., 2018; Pilkington, 2008). Teachers also need an outlet to report technology issues that affect their ability to move seamlessly through their lesson and need to feel confident the issue will be resolved in a reasonable amount of time consistently. Although once teachers feel these first-order barriers are overcome, they will continue to progress as their environment expects and supports (Blackley et al., 2018; Pilkington, 2008).

Second-Order Barriers

Second-order barriers that hinder technology integration are pedagogical beliefs, and fundamental beliefs such as motivation, enthusiasm, and ability levels for using technology (Tondeur, Braak, Ertmer, & Ottenbreit-Leftwich, 2017). Yu and Okojie’s (2017) research found teachers who lack the fundamental understanding or do not possess the pedagogical knowledge
to implement technology into their curriculum do not further their level of technology use unless they receive targeted, on-site professional development opportunities to address teachers’ connection with pedagogical knowledge and technology (Blackley et al., 2018).

Hsu (2016) found a consistency between teachers’ fundamental belief levels and practices with technology use. Those teachers who had high self-efficacy beliefs in their abilities to use and understand the technology used with their lessons had a positive view of technology. Inversely, those teachers who were uncomfortable or placed little value on their ability to use technology had an increase in first-order barrier reasoning on why technology was not being used in their classrooms (Hsu, 2016; Tondeur et al., 2017). The research of Tondeur et al. (2017) was a meta-aggregation of 14 qualitative studies aimed at creating a bigger picture to identify common ideas that will help educators better understanding the relationships between pedagogical beliefs and technology use in education. The research highlighted that second-order barriers, the core beliefs, about technology integration are difficult to change unless they can be challenged and changed through practice and collaboration over time.

**Overcoming Second-order Barriers**

According to Ertmer (1999), three strategies exist to help overcome barriers to technology integration. These strategies are ongoing collaboration with peers around experiences and development, job-embedded modeling and access to continuous professional development guided by an instructional coach or “seasoned practitioner,” and a safe environment to reflect on their practice (Bargal & Burnes, 2017; Ertmer, 1999; Tondeur et al., 2017). Lewin’s theory of change supports the instructional coach model by explaining how having a leader, mentor, or model promotes change (Dudar et al., 2017). PLCs encompass all three of these strategies that help overcome barriers in incorporating technology in schools. Professional
learning communities go a long way toward helping to facilitate and sustain technology integration (Hsu & Sharma, 2008; Tondeur et al., 2017).

**Technology Integration Through TPACK**

Shulman’s (1986) early work on Pedagogy Content Knowledge helped educators better understand why some topics are more difficult to learn than others. Mishra and Koehler (2006) expanded on Pedagogy Content Knowledge by adding technology knowledge into the larger picture of teaching and learning. While their research looks at an overarching perspective of teaching and learning and technology integration, they breakdown the specific elements of knowledge required to possess an effective teaching practice. Table 1 describes the TPACK independent elements.

Technology integration through TPACK requires a deep understanding that while each component is independently important, and continued professional development can make a teacher more proficient in their practice, these components are also interdependent and require guidance to navigate the complexities of its dynamic relationship (Harris, Koehler, & Mishra, 2009). Figure 2 presents the independent and interdependent relationship between the components of TPACK (Mishra & Koehler, 2006).
Table 1

*The Mishra and Koehler TPACK Model Knowledge Components*

<table>
<thead>
<tr>
<th>Knowledge Component</th>
<th>Description</th>
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<tr>
<td>Technology Knowledge (TK)</td>
<td>Technology knowledge is general knowledge and proficiency of skills to use and operate standard technology (Mishra &amp; Koehler, 2006).</td>
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<tr>
<td>Pedagogical Knowledge (PK)</td>
<td>Pedagogical knowledge is knowledge about process, practices, or methods around classroom issues such as lesson and assessment planning and implementation, and classroom management (Mishra &amp; Koehler, 2006).</td>
</tr>
<tr>
<td>Content Knowledge (CK)</td>
<td>Content knowledge refers to the specific subject matter knowledge within the educational standards being taught to students in the classroom (Mishra &amp; Koehler, 2006).</td>
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<tr>
<td>Pedagogical Content Knowledge (PCK)</td>
<td>Pedagogical content knowledge is knowledge about process, practices, or methods around a specific subject matter to promote student learning (Mishra &amp; Koehler, 2006).</td>
</tr>
<tr>
<td>Technological Content Knowledge (TCK)</td>
<td>Technological content knowledge refers to the relationship between technology and content that adds value to the learning process (Mishra &amp; Koehler, 2006).</td>
</tr>
<tr>
<td>Technological Pedagogical Knowledge (TPK)</td>
<td>Technological pedagogical content knowledge is the “thoughtful interweaving of all three key sources of knowledge: technology, pedagogy, and content” (Mishra &amp; Koehler, 2006, p. 1029).</td>
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<tr>
<td>Technological Pedagogical and Content Knowledge (TPACK)</td>
<td>Technological pedagogical and content knowledge is “the synergistic understanding of how technology can be used for pedagogical purposes to help students learn the content area” (Bower, 2017, p. 19).</td>
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(Mishra & Koehler, 2006)
TPACK professional development should have the flexibility that allows an educator to work within their own teaching philosophy, style, methods, and processes (Angeli & Valanides, 2013; Harris et al., 2009). Research shows for this professional development to be effective, it must be dynamic by allowing teachers to draw upon their practical experiences and relatable to their real personal classroom experiences (Angeli & Valanides, 2013). The research recognizes that due to the complex nature and time associated with this type of teacher development, learners need ongoing support and dedicated time (Angeli & Valanides, 2013; Harris et al., & Mishra, 2009).
Professional Learning Communities

Professional learning communities hold significant promise as the vehicle to bring about sustainable improvements (Bolam et al., 2005). For change to be sustainable, norms and roles within the school organization must be the focus of change (Langmeyer and others, 1969). Rosenholtz and Simpson (1990) advocated for collaborative teacher development rather than teachers learning in isolation. Research found isolation as an impediment to learning and collaboration a catalyst for shared growth and innovation (Hawley et al., 1984; Rosenholtz & Simpson, 1990).

A professional learning community (PLC) is a vehicle or mechanism where educators engage in a collaborative, supportive, and systematic process that promotes the achievement of significant gains and second-order pedagogical change in teaching and learning (Battersby & Verdi, 2015; Blackley et al., 2018; Bolam, McMahon, Stoll, Thomas, & Wallace, 2006; Reeves & DuFour, 2016). “An effective professional learning community has the capacity to promote and sustain the learning of all professionals in the school community with the collective purpose of enhancing pupil learning” (Bolam et al., 2006, p. iii). Fullan (2007) emphasized the importance of on-site professional development due to the opportunities “to engage teachers in working collaboratively, jointly planning, and sharing strategies and approaches” (Dudar et al., 2017, p. 38). A properly executed PLC can have dramatic effects on teaching and learning (Reeves & DuFour, 2016).

Bolam et al. (2005) described five characteristics that a PLC must possess to be effective: shared values and vision, collective responsibility for pupils’ learning, reflective professional inquiry, collaboration focused on learning, and group as well as individual professional learning. DuFour (2014) has very similar characteristics including a sixth, results orientation.
Hord (2009) expanded on the first characteristic, shared values and vision, by proclaiming PLC members “focus on a shared purpose, mutual regard and caring, and an insistence on integrity and truthfulness” (p. 41). When a team comes together to create norms of behavior developed around their shared values and vision, the collaborative work binds the team together (Hord, 1997). Essentially, PLC team members come together around a shared focus created and supported by the team for the team as the norm for how they conduct their business.

PLC members must take collective ownership for student learning (DuFour, 2014; Reeves & DuFour, 2016). Teachers at schools who shared responsibility for student learning and focus on improving their instructional practices are more likely to see higher levels of student learning (Little, 2006). In fact, in schools where teachers had a collective responsibility for student learning, math and science achievement was higher (Little, 2006).

Reflective inquiry is an important aspect of an efficiently functioning PLC. PLC members participate in a process that looks at formal and informal data on student achievement for the purpose of improving teaching and learning (Bolam et al., 2005). Peer observation is another method where teachers can visit each other’s classroom with a specific “look for” or problem of practice, with the proposed outcome of engaging thought around best practices and to inform future professional development if those needs exist (Bolam et al., 2006). Teachers participate in reflective inquiry when they come together and have reflective professional dialog around the various topics that affect student learning.

PLC members must work in collaborative teams focused on student learning (Reeves & DuFour, 2016). When teachers teach in isolation within an established culture that values private practice, teachers resist collaboration, peer observation, and feedback for improvement (Talbert, 2010). Collaborating allows members get closer to their common goals by drawing on each
other’s strengths (Dooner et al., 2007). “True collaboration—the kind that makes adults significantly better at their jobs—happens only when professionals collaborate daily on the defining work of their profession, striving collectively to make that work the best it can be” (Baum & Krulwich, 2017, p. 63). According to Lavie (2006), teacher collaboration by itself is not valuable, when it is used as a tool for improvement it then becomes valuable.

Individual and group professional learning is an important by-product of a PLC whether it happens on purpose or spontaneously. Rosenholtz and Simpson (1990) argued against isolation for teacher learning because it undermines learning opportunities that are a natural part of collegiality. Professional learning is one of the most prominent features of a PLC due to all members being learners and owners of knowledge that is shared either through formal professional development, work-based learning opportunities, or incidental learning opportunities (Bolam et al., 2005). Teachers can share a wealth of knowledge with others they obtained from prior experiences (Louis, 2008). In fact, professional learning opportunities can be more effective when teachers gather and learn through work-based interactions around topics essential to student progress within their schools (Archibald, Fermanich, Gallagher, & Odden, 2002; Bolam et al., 2006; DuFour, 2004a; Easton, 2005; Hsu & Sharma, 2008; Roy, 2007). Work-based interactions, formal and informal, can include lesson planning, teaching strategies, examining student work, analyzing student data, classroom observations, and coteaching opportunities focused around improving student learning (Roy, 2007; Sparks, 2008). Organizations that promote internal structures designed to allow for the exchange of ideas through meaningful work among staff may increase commitment and teacher efficacy (Rosenholtz & Simpson, 1990).
PLC members must keep the focus of their combined efforts around results rather than intentions (DuFour et al., 2016). As teachers work through the year developing ideas, implementing processes, and uncovering obstacles for the purposes of improving student learning, their findings become their new starting point in a continuing process (Hughes & Kritsonis, 2006). Purposeful improvement is achieved by answering PLC’s three fundamental questions:

1. What do we want each student to learn?
2. How will we know when each student has learned it?
3. How will we respond when a student experiences difficulty in learning? (Hughes & Kritsonis, 2006, p. 5)

**Barriers to a Productive Professional Learning Community**

Historically, schools have been created to serve students in silos where teachers are considered masters of their content, hired specifically for their high-level content knowledge rather than their teaching strategies and practices. Within this perspective, leadership does not share their level of content expertise and the teacher resists feedback and observations due to leadership’s inability to provide productive, content-driven suggestions due to a lack of knowledge (Talbert, 2010). Talbert’s (2010) research found top-down vs. bottom-up approaches in development of PLCs in schools can create a bureaucratic feel that most of the time draws teachers to conclude “this too shall pass.”

Top-down approaches create a mandate implementation leaving out PLC’s core feature, improving student learning. Top-down implementation can come with a perceived focus of compliance for teachers and administration alike that can undermine the process (Talbert, 2010). These unintentional by-products create barriers that can miss the foundation of any PLC.
collaboration among teacher members (Venables, 2018). Barriers exist that if either not overcome or compensated for, will create a friction between potential productivity and teacher resentment. Talbert (2010) described several barriers that, left unchecked, can disrupt or even dismantle the productivity of a PLC regardless of how well a school or school system promotes the environment that supports the work of PLCs. Although many barriers exist, the illusion of collective responsibility and the lack of or inappropriate use of time are three building block barriers that, when left unmanaged, can cause an environment to become unproductive and even toxic.

The illusion of collective responsibility for student learning is another barrier that exists. Within a school’s core subjects, only math and English are regularly subject to Federal and State accountability requirements (Alabama State Department of Education, Accountability, 2018). These “accountability systems can work against the development of mutual teacher accountability” (Talbert, 2010, p. 5). For collective responsibility to develop into a norm, leadership in schools must begin moving away from isolating and rewarding “top” teachers and move toward improving student achievement through mutual accountability (Talbert, 2010).

Arguably, the single most critical aspect in supporting a PLC environment is time. When looking at time as a stand-alone construct, it is a measurable and definable resource that is typically organized in very concrete ways. Importantly, all time is not the same and time has very different values and levels of importance. Teachers in the United States clock on average more than 1,000 hours of instructional time per year (Darling-Hammond, 2008; Merritt, 2016). The schedule for a typical seven period, 6-hour school day has teachers teaching six of the seven 50-minute periods over the 180 instructional days in a school year, equaling 900 hours of direct instruction with students. Teachers spend additional time on planning for instruction, grading,
professional development, student and parent meetings, and other before/during/after-school work duties. When looking at time as a resource, an asset that has as many ways to quantify its value as it has uses, it is important to define types of time that exist in schools today. In order to better understand the value and uses of the five types of time, a table was created from the research of Watts and Castle (1993). The values and uses information are shown in Table 2.

Table 2

<table>
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<tr>
<th>Five Approaches to Time</th>
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(Willis & Castle, 1993)

Advocating for dedicated time during teachers’ work schedule specifically for professional study and collaborative work is supported by many national organizations including The National Staff Development Council and the Center on Education Policy (Center on
For a teacher to become proficient with new instructional strategies, it is important they have time to practice, reflect, and work with colleagues to flush out the pros and cons of the strategy (Black, 2003; Thacker, 2017). Teachers need time “to gain a deeper understanding, time to practice and refine when they are changing, then supported as they integrate changes into their daily routines while also documenting the results” (Champion, 2004, p. 61). Practicing within their school, inside their classrooms, all while having the support of their colleagues is a valuable use of time.

Champion (2004) described the macro view of professional development as phases of implementation, beginning with initiation, where educators find a new approach worth investigating, then being supported in implementing the change and finally making the change a new norm. In order to better understand Champion’s (2004) progression, an illustration was created by the researcher: Initiation → Implementation → Institutionalization.

A school in Baltimore created a daily schedule incorporating common time that allows science teachers to meet once daily to examine student assessment data, dig deeper into their state’s science standards, create common lesson plans and assessments, and critique current trends in instructional strategies (Roy, 2007). By reallocating school resources such as changing the master schedule to increase opportunities for teachers to learn from each other supports grade-level, subject-area, and/or vertical team on-going collegial learning opportunities (Childs-Bowen, 2007; Merritt, 2016; Sparks, 2008; Thacker, 2017). The teachers at the school in Baltimore reported positive effects in their teaching practices and student achievement scores as a result of their increased time for planning and collaboration (Roy, 2007). Christensen, Griffin, and Knezek (2001) conducted a study that investigated the correlation between technology integration and student achievement through high stakes test scores results. This study of more
than 500 teachers from a large metropolitan school district found that higher classroom technology integration was positively associated with higher test scores in the Iowa Test of Basic Skills Vocabulary, Reading, and Writing.

Time set aside for teacher learning within the school day can be useful as long as it used constructively. Having a system of accountability in place for carved out time will reduce the opportunities for teachers to get off task and use this precious time for reasons outside the set expected purposes (Black, 2003; DuFour, 2004b). Teaching and leading teachers are two very different jobs. Teachers need training on how to effectively conduct a meeting before they can have effective meetings (Richardson, 2008). Black (2003) described several accountability methods to help teachers stay on task including; scheduled classroom observations with an administrator, requiring teachers to submit weekly agendas, and turning in performance assessments. DuFour (2004a) described how leadership must have hard conversations with teams or individuals who are not rising to the minimum standard set by confronting them and act as a guide, bringing them back to the established norms. Moreover, building a collaborative culture does not happen by just asking teachers to work together, putting structures in place that make collaborating a requirement and nonnegotiable sends the message that collaboration is the norm (DuFour, 2004a).

**Instructional Coach as a PLC Facilitator**

The Pennsylvania Institute for Instructional Coaches (PIIC), an organization whose mission is to “promote and support” instructional coaches, defined an instructional coach as “someone whose chief professional responsibility is to bring evidence-based practices into classrooms by working with teachers and other school leaders” (Pennsylvania Institute for Instructional Coaching, 2017, p. 1). The Annenberg Institute for School Reform (AISR)
supports using instructional coaches to facilitate professional development in schools through on-site school improvement efforts (Annenberg Institute for School Reform, 2004). The Institute is driven by the premise that instructional coaching enhances professional development by providing targeted supports to build knowledge, improve practice, and promote student achievement within on-site professional learning communities (Annenberg Institute for School Reform, 2004).

Research showed for teachers to use and promote technology in their classrooms, professional development, job-embedded coaching, and mentorship must be mainstays in the educational environment in which they work (Croft, Coggshall, Dolan, Powers, & Killion, 2010; Cubukcuoglu, 2013; Davies & Merchant, 2009; Eduventures, Inc., 2010; Ertmer, 1999; Giamellaro & Siegel, 2018; Kopcha, 2010). It is important that teachers have site-based continuous and collaborative just-in-time professional development with mentors or coaches (Office of Educational Technology, 2017). Giamellaro and Siegal’s (2018) research looked at how educators perceived the role of the instructional coaches and found they were effective in supporting teachers in implementing technology by addressing individual needs, providing targeted and timely support, and connecting teachers with outside resources. Instructional coaches have become an important part of professional development as teacher leaders work to facilitate and guide the learning within the PLC environment.

The benefits of instructional coaches facilitating professional learning communities include encouraging a collaborative, reflective practice, job-embedded professional learning, and a focus on data to inform teaching practices (Annenberg Institute for School Reform, 2004). The instructional coach as facilitator within the PLC allows for customized professional development specific to each teacher-learner’s individual starting point in integrating technology. Kopcha’s
(2010) research presented a systems-based model of technology integration found instructional coaches can make specific contributions to help teachers integrate technology as they move through the four stages of technology adoption.

Figure 3 illustrates the four stages of technology integration. This illustration shows a teacher-centered, systems-based approach for technology integration (Kopcha, 2010). This model keeps the teacher’s learning individualized, making the instructional coach a critical component in guiding the teacher through the complex learning process of integrating technology (Kopcha, 2010).

The first stage of technology integration is for the instructional coach to work with teachers to minimize barriers of technology use that may discourage a teacher such as outdated technology, access, and technology not working properly. The instructional coach will train teacher on troubleshooting minor problems and help develop systems and processes to minimize management time that may interfere with the flow of instruction (Kopcha, 2010).

The second stage of technology integration is to help teachers prepare for use. The instructional coach will conduct a needs assessment for each teacher to determine the level of training required and track progression as they move from their individual beginnings to a predetermined technology integration goal or level of use. Instructional coaches will help develop lesson plans with teachers and provide support in the classroom by modeling, side-by-side coaching, and offering job-embedded professional development (Kopcha, 2010). Teachers require support in the construction of integrating technology into a lesson plan (Beerer, 2002). Job-embedded professional development and side-by-side coaching allows a teacher, within the school day, to construct and deliver lessons that utilize technology through evidence-based practices and strategies with the support of an instructional coach.
The instructional coach focuses on the technical aspects of instruction, teaching strategies, and provides ongoing support inside the classroom and within the PLC environment. PLCs create an environment that enables job-embedded coaching where teachers can learn as they engage in their daily work (DuFour, 2014). Instructional coaches as PLC facilitators and mentors, should serve as a colleague working together with teachers, viewed as a liaison between teachers and administrators to accomplish the instructional goals set by leadership (Annenberg Institute for School Reform, 2004). Teachers exhibit higher levels of confidence in integrating technology into their lessons when they are supported by an instructional coach within the PLC environment (Kopcha, 2010).

Stage three focuses on instructional coaches organizing “learning walks” or “instructional rounds” where teachers visit each other’s rooms, participate in discourse, and create outlets to share best practices and ideas within their PLCs around technology integration. Teachers are taking more control in their lesson planning and ways they will use technology within their lessons (Kopcha, 2010). Within this environment, instructional coaches must have knowledge of not only how children learn, but also how adults learn. They should serve to promote professional learning as they support teachers in collaboration and inquiry while reinforcing and strengthening the correlating link of teacher learning to student learning (Croft et al., 2010). In this phase, pedagogical beliefs will be challenged through second-order change to teachers’ personal beliefs system (Tondeur et al., 2017).

In stage four, mentors are elevating teachers who have become proficient in technology integration to technology leaders tasked to mentor those who are still struggling. This strategy promotes and creates teacher leaders, further developing the peer-to-peer relationships within the
The instructional coach is tasked with developing a system for sustaining the ongoing site-based support that is in place for learning and using technology (Kopcha, 2010). 

Figure 3. This four stage systems-based technology integration model creates individualized teacher-centered learning utilizing an instructional coach. (Kopcha, 2010, p. 186)

The instructional coach cycles back through the stages working closer with those struggling or resistant teachers, but with additional support through the added leadership of the
teacher leaders (Kopcha, 2010). This process is continuous and with each passing cycle improvements to instruction and student learning is being measured and evaluated. Within the PLC, teachers and the instructional coach reflect, evaluate, and discuss progress, concerns, and next steps to continually improve teaching and learning.

Summary

As society’s complexities grow both technologically and socially, our educational institutions’ responsibility to prepare students to be productive citizens also grows at a constant rate. Researchers have been looking at ways to address the growing needs of our school by borrowing from business and industry to further the progress made in organizational development. Professional learning communities have become the tool of choice within a school as the vehicle to deliver new mandates and initiatives. As research continues to show the promise PLCs hold in championing this effort, resistance and noncommitment have diverted gains in the realization that PLCs are not a simple construct that can just be created and produce instant success. Kurt Lewin’s (1951) theory of change supports and aligns with PLCs within stage two, change, and helps to sustain the continued efforts in stage three, refreezing the new norms.

Research has found that PLCs have uncovered many social and emotional elements that, left unchecked, will stall potential progress. Instructional coaches, recognized as master teachers, have begun to bridge the gap between the social and emotional aspects of teacher development that need to be addressed and potential progress unrealized. If progress can be made in drawing these aspects together, perhaps schools will not only have a supportive tool to infuse technology, but also a tool to address a collaborative culture; wherein teachers unafraid to
fail can experiment with innovation surrounded by a supportive team to learn and reflect, but much more rigorous research is needed.
CHAPTER III
RESEARCH METHODOLOGY

The purpose of this qualitative study was to examine how site-based PLCs promote technology integration for middle school science teachers through the lens of Lewin’s (1951) theory of change. As schools implement PLCs to manage goals and objectives of their school, the use of PLCs represents their recognition of needed change, processes in place to facilitate that change, and how have PLCs changed the school at it relates to technology integration. This study also examined the opinions of instructional coaches as PLC Facilitators and teachers regarding PLCs and technology integration by teachers.

Research Design

This research study used a qualitative analysis approach. This method allowed the researcher to collect and analyze qualitative data in the natural setting where teachers working within the PLC environment worked on lesson planning activities to integrate technology. In the first phase, middle school science teachers who participated in PLCs were surveyed to determine their opinions of how the PLC drives technology integration in their curriculum. Part one of the survey used a Likert-type scale that rated teacher beliefs and opinions. Part two of the survey included open-ended questions for teachers to respond to and leave comments. These data were collected to study how teachers perceived the contribution PLCs and instructional coaches have on integrating technology into their science curriculum. Guided by the conceptual framework, the surveys allowed the researcher to evaluate science teachers’ opinions of the social, emotional, and instructional changes they experienced as active members of PLCs working
toward technology integration. Science classrooms were chosen for this study due to the unique possibilities technology integration can have on student engagement and outcomes. Science curriculum is unique, as it can serve as a derivative of the professional work done by the science community at large, including authentic real-world situational learning experiences, collaborative interactions with peers and experts for research, and practice of inquiry for explanation and reflection (Freemyer & Kim, 2011).

During the second phase of the study, the researcher conducted observations to detail the inner workings of the PLC, conditions that exist that enable or discourage growth, and if learning translates into practice. Observations were conducted in the PLC meetings as well as in participating teachers’ classrooms. Using Lewin’s (1951) theory of change as a lens through which to conduct the observations allowed the researcher to make determinations around the progress made by each organization’s process and norms and how they aligned within the stages of change: unfreeze, change, and refreeze. This method allowed the researcher to study how PLCs promoted technology integration in science classes by examining how schools organize time for teachers to participate in PLCs; functions within the PLC such as lesson planning, meeting organization, collaboration; contributions of instructional coaches within the PLC and classroom instruction to enable the integration of technology; and relationships between the various players and subjects.

In the final phase of the research, interviews were conducted with each of the instructional coaches from each of the three participating schools. The interview data related to the conceptual framework by informing the researcher of the stage one (unfreeze) rationale to better understand the goals and objectives of the school, stage two (change) changes in processes and procedures that are in place, and stage three (refreeze) supports that have been
institutionalized all to explain and support how PLCs promote and support teachers to integrate technology in middle school science class. Each interview lasted approximately 45 minutes.

Setting

The study was conducted at three suburban middle schools in West Alabama. The selected schools represented schools from the school systems in three area clusters, eastern, northern, and southern. The eastern cluster middle school is comprised of approximately 800 6th, 7th, and 8th graders. According to the school’s continuous improvement plan, the demographic make-up is 88% White, 8% African American, and 4% other including multiracial, American Indian, and Asian. Fifty-two percent of the student population receives a free or reduced lunch as a result of reported household income. This middle school has the largest footprint of students who attend any of the system’s eight middle schools and is positioned in the eastern cluster of the county.

The northern cluster middle school is comprised of approximately 800 6th, 7th, and 8th graders. The demographic make-up is 65% White, 21% African American, 12% Hispanic, and 2% other including multiracial, American Indian, and Asian. Thirty-four percent of the student population receives a free or reduced lunch as a result of reported household income. This middle school is located in the intersection between two conjoined towns. This middle school is a feeder school to the system’s largest high school.

The southern cluster middle school has approximately 500 6th, 7th, and 8th graders enrolled. According to the school’s continuous improvement plan, the demographic make-up is 61% White, 34% African American, 3% Hispanic, and 2% other including multiracial and American Indian. Fifty percent of their student population receives a free or reduced lunch as a result of reported household income. This middle school is one of the fastest growing schools in
the system, almost doubling the student population over the last 10 years. The school is the southernmost middle school in the county and lies just a few miles north of the border between counties. These schools were selected based on their ongoing use of professional learning communities. These schools have similar characteristics, including the curriculum and assessments at each school which are evaluated annually and aligned throughout the system. These schools also represent the most diverse student population in each of the three systems’ clusters of schools. The county school system has over 19,000 students enrolled within the 34 campuses it operates.

Researcher Positionality

As an administrator and past teacher, I have a passion for student achievement. I am personally vested in how well students perform through job function accountability and having my own children going through the educational system at different levels. I believe when we teach students in an environment that is reflective of how they engage the world, the learning and experience transcends beyond today and will affect them in a positive manner the rest of their lives. I have worked with teachers to integrate technology into their classrooms where the focus is on rigor and fidelity. I have built and led a 1:1 technology initiative, training teachers and students alike, to work in a new environment that reflects their futures not their pasts. I have a sense of honor and great accomplishment from my experiences in helping teachers transform their educational landscape and it brings me hope for the future in how we engage student learning.

Due to my experiences as a school leader and my work in educational technology, I have a good grasp on teacher experiences, what motivates students, the classroom social environment, and agentic engagement (Bandura, 2001). Agentic engagement involves the ways “students
contribute constructively into the flow of the instruction they receive, as by personalizing it and by enhancing both the lesson and the conditions under which they learn” (Reeves & Tseng, 2011, p. 258). Due to these experiences, I feel equipped to help make both teacher and student progress more manageable and productive.

This study matters to me because schooling is about much more than today, it is about young people and their ability to achieve life milestones in a way that will help them become successful for their future. Perhaps some of the changes we make in the lives of students will carry forward for generations of success. I am motivated by an intrinsic push to help develop people, opening their eyes to success and personal accountability. My personal investment in education is still being made. I prescribe to a lifelong learning mentality. By staying current with the coming changes in technology, I can work to integrate those changes seamlessly into our schools for the benefit of students.

Each day as I enter the school, I am more engulfed in the mission of educating children. My subjectivity has deepened my stance while my reflexivity continues to push me forward, gaining momentum with every experience. I guarded against bias during the study in two ways. First, all participants could opt out or quit without consequence. There was no reward linked to this study, as participation was on a voluntary basis only. Second, I preface the study as nonevaluative in nature. Due to my position as a principal in the system in which they work, participants needed to understand and believe their participation, perceptions, and general practices would be kept private and not disclosed to their school leadership in an evaluative way. I recognized there may have been bias towards technology integration and professional learning communities. I communicated my purpose, research goals, and protocols with each of the
research subjects to remove as much bias as possible. Finally, as a researcher, I recognized I had to maintain an impartial attitude to uncover those conclusions drawn to me by the research.

**Research Questions**

1. How do site-based Professional Learning Communities promote technology integration in the middle school?

2. What are instructional coaches’ opinions of how Professional Learning Communities help teachers integrate technology into their curriculum?

3. What are teachers’ opinions of how Professional Learning Communities help with technology integration in their curriculum?

**Participants**

Participants were eight middle school science teachers from the three selected middle schools. These participants work for a school system that has had a focus on PLCs for the last 6 years. The schools have purposefully dedicated time during the school day for teachers to meet in their PLC. Four instructional coaches from the three schools were interviewed and observations of PLCs were conducted at each of the three middle schools. The instructional coaches help facilitate their school’s PLC as part of their job duties.

**Instrumentation**

**Survey**

The survey instrument used in this study (see Appendix A) was derived from a survey that studied the impact PLCs had on teaching and learning in the middle school science class (Bitterman, 2010; Bolam et al., 2005). Bolam et al. (2005) developed this survey as a way to reliably measure the four targeted components of a PLC including learning trends, organizational support for PLCs, enquiry orientation, and staff involvement. Permission to use surveys is in
Appendix A. This instrument was modified to measure teacher opinions of how PLCs help with technology integration in their curriculum. Changes to the survey included focused question selection to more accurately assess the topics in this dissertation including technology, instructional coaches, and support.

**Interview**

The interview questions (see Appendix B) were developed by the researcher to better understand the opinions instructional coaches have on how professional learning communities help teachers integrate technology into their curriculum. The interview questions were created to allow instructional coaches to detail their experiences as facilitators in PLCs and the support they offer teachers in their classrooms for purposeful technology integration into the curriculum (Roulston, 2010).

**Observations**

A series of PLC meeting and classroom observations were conducted at each of the three middle schools to collect data. These observations were to better understand the planning and implementation of technology in the curriculum (Yin, 2014). The classroom observation data were recorded using field notes and a modified version of the LoFTI Classroom Observation Tool. The LoFTI observation tool is specifically designed for the recording of technology use in the classroom (see Appendix C). The research questions in this study along with the method and rational in which they were researched are referenced in Table 3.
Table 3

Research Question Method and Rationale

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Method</th>
<th>Rational</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do site-based Professional Learning Communities promote technology integration in the middle school science class?</td>
<td>Observations</td>
<td>Observations are to better understand the planning and implementation of technology in the curriculum (Yin, 2014).</td>
</tr>
<tr>
<td>What are instructional coaches’ opinions of how Professional Learning Communities help science teachers integrate technology into their curriculum?</td>
<td>Interviews</td>
<td>Interviews are to better understand the opinions instructional coaches have on how professional learning communities help teachers integrate technology into their curriculum</td>
</tr>
<tr>
<td>What are science teachers’ opinions of how Professional Learning Communities help with technology integration in their curriculum?</td>
<td>Survey</td>
<td>Surveys will measure teacher opinions of how PLCs help with technology integration in their curriculum (Bolam et al., 2005).</td>
</tr>
</tbody>
</table>

Data Collection

After all the required paperwork was completed and accepted, an introductory meeting was set up for the researcher to speak with the science teachers and instructional coaches at each of the three selected schools to share information regarding the research, surveys, interviews, and time frames. I conducted observations over a 2-3 week period. Once the observations were completed, the Professional Learning Communities Survey was administered to participating science teachers. The researcher collected participating teachers’ surveys in a 2-3 week time frame. Instructional coaches’ interviews were conducted after the classroom and PLC meeting observations were completed. The interviews took place face-to-face and lasted for 45 minutes.
Data Analysis

Data were analyzed within commonly accepted qualitative methods described by Dimitriadis and Kamberelis (2005) and Yin (2014). Data were collected from the developed teacher survey, PLC meetings and classroom observations, and instructional coach interviews. Survey response data helped the researcher measure teacher opinions of how PLCs help with technology integration in their curriculum. The survey employed Likert-type scale questions, open-ended questions, and demographic information. Likert-type questions were analyzed descriptively using percentages. Open-ended questions were categorized by themes and color coded for analysis purposes.

Instructional coach interview data helped the researcher better understand the opinions instructional coaches have on how professional learning communities help teachers integrate technology into their curriculum. To analyze the data, a complete transcript of each interview was performed. During the transcribing process, the researcher developed categories through the coding process as a way to find narratives and relationships in the data (Maxwell, 2013). A coding table was created and memo writing was performed throughout the entire process. Observations were used for the purposes of establishing a better understanding of everything the teacher, instructional coach, and students experienced as it pertains to the environment, interactions, and instructional strategies both within the PLC meeting and classroom. The survey, observation, and interview data were cross analyzed to answer Research Question 1—how site-based Professional Learning Communities promote technology integration in the middle school science class. The coaches’ interview themes were compared to the teachers’ survey responses. The researcher kept all parties involved in the research anonymous as required.
CHAPTER IV
RESULTS OF THE STUDY

The purpose of this study was to examine opinions of how site-based Professional Learning Communities promote technology integration into the middle school science curriculum. DuFour et al. (2010) defined a Professional Learning Community as “an ongoing process in which educators work collaboratively in recurring cycles of collective inquiry and action research to achieve better results for the students they serve” (DuFour et al., 2010, p. 11).

The first section of this chapter will provide a detailed analysis of data collected from four instructional coaches’ interviews, fieldnotes from three science classroom observations and three PLC meeting observations, and eight science teacher surveys.

This chapter will also present findings of the three research questions. The first question provided an overall opinion of how site-based Professional Learning Communities promote technology integration in the middle school science classroom. The second question focused on the instructional coaches’ opinions, as the Professional Learning Community facilitator, of how PLCs help science teachers integrate technology into their curriculum. The third question provided science teachers’ opinions of how Professional Learning Communities help with technology integration in their curriculum. This chapter will conclude by summarizing the overall findings of the presented data.

Study Participants

The participants for this study consisted of middle school science teachers, grades six through eight, and instructional coaches from three of the eight middle schools within the
selected school system. Within the school system, educators participate in professional learning communities as a function of their local school system mandates and have done so for several years. A total of 12 people participated including 8 science teachers, which accounted for 72% of all available science teachers, and 4 instructional coaches, which accounted for 100% of instructional coaches serving within these three middle schools. All middle schools within the school system employ an instructional coach, although one school employed two instructional coaches due to its large size and the high numbers of students and teachers they serve. After IRB approval (see Appendix D) was granted and the school system’s superintendent and middle schools building principals consented to the study being conducted within the system and their school, I met with all willing participants and scheduled time with each building principal to conduct the study.

**Results of the Observations**

Observations of one PLC meeting and one science class in each school were conducted to better understand how each school’s PLCs operated and their procedures for planning and implementation of technology in the curriculum (Yin, 2014). The PLC observation data were collected using field notes, while the classroom observation data were recorded using field notes and a modified version of the LoFTI Classroom Observation Tool. Each PLC and classroom observation was approximately 45 minutes in length.

**Science Class Observation**

The researcher examined technology usage in the classroom to help better understand how planning in the PLC affects or promotes technology use. Classroom observations had four categories for reporting: (a) teacher activities, (b) technology is being used as a tool for…, (c) technology hardware is in use by…, and (d) how was technology used in this classroom? These
categories allowed the researcher to relate observational data collected to the conceptual framework in this study.

The observer noted each of the three science classrooms had a structured process for students. At the beginning of each class, students participated in a bell ringer assignment, which is a check of understanding of prior knowledge, or a review of an objective from a previous lesson. In two of the three classrooms, the science teacher displayed the bell ringer questions using technology. The School A teacher used a projector to display the PowerPoint presentation for students to view, while the School B teacher used a combination of an iPad, Apple TV, and flat screen television to project the questions for the students. The School C teacher had the bell ringer questions on one-quarter sheet of paper and had a student hand them out to the rest of the students. The teacher in School A used technology for this assignment, which included students filling out a five-question bubble sheet on the functions of a microscope. Once the students finished answering their questions, they brought their bubble sheet to the teacher’s desk to scan them into software on the teacher’s computer that would then analyze the answers. The other science classes observed had a similar process but did not utilize technology in the process. For the class in School B, students answered in a notebook, and in School C, students answered on the same quarter sheet of paper the questions were on. All three science teachers went over the answers with the students to check for understanding.

Teachers then moved on to the activities of their main lesson. In the School A science class, the teacher began going over instructions for the lab on well slides, which are microscope slides with pond water dropped on them to study the living organisms in pond water. Students were instructed to collect one petri pond and begin completing five tasks that included research, problem solving, information processing, and group productivity/cooperative learning. Students
used iPads and electronic microscopes. Students were asked to take photos, research, and write on the iPads. They were asked to magnify the pond water to identify microorganisms. The teacher displayed the instructions on the projector screen using PowerPoint.

In the School B science class, the teacher lectured on motion and stability through a slide share application on the teacher’s iPad. This presentation was screen mirrored from the iPad through the Apple TV and was displayed on the flat screen TV. This allowed the teacher to move about the room and make notes on the presentation itself by writing on the slide with a finger. At the end of the presentation, the teacher uploaded the presentation to the class webpage for students to view on their own. In the School C classroom, the teacher was reviewing for a test. The teacher was verbally going over concepts, randomly selecting students to discuss the various topics. Once the review ended, the teacher instructed students to take their assigned MacBooks and log into their software account to take their test. Students in this class knew the routine, so it did not appear to be a new task. Students logged into their accounts and took an assessment on the computer. Once the students finished the assessment, they returned the MacBooks to the cart.

Table 4 summarizes the observations of technology use in the science classrooms both by teachers and students. The science classroom observations included teacher activities involving technology, technology used as a tool by teachers and/or students, and identifying the technology hardware types being used by teachers and/or students.
**Table 4**

*Observation Results From Science Classrooms*

<table>
<thead>
<tr>
<th></th>
<th>Science Classroom School A</th>
<th>Science Classroom School B</th>
<th>Science Classroom School C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Teacher Activities</strong></td>
<td>-Assessment</td>
<td>-Assessment</td>
<td>-Assessment</td>
</tr>
<tr>
<td></td>
<td>-Lecture</td>
<td>-Lecture</td>
<td>-Lecturing</td>
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<tr>
<td></td>
<td>-Facilitation</td>
<td>-Facilitation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Setting Objectives</td>
<td>-Providing Feedback</td>
<td></td>
</tr>
<tr>
<td><strong>2. Technology is being used as a tool for teacher and/or student</strong></td>
<td><strong>Teacher</strong>&lt;br&gt;-Formative Assessment&lt;br&gt;-Face-to-face classroom discussion&lt;br&gt;-Group Productivity</td>
<td><strong>Teacher</strong>&lt;br&gt;-Communication&lt;br&gt;-Summarizing and note-taking&lt;br&gt;-Face-to-face classroom discussion</td>
<td><strong>Teacher</strong>&lt;br&gt;-Formative Assessment</td>
</tr>
<tr>
<td><strong>Student</strong></td>
<td>-Research</td>
<td>-Summarizing and note-taking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Formative Assessment</td>
<td>-Face-to-face classroom discussion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Generating &amp; Testing hypotheses</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Group Productivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Problem Solving</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3. Technology hardware is in use by teacher and/or student</strong></td>
<td><strong>Teacher</strong>&lt;br&gt;-Display &lt;br&gt;-Desktop Computer</td>
<td><strong>Teacher</strong>&lt;br&gt;-Display &lt;br&gt;-Desktop Computer &lt;br&gt;-iPad</td>
<td><strong>Teacher</strong>&lt;br&gt;-Desktop Computer</td>
</tr>
<tr>
<td><strong>Student</strong></td>
<td>-iPad</td>
<td><strong>Student</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Digital Microscope</td>
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</tbody>
</table>

**PLC Observations**

PLC observations were conducted to better understand the environment teachers and instructional coaches meet in for their PLCs. Observing PLCs from start to finish allowed the researcher to draw upon the interactions between the participants, tools for support, and PLC structure that will aide in triangulating survey, classroom observation, and instructional coach interview data.
**School A.** The PLC meeting occurred in a teacher workroom centrally located near the center of the school. The room was set up with a large conference table in the center of the room. There was a copy machine and several white boards on the walls. The instructional coach had a desk in the room and occupied the room as their primary work location. Teachers and the instructional coach all gathered at the conference table. There was a total of eight participants, seven teachers, of which two were science teachers, two math teachers, one English teacher, two history teachers, and one instructional coach. The PLC meeting started with some side conversations until the instructional coach began asking probing questions around an assessment that was given in the science classroom.

The two science teachers began discussing their test results. Specific test questions and instructional practices were discussed. Other content area teachers gave their opinions on why certain test questions had a lower number of students correctly answering the questions compared to other test questions. After they finished sharing their data, the discussion turned to what needed to be accomplished to remediate those students who did not score at a mastery level. Once those discussions concluded, the instructional coach prompted a question about a grade level STEAM project. This project required all content area teachers to come up with student activities and assignments for standards they were about to teach, that together with the other content area teachers, would culminate in a larger grade level project that would be presented to a panel of educators and stakeholders. This team of teachers worked until the bell rang to dismiss for the next period. The instructional coach took notes and created a list of follow-up items for the next time they met.

**School B.** This PLC meeting also occurred in a teacher workroom centrally located near the center of the school. This classroom had four square tables put together in the center of the
room with eight chairs around it. The room, which was an unused classroom, did not have a primary desk for a teacher or instructional coach. This room was for meetings only. Once the tardy bell rang for students to be in their classes, teachers started entering the room. As they entered, each teacher signed a sign-in sheet on a small student table near the entrance to the room. There was a total of six participants, four science teachers, of which two were sixth grade science teachers, two seventh grade science teachers, one eighth grade science teacher, one school administrator and one instructional coach. An eighth grade science teacher began the meeting by asking everyone their availability to attend an academic science extracurricular after school meeting. For several minutes, teachers spoke about their availabilities. Once that topic was settled, teachers began discussing the upcoming final exams. Each grade level science teacher discussed the common summative assessment they were giving, relating the questions to the standards that would be covered during the last 9 weeks of school, as well as those standards that were pulled out of the first three 9 weeks of school. Once this topic concluded, the teachers gathered their belongings and left the room.

**School C.** The PLC meeting was conducted in a school conference room. The room had a conference table in the center of the room with 10 boardroom chairs around it. This room was primarily a meeting room that the school used for various gatherings of school employees and parents. This room was a scheduled use room and had to be approved for use by a school administrator or by the front office staff. Once the tardy bell rang for students to be in class, teachers began entering the room. There was a total of nine participants, two science teachers, two math teachers, two English teachers, one history teacher, one band director, and one instructional coach. The instructional coach entered and immediately began handing out some paperwork on testing requirements. The instructional coach instructed them on filling out the
paperwork and they began. Once teachers were finished filling out the testing paperwork, the instructional coach began a professional development on testing requirements for an upcoming system test that would be given. Several times during the presentation of information, teachers would ask questions and the instructional coach, who was serving as the testing coordinator of that school, would answer and clarify the topic. This presentation of information continued until the bell rang. As each teacher left the conference room, they turned in their paperwork.

**Results of the Instructional Coach Interviews**

After each PLC observation, the instructional coaches for each school took part in a semi-structured interview that lasted approximately 45 minutes. The 14 semi-structured interview questions (see Appendix E) allowed the interviewer to explore various topics within the scope of the second research question, “What are the instructional coaches’ opinions, as the Professional Learning Community facilitator, of how PLCs helps science teachers integrate technology into their curriculum?” The interview questions allowed the instructional coaches to detail their experiences as a facilitator in PLCs. The interviews were audio recorded and transcribed using thematic analysis to explore themes related to the conceptual framework in this study. The following results from the four instructional coaches’ responses have been grouped according to the themes that emerged and arranged to respond to the research questions. Four themes emerged including (a) PLC structure and norms, (b) interpersonal relationships, (c) student learning, and (d) professional learning.

**Professional Learning Community Structure and Norms**

Instructional coaches reported that the very structure of the PLC contributes to the success or failure of any potential gains in instructional technology integration. For example, one instructional coach said, “at the very beginning, when our school system started integrating PLCs
into the school system, it was such an overwhelming type of proclamation.” The instructional coach went on to explain,

that teachers needed that person, to help them answer and explain how they were supposed to work, a kind of mentor to model what they need to be doing, setting agenda, and keeping everybody on task, and then over time, doing a gradual release for teachers to take over their PLCs. (Instructional Coach 1, School A)

Instructional Coach 4, School C described,

Our PLCs over the last 3 years have transformed into how they operate now. We’re in there together, we’ve got a formal way for them to document what they talk about and those types of things. Early in the process, we all realized they didn’t know what they didn’t know…they didn’t know how to PLC.

Instructional Coach 3, School B stated, “Now my participation is kind of for support. I don’t run it, I kind of just keep it moving, sometimes.”

Instructional coaches reported time as an important part of a PLC’s structure. Time, “It needs to be part of the school day, whether it’s right before, during a planning, or right after, it has helped tremendously with collaboration” (Instructional Coach 2, School A). Instructional Coach 4, School C stated,

Having protected time is so important. I mean, we rearranged the whole schedule to build and to grow and to try to make it where you have a grade level of prep and a content area of prep, so we can say this is a PLC day, you don’t have to do anything else, we are going to protect that time to be together.

Instructional Coach 3, School B described, “At first, what they felt like was we were taking their time away from them. Now they see it as a time saver.”

Instructional coaches reported their PLCs function in more elaborate ways over time and added value to various instructional practices. “We use PLCs to do school-wide projects with STEAM and getting ready for testing so that people’s voices are being heard” (Instructional Coach 1, School A). Instructional Coach 2, School A added, “We have special education teachers in the PLCs so they can talk about how to differentiate for some of the learners who are
struggling and also work to try to come up with enrichment activities so your high-end learners are being challenged.” Instructional Coach 4, School C explained, “We work on building our character education curriculum in our PLC.”

**Interpersonal Relationships**

Rosenholtz and Simpson (1990) were early advocates for collaborative teacher development rather than teachers learning in isolation. Research found isolation as a barrier to learning, and collaboration, a catalyst for growth and innovation (Hawley et al., 1984; Rosenholtz & Simpson, 1990). The researcher found interpersonal relationships one of the major themes instructional coaches deemed essential to the success of PLC and technology integration in science classroom instruction. Instructional coaches reported their experiences on building a collaborative environment; for example, “our biggest barrier to collaboration is to be perfectly honest, they were kind of scared of each other and what the other one knew” (Instructional Coach 3, School B). “At first, we had to force it, and know they collaborated without thinking about it. So, it’s just something they do” (Instructional Coach 2, School A).

Instructional Coach 1, School A explained, “sometimes teachers are afraid to speak out. But as they have built trust, and they know each other well, and they meet together constantly, they start finding that voice and keep each other in check.” “Because of the PLC, because they’ve developed trusting relationships with each other, they have built the foundation for the relationships of constant collaboration” (Instructional Coach 4, School C).

From trust to support, successful interpersonal relationships precipitate innovation and leadership among the teachers. Instructional coaches said they believe because of the PLC, teachers are working together, supporting each other’s growth, and stepping outside their comfort zone to accomplish a common goal. Instructional Coach 2, School A reported,
You see a lot of camaraderie because of the PLC, I see teams of teachers working together, and they come up with these great ideas, they come up with things they want to do. They are becoming leaders in the building, not only being a collaborator, but also being a motivator as well.

Instructional Coach 3, School B explained, “They are realizing each other’s strengths and weaknesses, and there’s been a mutual respect that has sparked more frequent informal conversations.” Instructional Coach 4, School C reported, “There’s just been a lot of outside the box thinking this year. You think about the PLCs and having time just to talk and it makes a huge difference.” As for supporting each other, Instructional Coach 1, School A reported,

They want to try something new, they know that they have the PLC group that’s going to help them, knowing that they’re going to have support if they fall. We’ve had teachers go into other teachers’ classrooms and help facilitate.

Instructional coaches have reported resistance to PLCs. “There are some teachers who are very resistant to the idea of PLCs, and don’t want to hear what others have to say, because they want to do it their way” (Instructional Coach 1, School A). Instructional Coach 3, School B explained, “some teachers are resistant, but I feel the main barrier is their insecurities.”

**Student Learning**

Bolam et al. (2006) characterized an effective PLC as one that promotes and enhances learning within the PLC for the collective purpose of enhancing student learning within the classroom (Bolam et al., 2006). Instructional coaches reported student learning is the central focus of all teachers in their PLCs. Instructional Coach 3, School B described how, due to PLCs, teachers have

collectively taken responsibility for student learning. There’s not a lot of they or them anymore, it’s ours when talking about student learning. Prior to PLCs, we were doing autopsies here, we were not doing diagnoses of their learning, we were too late.
Instructional Coach 4, School C described how planning for student learning has changed, “We have data reflection, where are we, can we find holes instructionally, maybe in a particular class and sometimes within the whole content area.” Instructional Coach 1, School A explained, Teachers are honest with themselves, there were concepts that well, students don’t get every year and that’s the kind of thing we had to overcome. There’s a reason they are not getting this every year, and we have to figure it out. Teachers are planning the next test together, they’re deciding what questions are going on it, a lot more front loading and pre-planning from the teachers.

Instructional coaches reported their opinions about how technology needs and uses are being addressed in their PLCs. Several instructional coaches reported students need to be taught responsible use to prepare them for their future. “I believe students need to be taught proper or correct ways to use technology. Educational purpose is very different than a social purpose” (Instructional Coach 2, School A). Instructional Coach 4, School C reported, “The ultimate goal is to get students to really use technology in a purposeful manner, to use technology as a tool to make learning more engaging and to help them move forward.” Instructional Coach 1, School A explained, “With technology, they can go and they can click on it, it can read to them, they can highlight a word and find a definition, record their own interview for other kids to listen to, really do more with using technology in an authentic manner and not just for the sake of using technology.” As for the bigger picture of technology use, Instructional Coach 3, School B proclaimed that technology “is necessary for what comes next, as middle school students are going to be using more technology in the high school. Looking forward, technical school, college, even the military, everybody incorporates technology now.” Instructional coaches described how PLCs are helping teachers incorporating technology into their instruction. “I think there are a lot of teachers that would still be pulling back on technology, and not even trying. But because of the PLC, they’re putting more technology into their lessons” (Instructional Coach 2, School A). Instructional Coach 1, School A explained,
Some people do not pick up on technology naturally. So, in the PLC you can be focusing on different areas with technology, one person might be looking at ways to use it to remediate, while another person is looking for ways to become more interactive with students.

**Professional Learning**

Instructional Coaches reported that PLCs provide teachers with formal and informal opportunities for professional learning. Instructional coaches described how professional learning enriches both interpersonal relationships and student learning by exposing vulnerabilities and building trust to create an environment that promotes innovation.

A lot of times new teachers thought because somebody had been teaching 15, 16, 17, 20 years, they were an expert in their content, and so they were scared to speak up. We've got a lot of newbies and a lot of teachers who have been here a long time have this perception that this new person is super knowledgeable, and they got all their ducks in a row with technology. And so, there was a lot of insecurity on both sides. (Instructional Coach 3, School B)

Instructional Coach 1, School A explained how PLCs support new teachers: “I wish every school did this, I feel like I’m supported. I feel like if I have a question, I can ask someone, I will have a support system.” Instructional Coach 2, School A explained,

I’d say a good percent of teachers I’ve been with the past 4 years are wanting to continue to grow professionally not just during the PLC, they’re stepping out there doing other things and bringing that information back to share during their PLC.

Instructional Coach 4, School C added, “Teachers will ask can I go to this conference, or wherever they’re teaching this stuff and bring it back and work with our team, because we know our whole team needs this.”

Coteaching is a method of professional learning where an instructional coach will teach with a teacher side-by-side to help develop the teacher’s skills and increase their comfort level.

The instructional coaches have indicated how they feel the PLC contributes in a positive way to teacher professional development by creating an environment of trust to be comfortable and open to the practice. “Sometimes I’ll go in a class and help coteach. When I’m coteaching with the
teacher they’re doing the activity with me. Then we debrief at the end . . . we are there to support them” (Instructional Coach 2, School A). Instructional Coach 4, School C explained how teachers express that “it's okay for me to be a learner. I'm not supposed to come to this PLC and know everything, and if I you know, and when I do fail, that's what this team is for.”

**Results of the Survey**

The survey (see Appendix E) was comprised of 30 questions that asked teachers to respond on a scale from strongly agree to strongly disagree for questions rating their experiences in their site-based PLC around the five targeted components of a PLC including shared values and vision, collective responsibility for pupils’ learning, reflective professional inquiry, collaboration focused on learning, and group/individual professional learning. Teachers also responded with their opinions regarding technology integration and instructional coaches’ contributions and support. The survey allowed the researcher to better understand science teachers’ opinions of how Professional Learning Communities help with technology integration in their curriculum.

**Shared Values and Vision**

The very idea of a PLC, bringing a group of professionals together to work collaboratively for a common purpose, sets the broad direction for the PLC. It is up to the professionals within that group to develop specifics, the shared values and vision that will direct the group to find solutions for the organizations short and long-range success.

Data in Table 5 represent the opinions of science teachers about the first core PLC component, shared values and visions. All teachers responded that participants in their PLC shared a common core of educational values. A majority of teachers, 87.5%, responded their colleagues were involved in seeking solutions to problems facing the school, and believed
participants in their PLC were actively contributing to the school PLC, while 75% of teachers reported the school was stimulating and professionally challenging.

Table 5

*Percentage of how Middle School Science Teachers Identify Shared Values and Vision Evident Within Their Schools’ PLC*

<table>
<thead>
<tr>
<th>Rating</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 7: Share a common core of educational values</td>
<td>2</td>
<td>6</td>
<td>0</td>
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</tr>
<tr>
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</tr>
<tr>
<td>Percentage</td>
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<td>75.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Item 9: Are involved in seeking solutions to problems facing the school</td>
<td>2</td>
<td>5</td>
<td>1</td>
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<td>0</td>
</tr>
<tr>
<td>N</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>25.0%</td>
<td>62.5%</td>
<td>12.5%</td>
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<td>0.0%</td>
</tr>
<tr>
<td>Item 14: See the school as stimulating and professionally challenging</td>
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<td>4</td>
<td>2</td>
<td>0</td>
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</tr>
<tr>
<td>N</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
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<td>50.0%</td>
<td>25.0%</td>
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</tr>
<tr>
<td>Item 18: Actively contribute to the school as a professional learning community</td>
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<td>5</td>
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<td>1</td>
<td>0</td>
</tr>
<tr>
<td>N</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>25.0%</td>
<td>62.5%</td>
<td>0.0%</td>
<td>12.5%</td>
<td>0.0%</td>
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</tbody>
</table>

**Collective Responsibility for Students’ Learning**

Collective responsibility for student learning is achieved by working interdependently to achieve planned outcomes in which all teachers are accountable. Table 6 presents data on the opinions of how science teachers identify collective responsibility for students’ learning is evident within their school’s PLC. All teachers responded participants in their PLC take collective responsibility for student learning and share responsibility for student learning. A majority of teachers, 87.5%, reported they believed participants share their experiences and success.
Table 6

*Percentage of how Middle School Science Teachers Identify Collective Responsibility for Students’ Learning Evident Within Their Schools’ PLC*

<table>
<thead>
<tr>
<th>Rating</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1: Take collective responsibility for student learning</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>N</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>37.5%</td>
<td>62.5%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

| Item 11: Share experiences and successes | 2    | 5    | 1       | 0        | 0                 |
| N                                           | 10   | 5    | 0       | 0        | 0                 |
| Percentage                                   | 25.0%          | 62.5% | 12.5%   | 0.0%     | 0.0%              |

| Item 20: Share responsibility for student learning | 2    | 6    | 0       | 0        | 0                 |
| N                                           | 10   | 5    | 0       | 0        | 0                 |
| Percentage                                   | 25.0%          | 75.0% | 0.0%    | 0.0%     | 0.0%              |

**Reflective Professional Inquiry**

Table 7 presents science teachers’ opinions about the practice of reflective professional inquiry in their PLC to improve teaching and learning within their school. All teachers responded that PLC participants actively seek ideas from colleagues in other schools, and 87.5% reported teachers base their approach to change on good evidence. A majority of teachers, 75%, responded participants routinely collect, analyze, and use data and evidence to inform their practice, regularly monitor the learning and progress of individual students, and regularly discuss teaching methods. Teachers reported only 50% experiment and innovate about new curriculum.
Table 7

Percentage of how Middle School Science Teachers Identify Reflective Professional Inquiry Evident Within Their Schools’ PLC

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 2: Base their approach to change on good evidence</td>
<td>N</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td>37.5%</td>
<td>50.0%</td>
<td>12.5%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Item 4: Actively seek ideas from colleagues in other schools</td>
<td>N</td>
<td>2</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td>25.0%</td>
<td>75.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Item 5: Routinely collect, analyze, and use data and evidence to inform their practice</td>
<td>N</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td>37.5%</td>
<td>37.5%</td>
<td>12.5%</td>
<td>12.5%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Item 6: Regularly monitor the learning and progress of individual students</td>
<td>N</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td>62.5%</td>
<td>12.5%</td>
<td>25.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Item 10: Regularly discuss teaching methods</td>
<td>N</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td>12.5%</td>
<td>62.5%</td>
<td>25.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Item 12: Experiment and innovate about new curriculum</td>
<td>N</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
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<td>50.0%</td>
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</tbody>
</table>

Collaboration Focused on Learning

Table 8 provides data on science teachers’ opinions on how collaboration focused on learning is evident within their PLC. All teachers agreed that participants learn from and with each other. A majority of teachers, 87.5%, responded they have protected time for joint planning and development, and that their colleagues are supportive in helping integrate technology into lessons.
Table 8

*Percentage of how Science Teachers Identify Collaboration Focused on Learning Evident Within Their Schools’ PLC*

<table>
<thead>
<tr>
<th>Rating</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 3: Learn together with colleagues</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>N</td>
<td>62</td>
<td>2</td>
<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>75.0%</td>
<td>25.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Item 15: Learn from each other

| N | 2 | 6 | 0 | 0 | 0 |
| Percentage | 25.0% | 75.0% | 0.0% | 0.0% | 0.0% |

Item 17: Have some protected time for joint planning and development

| N | 2 | 5 | 0 | 1 | 0 |
| Percentage | 25.0% | 62.5% | 0.0% | 12.5% | 0.0% |

Item 23: Are supportive in helping integrate technology into lessons

| N | 2 | 5 | 0 | 1 | 0 |
| Percentage | 25.0% | 62.5% | 0.0% | 12.5% | 0.0% |

**Shared Group/Individual Professional Learning**

Table 9 represents data on science teachers’ opinions on how shared group/individual professional learning is evident within their PLC. All teachers agreed that participants took responsibility for their own professional learning. A majority of teachers, between 75 and 87.5%, responded their colleagues gave priority to learning more about subject knowledge, have opportunities for professional development, and see the PLC as a valuable place to learn and experiment with new technologies. Science teachers reported in a slight majority, 62.5%, they received training in how to work and learn in teams.
Table 9

Percentage of how Science Teachers Identify Shared Group/Individual Professional Learning Evident Within Their Schools’ PLC

<table>
<thead>
<tr>
<th>Rating</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item 13:</strong> Receive training in how to work and learn in teams</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>25.0%</td>
<td>37.5%</td>
<td>25.0%</td>
<td>12.5%</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>Item 16:</strong> Take responsibility for their own professional learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>37.5%</td>
<td>62.5%</td>
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<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>Item 19:</strong> Give priority to learning more about a subject knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>1</td>
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<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>12.5%</td>
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<td>0.0%</td>
<td>25.0%</td>
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</tr>
<tr>
<td><strong>Item 21:</strong> Have opportunity for professional development</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>37.5%</td>
<td>50.0%</td>
<td>12.5%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>Item 26:</strong> See the PLC as a valuable place to learn and experiment with new technologies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>37.5%</td>
<td>37.5%</td>
<td>0.0%</td>
<td>25.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Technology Integration as a Function of Student Learning

Table 10 represents data on science teachers’ opinions on how technology integration as a function of student learning is evident within their PLC. All teachers agreed that PLC participants would be open to learning about ways to integrate technology that would enhance lessons for students. A majority of teachers, 87.5%, responded technology can increase engagement and enhance the student’s learning experience and that PLCs can be the forum to address ways to teach responsible use of technology to students. Interestingly, 50.0% strongly agreed or agreed and 37.5% disagreed or strongly disagreed that the digital divide is being
addressed in the classroom and all students have equal access to the technology planned in the lessons.

Table 10

**Percentage of how Science Teachers Identify Technology Integration as a Function of Student Learning Evident Within Their Schools’ PLC**

<table>
<thead>
<tr>
<th>Rating</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 27: Would be open to learning about ways to integrate technology that would enhance lessons for students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>37.5%</td>
<td>62.5%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

**Item 28: Believe technology can increase engagement and enhance the student’s learning experience**

| N      | 4              | 3     | 0       | 1        | 0                |
| Percentage | 50.0% | 37.5% | 0.0% | 12.5% | 0.0% |

**Item 29: Feel the digital divide is being addressed in the classroom and all student have equal access to the technology planned in the lessons**

| N      | 1              | 3     | 1       | 2        | 1                |
| Percentage | 12.5% | 37.5% | 12.5% | 25.0% | 12.5% |

**Item 30: Believe the PLC can be the forum to address ways to teach responsible use of technology to students**

| N      | 1              | 6     | 0       | 0        | 1                |
| Percentage | 12.5% | 75.0% | 0.0% | 0.0% | 12.5% |

**Instructional Coach Contributions and Support**

Table 11 provides data concerning science teachers’ opinions on how an instructional coach’s contributions and support is evident within their PLC. A slight majority of teachers, 62.5%, responded the instructional coach is a valuable member of the PLC team. Inversely, 25% of teachers disagreed with that opinion. Regarding science teachers’ opinions on whether the instructional coach is available and encourages PLC members to learn new technologies, 50.0% strongly agreed or agreed and 25.0% disagreed or strongly disagreed.
Table 11

Percentage of how Science Teachers Identify Instructional Coach Contributions and Support Evident Within Their Schools’ PLC

<table>
<thead>
<tr>
<th>Rating</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item 24:</strong> Believe the instructional coach is a valuable member of the PLC team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Percentage</td>
<td>37.5%</td>
<td>25.0%</td>
<td>12.5%</td>
<td>12.5%</td>
<td>12.5%</td>
</tr>
<tr>
<td><strong>Item 25:</strong> Believe the instructional coach is available and encourages PLC members to learn new technologies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Percentage</td>
<td>50.0%</td>
<td>0.0%</td>
<td>25.0%</td>
<td>12.5%</td>
<td>12.5%</td>
</tr>
</tbody>
</table>

**Summary of Research Question 1**

The first research question focused on how site-based Professional Learning Communities promote technology integration in the middle school science class. The researcher noted similarities within all three science teachers’ instructional practices. Each science teacher began their class with a bell ringer to measure prior knowledge or review a concept from recent instruction. Each classroom, at varying levels, integrated technology within their instruction. The PLC brought teachers together with purpose in each environment observed. The majority of science teachers believed participants in their PLC were actively contributing to the school PLC, were open to learning about how technology integration can enhance their lessons, and believed the PLC is the place where they receive support from their colleagues in learning how to incorporate technology.

The researcher observed teachers working collaboratively to analyze assessment data and instructional practices to increase student outcomes. While the researcher did not observe specific technology training occurring in the PLC, past support was evident by the proficient navigation of the tools used to analyze student data by teachers communicating and receiving the
analyzed results. Training on technology use to support instruction was also evident in the science classroom as each teacher either used the reciprocating technology to gather classroom data or used technology to engage students in their daily objectives and lessons. Specifically, the software program used by the teachers to gather student assessment scores, produced a unique data sheet that was evident in the data discussions in PLCs and available for review in all PLC workspaces.

Instructional coaches reported their PLCs functioned in more elaborate ways over time and added value to various instructional practices. While each school had a unique structure, location and process, teachers were actively participating and instructional coaches were actively facilitating. Each school’s PLC process was known to all participants, as there was no instruction observed as to how they were to operate within the PLC meeting, each participant instinctively followed a practiced routine.

These results were consistent with the change theory framework. Science teachers exhibited norms in their classroom through similarities in instructional processes like bell ringers and purposeful technology integration. Science teachers and instructional coaches contributed to a supportive environment within their PLC where collaboration has brought about changes in individual practices and beliefs. Changes in the school were evident, science teachers and instructional coaches indicated the catalyst for change, the need to focus on student outcomes, was being addressed, supported, and sustained through the developed processes and procedures all teachers were practicing through their participation in their PLCs.

**Summary of Research Question 2**

The second research question focused on the instructional coaches’ opinions, as the Professional Learning Community facilitator, of how PLCs help science teachers integrate
technology into their curriculum. Instructional coaches at the three participating middle schools expressed their opinion that PLCs should be teacher-led and teacher-driven, and while they were organic in nature, they were an ever-evolving process that must have support at the beginning, a facilitator to guide the process, and teacher buy-in along the way. These findings were consistent with Lewin’s (1951) theory of change in that a mentor helped promote change as they moved from stage two (change) to stage three (refreeze). They noted as they worked with teachers at all different stages of their careers, each teacher had a unique personality and responded to the “proclamation” of a PLC in different ways.

Instructional coaches worked within the confines of available time, as dictated by their school administration, to encourage teachers to rally around a common idea, student learning, to provide the professional support in ways like professional development, technology integration, data analysis, and instructional practices. This was all while encouraging interpersonal relationships to build trust and trying to inspire teachers to work and support each other for that common idea. Instructional coaches serve two main functions; they are challenged to act as support for struggling teachers at the request of their administrators, creating and executing support plans, which sometimes creates a resentful relationship between them and their teachers, and as a facilitator and ranking member if you will, to bring knowledge and create an inclusive environment of trust in the PLCs. These two very similar but contradicting directives can cause conflict in accomplishing as they attempt to carry out their duties.

This can be explained through Lewin’s (1951) theory of change, as instructional coaches represent two opposing positions in the change timeline. First, they represent change itself, as they are the facilitators of the new expected norms resulting from the stage one unfreezing. Resistance to change is a natural occurrence and instructional coaches have to apply additional
force to overcome the resistance to change. Second, they function as support to teachers, working to build trust and inspire teachers. Instructional coaches admit overtime as they work more with teachers and teachers accept the new norms they are looked upon less as the change agent, and more as a supporter in their growth.

**Summary of Research Question 3**

The third research question provided science teachers’ opinions of how Professional Learning Communities help with technology integration in their curriculum. Following the themes of the study, science teachers reported PLC structure and norms are established within their schools. They believed PLCs within their school successfully encompassed the five core traits of a PLC as outlined in literature. They all share a common core of educational values that helped in the construction of their meeting norms and PLC structure. Instructional coaches agreed with the science teachers, noting they had formal processes of documentation, protected dedicated meeting time, and worked on activities with student outcomes in mind. PLC observation data supported their opinions on structure and norms. Teachers acted in a way that was routine to participation in questioning, presentation, and formalities such as signing in, where to sit, and location of support documents and tools.

Science teachers found collaboration and interpersonal relationships an important aspect of their PLCs, as all science teachers agreed that their colleagues learn together, and from each other in their schools PLC. Instructional coaches agreed and explained that because of PLCs teachers have developed trusting relationships with their colleagues.

Student learning is also the central focus of science teachers. Science teachers overwhelmingly reported they were responsible for student learning. The large majority of science teachers review student data, their instructional practices, and teaching methods in a way
to boost student outcomes. Science teachers also believed technology integration to support student learning was important and evident within their school. Instructional coaches agreed and discussed how teachers were reflecting on data, finding holes in their instruction, preplanning, and finding ways to use technology in a purposeful way, although some teachers expressed their concern that not all students may have equal access to technology.

Science teachers viewed professional development within their PLC with mixed opinions. Science teachers overwhelmingly agreed that they sought ideas from colleagues, took responsibility for their own professional learning, and were open to learning about ways to incorporate technology into their instruction. Only half reported they experimented and innovated about new curriculum and believed their instructional coach was available and would encourage them to learn new technologies. Instructional coaches found teachers were learning from each other rather than seeking out the guidance of their instructional coach.

A slight majority of teachers reported they believed the instructional coach was a valuable member of the PLC team. Instructional coaches noted when PLCs first began it was overwhelming and teachers needed guidance to help them answer and explain how PLCs were supposed to work. They acted as a mentor to model what teachers needed to be doing, and over time, teachers would take over their PLCs. While teachers did find value in their instructional coaches’ contributions, instructional coaches’ perspectives did reveal a separation or distance teachers put between themselves and their coaching facilitators. One instructional coach noted over time this distance seems to have diminished. At first teachers felt like instructional coaches were taking their time away because of what was being asked of them in the PLC, but later they saw the work being done as a time saver.
Looking specifically at science teachers’ responses, Lewin’s (1951) theory of change was very evident at all three stages. Teachers reported student learning is their central focus and overwhelmingly felt responsible for it. Science teachers acknowledged the urgency for change and have embraced that purpose. Science teachers were resistant to change at first, but over time they saw their work in PLCs as a time saver. Science teachers reported PLC structure and norms were established in their school and followed a routine in participation. They also have built trusting relationships with their colleagues. These organizational changes are now the new norm. Each member of the PLC works collaboratively to engage members independently with support and knowledge all while working to improve student learning.

**Summary**

This chapter reviewed the data collection procedures and explained the findings. As a result of the detailed analysis of data coded from the interviews, fieldnotes from the observations, and surveys, four themes emerged: PLC structure, interpersonal relationships, student learning, and professional learning. Chapter V will present conclusions, implications of the study, and recommendations for future research.
CHAPTER V
DISCUSSION

This chapter includes the summary of the findings, discussion of the results, implications for practice, and recommendations for future research on site-based professional learning communities. The purpose of this study was to examine how school site-based professional learning communities promote technology integration in the middle school science classrooms. It also examined the opinions of instructional coaches as PLC facilitators and teachers regarding PLCs and technology integration.

This study was based on the conceptual framework around Kurt Lewin’s (1951) change management process, unfreeze-change-refreeze (Cummings et al., 2016). What is known for effective school change is the school must have the capacity to do things a new way in order to find success (Langmeyer and others, 1969). Technology integration is a complex task and requires flexibility to allow teachers to work within their own teaching philosophy, style, methods, and processes (Angeli & Valanides, 2013; Harris et al., 2009). Unfreezing a school’s present systems is initiated by either a mandate or an ambition to integrate technology and, therefore, requires a change in the organization to modify or eliminate the prior (systems) way of lesson and instructional planning (Dudar et al., 2017; Fullan, 2007; Schein, 1990). Once the school has planned for their desired outcomes (unfreeze), the new norms are introduced for the PLC and processes are established (change). The new norms become normal operating procedures and the school focuses its efforts on supporting these new norms (refreeze) through the work done within PLCs.
Discussion of the Findings

Peter Senge (1990), the founder of the Society for Organizational Learning, described a learning organization where its people are constantly working to achieve their planned results, create innovative thinkers where ideas are valued and nurtured, where collaboration and continually learning work in lockstep for the betterment of the goals and objectives of the organization. This describes the professional learning community. The professional learning community allows educators to engage in a collaborative, supportive, and systematic process that promotes the achievement of significant gains and second-order pedagogical change in teaching and learning (Battersby & Verdi, 2015; Blackley et al., 2018; Bolam et al., 2006; Reeves & DuFour, 2016). The findings in this study, as they relate to technology integration in the middle school science classroom, revealed (a) the importance structure plays in creating sustainable PLCs, and (b) how process engages teachers in educational initiatives specific to their school and populations. The following section will explain and discuss these findings.

PLC Structure

PLC observations, science teacher interviews, and instructional coach interviews revealed how the structure of a PLC creates the foundation of a successful PLC. PLCs in the three schools all had the similar component of time. The observed PLCs had time carved out of the school schedule that was dedicated to PLC meetings. This time was equal to one school period, either daily or weekly depending on the school, and at reoccurring times daily depending on whether the school elected to gather grade level and/or content area teachers. In dedicating this time, participants were obligated as part of their daily schedule to meet in their PLC. The dedication of time itself acted as an accountability measure that supports PLC objectives. Instructional Coach 4, School C stated,
Having protected time is so important. I mean, we rearranged the whole schedule to build and to grow and to try to make it where you have a grade level of prep and a content area of prep, so we can say this is a PLC day, you don’t have to do anything else, we are going to protect that time to be together.

A majority, 87.5%, of science teachers believed they had protected time for joint planning and development. These findings support the work done by Cifuentes et al. (2011). In their study, they found when teachers have time designated to learning in PLCs, a higher use of technology during instruction occurred (Cifuentes et al., 2011). In addition, this dedication of time for PLCs by each of these three schools allowed teachers to overcome one of the three most common barriers that hold them back from integrating technology into their instruction (Bauer & Kenton, 2005; Castro & Santos, 2011; Hsu, 2016; Yu & Okojie, 2017).

Instructional coach interview data from the current study shows schools having dedicated PLC time also supported teacher collaboration. Instructional coaches noted how time dedicated to PLCs built collaborative teacher relationships: “Because of the PLC, because they’ve developed trusting relationships with each other, they have built the foundation for the relationships of constant collaboration” (Instructional Coach 4, School C), and “at first, we had to force it, and know they collaborated without thinking about it. So, it’s just something they do” (Instructional Coach 2, School A). All participating science teachers agreed that collaboration focused on learning was evident within their schools’ PLC. Teachers have built trusting relationships that allow them to learn from and with each other.

The growth of collaboration from teachers learning to trust each other and in working and supporting one another, was a result of the dedication of PLC time. PLCs help develop teachers into supporters of their colleagues’ professional development. Teachers are supporting each other by working together to come up with refined instructional practices that support student learning. Instructional Coach 2, School A remarked,
You see a lot of camaraderie because of the PLCs. I see teams of teachers working together, and they come up with these great ideas, they come up with things they want to do. They are becoming leaders in the building, not only being a collaborator, but also being a motivator as well.

Teachers in this study support each other in integrating technology into their lessons.

Instructional coaches reported that the very structure of the PLC contributed to the success or failure of any potential gains in instructional technology integration.

**PLC Process**

The PLC process allows educators to engage in activities to promote student achievement through second-order pedagogical change in teaching instructional practices. These changes in instructional practices include a movement toward a pedagogy that encourages technology integration derived from the 21st century learning objectives for all students. The observed science classrooms in this study revealed technology use both by the teacher and the students. Second-order changes require time and support. Support at these three schools was in the form of the inclusion of an instructional coach as a facilitator within the PLC meetings. Instructional Coach 1, School A noted,

At the very beginning, when our school system started integrating PLCs into the school system, it was such an overwhelming type of proclamation. Teachers needed that person to help them answer and explain how they were supposed to work, a kind of mentor to model what they need to be doing, setting agenda, and keeping everybody on task, and then over time, doing a gradual release for teachers to take over their PLCs.

An instructional coach as a facilitator was supported by teachers as the majority of science teachers believed they were a valuable member of the PLC team.

The establishment of goals for the PLC outline the shared values and vision which all participants will operate to achieve. Participants in this study believed their colleagues shared those common core values. Teachers worked together on the big picture items such as
assessment, instructional practices, and school culture. In PLCs, teachers are working together on common assessment building and analysis. Instructional Coach 1, School A explained,

Teachers are planning the next test together, they’re deciding what questions are going on it, a lot more front loading and pre planning from the teachers. As for assessment analysis, teachers are digging into data intentionally looking for ways to increase rigor and decrease errors due to question level issues such as misleading or badly worded questions.

Instructional Coach 4, School C explained, “We have data reflection, where are we, can we find holes instructionally, maybe in a particular class and sometimes within the whole content area.” This work leads teachers to reflect on problems of practice and instructional concepts, including efficient use of technology when appropriate. Instructional Coach 1, School A explained,

Teachers are honest with themselves, there were concepts that, well, students don’t get every year and that’s the kind of thing we had to overcome. There’s a reason they are not getting this every year, and we have to figure it out.

The majority of teachers in this study routinely collected, analyzed, and used data to inform their practice. They regularly monitored the learning and progress of individual students, and planned together ways to overcome those identified causes that were restricting or slowing student growth. This type of collaboration led these teachers to look for innovative ways to expand their teaching practice by developing their skills through the support of the instructional coach and/or other teachers sharing and even coteaching together. Instructional Coach 4, School C explained, “There’s just been a lot of outside the box thinking this year. You think about the PLCs and having time just to talk and it makes a huge difference.” Instructional Coach 1, School A said,

They want to try something new; they know that they have the PLC group that’s going to help them, knowing that they’re going to have support if they fall. We’ve had teachers go into other teachers’ classrooms and help facilitate.
Technology integration is one of the objectives within instructional strategies. Technology should enhance a lesson and not be forced for the sake of using technology. While most recognize the importance of technology in schools, building a comfort level for some teachers is a real challenge (Blackley et al., 2018). Failure in the implementation during a lesson can quickly turn off future possibilities of technology use for some teachers, negatively affecting their self-efficacy beliefs about technology integration (Hsu, 2016). The ongoing site-based learning opportunities a PLC offers is a way to combat the neglect of learning how to integrate technology into the science classroom. Instructional Coach 2, School A explained, “There are a lot of teachers that would still be pulling back on technology, and not even trying. But because of the PLC, they’re putting more technology into their lessons.” A majority of teachers surveyed would be open to learning about ways to integrate technology that would enhance lessons for students and they believe it can enhance lessons for students and increase student engagement. The majority of these teachers also believed their PLC can be the forum to address ways to teach responsible use of technology to their students.

Kopcha (2010) found barriers to integrating technology into teaching practices included time, beliefs, access, professional development, and culture. In this study, PLCs directly counteracted each of these barriers through the PLC structure and supports including a fixed time and location for teachers to meet, providing professional development through instructional coach and collaborative teacher supports, belief and culture being addressed by the PLC participants coming together finding solutions around the problem(s) of practice, and individualized school issues facing students. PLCs do not directly overcome the barrier of access. Access to technology is specific to each school and school system’s geolocation, financial situation, stakeholder involvement, and policies. Although, if access is identified by
the school and supported by data from the work done within PLCs, as a barrier to student learning, then a focus to overcome that barrier can be brought to the decision makers within the school or school system. Table 12 organizes the research results into stages of Kurt Lewin’s (1951) change management process.

Table 12

*Kurt Lewin’s Change Management Process and Major Findings From the Research Results*

<table>
<thead>
<tr>
<th>UNFREEZE</th>
<th>CHANGE</th>
<th>REFREEZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate current school needs around instruction and emphasize the threats to the goals and objectives, such as student learning, while encouraging the belief that the new processes and procedures will produce the desirable outcomes.</td>
<td>Members of the organization begin learning and gaining knowledge to support the changes. Members are also building trust for one another and strengthening their psychological safety (Dudar et al., 2017).</td>
<td>The organization’s new processes and procedures have been institutionalized and represent the new norms for the organization (Bargal &amp; Burnes, 2017). It is important for an organization to pay attention to the personal and individual needs of their members, as change is hard and feedback and acknowledgment for exhibiting behaviors that are aligned with the organization’s goals should be facilitated (Dudar et al., 2017).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Beliefs</th>
<th>Implementation</th>
<th>Institutionalized Norms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants in this study believe their colleagues share those common core values.</td>
<td>At the very beginning, when the school system started integrating PLCs into the school system, it was an overwhelming type of proclamation.</td>
<td>All participating science teachers agreed that collaboration focused on learning was evident within their school’s PLC. They regularly monitor the learning and progress of individual students, and plan together ways to overcome those identified causes that are restricting or slowing student growth.</td>
</tr>
</tbody>
</table>

| New Process/Procedure | Gaining Knowledge to Support Changes | Focusing on Support Member’s Work and Innovation |
The observed PLCs had time carved out of the school schedule that was dedicated to PLC meetings. Participants were obligated as part of their daily schedule to meet in their PLC.

Teachers needed that person, to help them answer and explain how they were supposed to work, a kind of mentor to model what they need to be doing, setting agenda, and keeping everybody on task, and then over time, doing a gradual release for teachers to take over their PLCs.

Teachers have built trusting relationships that allow them to learn from and with each other. Teachers are supporting each other by working together to come up with refined instructional practices that support student learning. Teachers are integrating similar technologies in their classrooms.

### Implications of the Study

Schools across America are finding it hard to implement common technology tools students generally use every day outside of school (Baylor & Kim, 2008; Cubukcuoglu, 2013; Office of Educational Technology, 2017). Some of the reasons schools lag behind in integrating technology are budget restraints, under-developed teacher technology training programs, and late adoption practices (Beavers, 2001; Beglau et al., 2011; Lawless & Smolin, 2007). The researcher believes PLCs can work to help overcome these barriers. PLCs provide time for teachers to learn new technologies in a supportive environment to enhance student learning.

Three primary goals of technology integration are to increase efficiency in student learning, connect the learning to real life situations, and to prepare students for their future workplace (Cuban, 2001). PLCs can help teachers by offering technology integration training that focuses on basic usage skills, pedagogical practices, and just-in-time job embedded professional support by utilizing their instructional coach and other teachers (Cubukcuoglu, 2013; Office of Educational Technology, 2017). The researcher found PLCs to be an effective
catalyst in promoting technology integration in the middle school science classroom. PLCs, in the researcher’s opinion, would add value to any subject area teacher in a secondary school supporting their evaluation and implementation of instructional practices to enhance student outcomes.

The researcher in this study found participants in PLCs optimistic about the possibilities of an ever-maturing PLC. PLCs offer schools a way to build a positive school climate and culture by bringing teachers together for a common purpose in a collaborative way. Rosenholtz and Simpson (1990) advocated for teachers working collaboratively, as they saw isolation as an impediment to learning and collaboration and growth and innovation. The researcher found participants in PLC meetings working together on common purposes around student learning. PLCs help build trust among teachers and coaches. The teaching profession is in many ways an ever-changing environment with new initiatives, changing populations, and workforce expectations. PLCs allow schools to address these changes in a safe and supportive environment with other like-minded professionals evaluating and reflecting on ways to integrate that information into their instruction.

For schools interested in establishing a PLC, having a facilitator to help formulate or guide the process is an important piece. When considering a facilitator, an instructional coach is a natural selection. Instructional coaches are typically experienced, well-respected educators whose primary purpose is to support teachers. While other positions can facilitate PLCs, instructional knowledge of strategies and tools should be a strong knowledge base for this position. An administrator who serves as an instructional leader is a good second choice as that position does have authority over teachers and could cause teachers to be a compliant participant rather than a willing participant. This is due to the possible evaluative aspect of the
administrative position, whereas the instructional coach position does not evaluate teachers as a function of a teacher’s job performance evaluation, in most cases. A teacher in the building could also serve as a facilitator within the PLC, which is how many PLCs currently function. One major issue to consider is the lack of time that teachers would have to research instructional practices and strategies, technologies, and the limited ability to offer extensive supports, as they would have their own classrooms to manage and lessons to plan. Time is a major component of a PLC and requires a lot of work for facilitators in preparing to support the objectives set by its community members.

**Recommendations for Future Research**

The fields of instructional technology and technology integration are always changing as new technologies are being introduced. Future research should reflect the continual changes in both technology and technology usage. Gaps in technology adoption within near age students can vary as much as the gaps in confidence between teachers in technology usage within a school building. Future research can examine student anxieties about using technology in the classroom at schools with low or limited access to resources. A by-product of creating time in a school schedule for teachers to have dedicated time for a PLC, is the absence of instructional time that is created by its development. This may inadvertently cause larger class sizes and add to teachers’ course loads in the number of different courses taught in the day due to a reduction in section numbers of the affected course. Research can look at the negative effects of installing PLCs on class size and teacher workloads.

This study was conducted in three schools within the same system; a future study could extend over a larger number of schools within the same system, compare schools in different systems, or increase the overall number of schools over many school systems. Future research
may also look at a different subject area, or concentrate on high schools, or elementary schools. Continued research in fields that are impacted by PLCs such as technology integration, instructional practices, and school culture will ultimate help students and increase their opportunities beyond K12 education and into college or career readiness.

**Conclusions**

In the mid-20th century, Kurt Lewin, the founding father of change management, laid the foundation of organization change in three words . . . unfreeze, change, refreeze (Cummings et al., 2016). In the mid-1960s, researchers began some of the earliest work around organization development in schools. Professional learning communities embrace these early ideas as the vehicle of change.

This research examined how site-based PLCs promote technology integration in middle school science classrooms. Eight science teachers across three schools were surveyed on their opinions of how PLCs helped with technology integration in their curriculum. Science teachers reported they believed technology integration to support student learning is evident and supported by the PLC, within their school, and successfully encompasses the five core traits as outlined in literature.

This research also examined instructional coaches’ opinions of how professional learning communities help science teachers integrate technology into their curriculum by interviewing four instructional coaches, serving as PLC facilitators within these three middle schools. Instructional coaches reported that PLCs should be teacher led and teacher driven, and while they are organic in nature, it is an ever-evolving process that must have support in the beginning, a facilitator to guide the process, and encourage teacher buy-in along the way. They note as they
work with teachers at all different stages of their careers, each teacher has a unique personality and responds to the work to be done in PLCs in different ways.

The overall findings in this research have shown how PLCs promote technology integration in the middle school science classroom. Specifically, this study revealed the PLC structure plays an important role in sustainability, and how the process engages teachers in educational initiatives specific to their school and populations. The PLC structure and process directly affect culture and building interpersonal relationships, student learning to help enhance academic progress, and professional learning in providing opportunities for teacher growth and development. Additional research needs to be conducted specifically on student achievement growth from the effects of the integration of technology in the science classroom curriculum.
REFERENCES


APPENDIX A

PERMISSION TO USE SURVEY
Re: Dissertation Survey

Teresa_Bitterman@Gwinnett.k12.ga.us

Mon 1/29/2018 8:18 AM

To: Daniel Bray <dbray@tcss.net>;

Good Morning,

Yes, you are welcome to use any parts that will be useful for your dissertation. Please feel free to contact me, if you have questions. Have a great day.

Teresa

Dr. Teresa Bitterman
Osborne Middle School
6th Grade Science
Master Teacher Certified
From: Daniel Bray <dbray@tcss.net>
To: "teresa_bitterman@gwinnett.k12.ga.us"
     <teresa_bitterman@gwinnett.k12.ga.us>
Date: 01/28/2018 01:34 PM
Subject: Dissertation Survey

Dr. Bitterman,

I am working on my dissertation and ran across your survey on PLCs. I was hoping you would allow me to use parts of your survey. Part of my research involves teacher perceptions of PLCs. Thanks for the consideration.

Daniel Bray
Principal
Brookwood Middle School
205-342-2748

LEARN, GROW, ACHIEVE!

E-MAIL CONFIDENTIALITY NOTICE The contents of this e-mail message and any attachments are intended solely for the addressee(s) and may contain confidential and/or legally privileged information. If you are not the intended recipient of this message or if this message has been addressed to you in error, please immediately alert the sender by reply e-mail and then delete this message and any attachments. If you are not the intended recipient, you are notified that any use, dissemination, distribution, copying, or storage of this message or any attachment is strictly prohibited.
APPENDIX B

INTERVIEW PROTOCOL
Interview Protocol

The Professional Learning Communities Instructional Coach Interview was administered to participating instructional coaches within the three selected schools in my study. An introductory meeting was set up for the interviewer to speak with the instructional coaches at each of the three selected schools to share information regarding the research, interviews, and time frames. Interviews will take place face-to-face. Instructional coaches’ interviews were conducted after the classroom and PLC meeting observations have occurred.

Interview Guide

Welcome and thank you for participating. I am Daniel Bray, a graduate student at the University of Alabama working on my PHD in Educational Technology. My study examines how site-based PLCs promote technology integration for middle school science teachers. I will ask you a series of questions and I would like you to give your perspective. If you need a break please let me know and we can take a break. I will be recording your voice on my iPhone and MacBook, although this is for my reporting process and you will not be identified. Do you have any concerns or questions before we begin?

Research question: The purpose of this research is to examine how site-based professional learning communities promote technology integration in the middle school science class. Specifically, what are instructional coaches’ opinions of how PLCs help teachers integrate technology into their curriculum?
Interview Questions

1. Tell me your thoughts around student use of technology and student engagement?
2. Do you believe technology integration can enhance a student’s ability to learn? If so, how?
3. With all the types of technology students immerse themselves with in their everyday lives, how should schools react or change to make student’s learning environment reflect their living/social environment?
4. What role does the school have in helping teachers become comfortable with technology to encourage its use? Have you ever felt unprepared to use technology and how have those feelings been addressed in your PLC?
5. Please describe how PLCs operate in your school.
6. PLCs require participants to plan, collaborate, and work together with a focus on results on learning. In your opinion, how does a PLC hinder or enhance the teacher experience in planning with technology integration in mind? Enhance or hinder their interpersonal relationships among the team?
7. Tell me how your participation in the PLC has affected teacher planning and growth.
8. How do you feel having on-site PLCs on a regular basis have contributed teacher collaboration? What positive contributions has collaboration had in your school?
9. First order change, is described as minor alterations within strategies, practices, or pedagogy. Second order changes are fundamental shifts in teaching practices. In your opinion, in what ways have you experienced PLCs help teachers make these fundamental shifts in their teaching practices?
10. Please describe the following attributes of PLCs characteristics for your school’s PLC:
   1. Shared values and vision
   2. Collective responsibility for student learning
   3. Reflective professional inquiry
   4. Collaboration
   5. Professional learning
11. What barriers have affected your teacher’s ability to be a contributing member within the PLC environment?
12. Arguably, the single most critical aspect in supporting a PLC environment is time. How does your school address PLC time?
13. Describe how you support teachers with job-embedded coaching and specifically as it pertains to technology integration?
14. What aspects of the instructional coaching position do you find most frustrating when working with those teachers who are disengage or disinterested?
APPENDIX C

OBSERVATION TOOL
Technology includes such things as computers, laptops, software, iPods, iPads, interactive whiteboards, digital cameras, document cameras, video cameras, the Internet, clickers, 3D virtual space, etc.

1. Teacher Activities:
*(check only if technology is being used for...)*
- Activating prior knowledge
- Assessments
- Cues, questions and advance organizers
- Demonstration
- Differentiated instruction
- Facilitation (guiding)
- Lecture
- Providing Feedback
- Questioning
- Reinforcing/recognition
- Scaffolding
- Setting objectives
- Summarizing
- Other (please specify): ______________

2. Technology is being used as a tool for...
*(Check either Teacher or Student or both)*

<table>
<thead>
<tr>
<th>Problem Solving (e.g. graphing, decision support, design)</th>
<th>Teacher</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication (e.g., document preparation, email, presentation, web)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Processing (e.g., data manipulation, writing, data tables)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research (e.g., collecting information or data)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal Development (e.g., e-learning, time management, calendar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group Productivity/Cooperative Learning (e.g., collaboration, planning,)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formative Assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summative Assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brainstorming</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer-assisted instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Face to face classroom discussion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Face to face group discussion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asynchronous discussion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drill and practice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generating and testing hypotheses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identifying similarities and differences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project-based activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summarizing and note-taking</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. **Technology hardware is in use by...**  
*(Check either Teacher or Student or both)*

<table>
<thead>
<tr>
<th>Technology Hardware</th>
<th>Teacher</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistive Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Audio (e.g., speakers, microphone)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art/Music (e.g., drawing tablet, musical keyboard)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imaging (e.g., camcorder, film or digital camera, document camera, scanner)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display (e.g., digital projector, digital white board, television, TV-link, printer)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Media Storage / Retrieval (e.g., print material, DVD, VCR, external storage)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math / Science / Technical (e.g., GPS, probeware, calculator, video)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desktop computer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laptop computer (including tablets)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please specify):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. **Student engagement is shown by...**

<table>
<thead>
<tr>
<th>Positive indicator of Engagement</th>
<th>Circle your best estimate of the percentage of students showing each positive indicator of engagement</th>
<th>The opposite is Disaffection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustained behavioral involvement</td>
<td>100% 80% 60% 40% 20% 0%</td>
<td>Tendency to give up easily in the face of challenges</td>
</tr>
<tr>
<td>Positive emotional tone—cheerful, calm, communicative</td>
<td>100% 80% 60% 40% 20% 0%</td>
<td>Negative emotional tone—boredom, depression, anxiety, anger, withdrawal, or rebellion</td>
</tr>
<tr>
<td>Selection of tasks at the border of their competencies</td>
<td>100% 80% 60% 40% 20% 0%</td>
<td>Selection of tasks well within their comfort zone</td>
</tr>
<tr>
<td>Initiation of action when given the opportunity</td>
<td>100% 80% 60% 40% 20% 0%</td>
<td>Passivity, lack of initiative</td>
</tr>
<tr>
<td>Exertion of effort and concentration</td>
<td>100% 80% 60% 40% 20% 0%</td>
<td>Laziness, distraction</td>
</tr>
</tbody>
</table>

5. **How was technology used in this classroom?**

   - Replacement: ________________________________

   - Amplification: _______________________________

   - Transformation: ______________________________

*Modified with expressed permission from: The Friday Institute (2007)  
https://eval.fi.ncsu.edu/lofti-looking-for-technology-integration/*
APPENDIX D

IRB APPROVAL LETTER
April 22, 2019

Daniel Bray
ELPTS
College of Education
Box 870302

Re: IRB # 19-OR-115, "An Examination of how School Site-Based Professional Learning Communities (PLCS) Promote Technology Integration in Middle School Science Classrooms"

Dear Mr. Bray:

The University of Alabama Institutional Review Board has granted approval for your proposed research. Your application has been given expedited approval according to 45 CFR part 46. Approval has been given under expedited review category 7 as outlined below:

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

The approval for your application will lapse on April 21, 2020. If your research will continue beyond this date, please submit the continuing review to the IRB as required by University policy before the lapse. Please note, any modifications made in research design, methodology, or procedures must be submitted to and approved by the IRB before implementation. Please submit a final report form when the study is complete.

Please use reproductions of the IRB approved informed consent form to obtain consent from your participants.

Good luck with your research.

Sincerely,

[Signature]

Director & Research Compliance Officer
APPENDIX E

PROFESSIONAL LEARNING COMMUNITIES (PLCS) SURVEY
PROFESSIONAL LEARNING COMMUNITIES (PLCS) SURVEY

Survey Protocol

The Professional Learning Communities Survey was administered to participating science teachers within the three selected schools in my study. An introductory meeting was set up for the surveyor to speak with the science teachers at each of the three selected schools to share information regarding the research, surveys, and time frames. The researcher collected participating teachers’ surveys in a 2-3-week time frame.

Professional Learning Communities (PLCs)

Section 1:
A professional learning community (PLC) is a vehicle or mechanism where educators engage in a collaborative, supportive, and systematic process that promotes the achievement of significant gains and second-order pedagogical change in teaching and learning (Battersby & Verdi, 2015; Reeves & DuFour, 2016; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006).

In completing this section, select one number using the scale provided that best reflects your position.

<table>
<thead>
<tr>
<th>Teachers in your professional learning community…</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Take collective responsibility for student learning.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. Base their approach to change on good evidence.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. Learn together with colleagues.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. Actively seek ideas from colleagues in other schools.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
5. Routinely collect, analyze, and use data and evidence to inform their practice. 1 2 3 4 5

6. Regularly monitor the learning and progress of individual students. 1 2 3 4 5

7. Share a common core of educational values. 1 2 3 4 5

8. Think their work load is too heavy. 1 2 3 4 5

9. Are involved in seeking solutions to problems facing the school. 1 2 3 4 5

10. Regularly discuss teaching methods. 1 2 3 4 5

11. Share experiences and successes. 1 2 3 4 5

12. Experiment and innovate about new curriculum. 1 2 3 4 5

<table>
<thead>
<tr>
<th>Teachers in your professional learning community…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

13. Receive training in how to work and learn in teams. 1 2 3 4 5

14. See the school as stimulating and professionally challenging. 1 2 3 4 5

15. Learn from each other. 1 2 3 4 5

16. Take responsibility for their own professional learning. 1 2 3 4 5

17. Have some protected time for joint planning and development. 1 2 3 4 5

18. Actively contribute to the school as a professional learning community. 1 2 3 4 5

19. Give priority to learning more about a subject 1 2 3 4 5
20. Share responsibility for student learning. 1 2 3 4 5

21. Have opportunity for professional development. 1 2 3 4 5

22. Are satisfied with their job. 1 2 3 4 5

23. are supportive in helping integrate technology into lessons. 1 2 3 4 5

24. Believe the instructional coach is a valuable member of the PLC team. 1 2 3 4 5

25. Believe the instructional coach is available and encourages PLC members to learn new technologies. 1 2 3 4 5

26. See the PLC as a valuable place to learn and experiment with new technologies. 1 2 3 4 5

27. Would be open to learning about ways to integrate technology that would enhance lessons for students. 1 2 3 4 5

28. Believe technology can increase engagement and enhance the student’s learning experience. 1 2 3 4 5

29. Feel the digital divide is being addressed in the classroom and all students have equal access to the technology planned in the lessons. 1 2 3 4 5

30. Believe the PLC can be the forum to address ways to teach responsible use of technology to students 1 2 3 4 5

31. How long have you been teaching? _____Years _____Months

32. How long have you been teaching at this school? _____Years _____Months

33. Do you have common planning? _____Yes _____No

34. Do you regularly attend PLCs? _____Yes _____No