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Creating a Technology-Enabled Practice: Integrating Technology through Collaborative Professional Development

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Creating a Technology-Enabled Practice: Integrating Technology through Collaborative Professional Development

By

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ABSTRACT
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Technology has transformed our world, however; it has yet to revolutionize our schools. When teachers integrate technology effectively into their classroom practice, they provide students with the ability to access a tremendous amount of information, communicate with others both near and far, and demonstrate their learning in innovative ways. The literature indicates that teachers who utilize more constructivist approaches, that incorporate students' interest into the classroom, provide time for students to collaborate and construct meaning and demonstrate understanding, are better able to integrate technology in meaningful ways. Many secondary teachers are constrained by the isolation inherent in the schools, which perpetuates their use of traditional, didactic teaching approaches and maintains teachers' low sense of efficacy with the use of technology. The theory of action that underpins this research is based on the assumption that teachers who are provided with a professional learning experience allowing them to experiment with technology and to develop their pedagogical and technological confidence in the use of the technology will be more likely to integrate technology into their teaching in meaningful ways.

This design development study aimed to provide teachers with a collaborative professional learning experience to support the integration of technology, specifically their use of a learning-management system, Google Classroom, and student mobile devices. Eight secondary teachers participated in the professional learning experience, which included five workshop sessions (two full-day sessions and three after-school two-hour sessions). The workshop series provided teachers with open-ended work time to create curricula in the Google Classroom as well as time to reflect on their students' experiences in their classrooms. Two kinds of data were collected and analyzed through the courses of this study; process and impact data. The process data provided insight into how the

professional learning experience unfolded and the impact data illuminated how the experience influenced the teachers' classroom practice.

The professional learning experience was designed to impact two dimensions of the teachers' practice. First, through modeling and structured work time, the teachers were encouraged to develop student-centered instructional practices, routines, norms, and procedures that support technology integration. The second dimension related to teachers' increased use of technology-enabled instructional strategies, norms, and organization. Overall, the teachers increased their effective use and integration of technology. They also showed more willingness to consider possible ways of incorporating student-centered instructional strategies into their practice, although the influence of the design development study on this aspect of the teachers' practice was less pronounced. Finally, the data indicated that professional development designed to increase teachers' effective use of and sense of confidence with technology requires that teachers have time to collaborate with like-minded colleagues, experiment with the technology in the context of their curriculum, and be provided appropriate levels of technical support.

Dedication

This dissertation and all that it represents is dedicated to my husband, Eddy. You made this possible. Thank you for driving me to and from class when I was tired, for holding my hand when I was stressed, and holding my heart when I was just plain done. To my daughter, Rosalind, I carried you in my womb and then in my arms for the majority of this undertaking, you inspire me to be the best of myself. To my parents, Mom and Dad, thank you for bringing me into this world and always being supportive, no matter what. Also, thank you for always being there to talk! Finally, I dedicate this dissertation to my grandmother, Elaine Marquardt; you continue to inspire generations of your children and grandchildren to pursue a higher education with your legacy.

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LEEP reignited my passion for education. I learned as much about research as I did about myself. I would like to acknowledge my advisor, Dr. Glynda Hull. Thank you for taking the chance with me! You provided just the right amount of structure, rigor, and kind, positive support to guide me through this process. To Brenda, Pam, and Judy, the ladies of LEEP 6, thank you for keeping the pace strong! Finally, thank you, Dr. Rick Mintrop, for creating a program for practitioners to interact, understand, and deeply inquire into the research about our work so we can do better by the students that we serve.

CHAPTER 1
PROBLEM OF PRACTICE AND REVIEW OF THE LITERATURE

Introduction

Technology has transformed the way students communicate, socialize, and learn about the world around them (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013; L. D. Rosen, Carrier, & Cheever, 2010). Widespread access to the Internet via laptops, tablets and smartphones allow students, particularly teenagers, to access information instantaneously, interact and communicate with peers both locally and globally in real time, as well as in asynchronous ways (G. A. Hull, Stornaiuolo, & Sahni, 2011; Mahiri, 2011). Advances in mobile communication and easy access to a profound amount of information have the potential to revolutionize public education by engaging and inspiring students (Chandrasekhar, Ittelson, Quinones, & Silberberg, 2012; Darling-Hammond, 2010; Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013), or at least that is the hope.

Educators, policy makers and community members recognize the need to change the way that students are educated by deploying the current educational technology (Chandrasekhar et al., 2012). The widespread deployment of student mobile devices into schools has increased teachers' access to technology (P. Ertmer & Ottenbreit-Leftwich, 2010; Mahiri, 2011; November, 2012), and the influx of these devices has re-ignited the discussion on how best to integrate and fully utilize technological tools for student learning (Cuban, Kirkpatrick, & Peck, 2001; Lei, 2010). Teachers feel pressure to update their teaching to integrate technology in order to create relevancy for their students; however, such change requires a shift in practice and belief about the best way of educating students—from rote memorization and simple reproduction of facts to an instructional practice that allows for students to use technology to learn in innovative ways (Chandrasekhar et al., 2012; Darling-Hammond, 2010; Ross, Morrison, & Lowther, 2010).

Statement of the Problem and Design Challenge

The problem of practice selected for this design development study is that secondary teachers in Coronado Unified School District[1] tended to rely on traditional teaching practices to deliver content to students. The traditional teaching practices, which sometimes are referred to as "direct instruction," included lectures, close-ended questioning and whole class discussion, created few opportunities to integrate student mobile devices effectively (Hill & Smith, 1998; Karagiorgi & Symeou, 2005; Y. Rosen & Beck-Hill, 2010). Reliance on traditional teaching techniques as well as the

[1] Pseudonyms have been used for the names of all persons and schools.

institutional structure of schools negatively impact secondary teachers' capacity to integrate technology effectively into their teaching practice (Cuban et al., 2001). The goal of this design development study was to disrupt the isolated teaching environment and provide teachers with the time and space to innovate and develop the pedagogical and technological skill to integrate technology effectively. I strived to accomplish this by creating a research-based and collaborative professional learning experience for secondary teachers in the Coronado Unified School District.

According to my preliminary research, middle and high school teachers in Coronado struggled to integrate technology in a way that enhanced student learning, because they had few opportunities to examine and ultimately shift specific teaching behaviors. Such behaviors include their sense of efficacy in the use of technology, their beliefs about student learning and instruction, an over reliance on teacher-centered instructional strategies, and their lack of access to collaborative learning experiences (Achinstein, 2002; P. A. Ertmer, 2005; Mishra & Koehler, 2006). Self-efficacy refers to a teachers' confidence about their technical and instructional ability to effectively integrate technology (P. Ertmer & Ottenbreit-Leftwich, 2010; G. Hull, Scott, & Higgs, 2014; Zhao, Y., Pugh, K., Sheldon, S., Byers, 2002). When teachers are not sure about when or how to use technology to meet student-learning goals, they are understandably reluctant to incorporate technology (P. A. Ertmer, 2005). Further, since teachers develop instructional strategies based on their beliefs about how students learn, and many teachers, particularly secondary teachers, hold strong beliefs that students learn best through a teacher-centered and traditional practice, the result is often low-levels of technology use (Cuban et al., 2001; Mahiri, 2011; Tondeur, Hermans, van Braak, & Valcke, 2008).

An obstacle to effectively integrating educational technology is the beliefs that teachers hold about how students learn (P. Ertmer & Ottenbreit-Leftwich, 2010). The traditional style of teaching— in which students are passive recipients of information and the teacher is the main source of it has been the mainstream education model for so long that many veteran and even new teachers continue in this mode of teaching because it is the way that they were taught themselves (Darling-Hammond, 1997; Roberts, Shedd, & Norman, 2012). Making the shift from a traditional to a more "constructivist" approach to teaching requires that teachers have the opportunity to take on the role of a student and thereby readjust their beliefs about teaching and learning (Desimone, Porter, Garet, Yoon, & Birman, 2002; Wineburg & Grossman, 1998). When teachers transition toward a more constructivist pedagogy, they begin to design their classes based on the belief that students can learn and construct knowledge when educators create experiences that allow for problem-solving and collaboration around broad, open-ended questions in contrast to more traditional approaches that position students to learn passively through lecture or other similar strategies (Cuban et al., 2001; Petko, 2012). Technology can be used to encourage this shift, but it does not necessarily guarantee that teachers will become more student-centered (Dexter, Anderson, & Becker, 1999). Thus, while secondary teachers in Coronado had access to more instructional technology, it is not likely they would have

effectively integrated technology in the way that has the potential to transform the learning environment and promote student learning. This study was an attempt at providing the teachers with an opportunity to learn how to utilize the technology in an effective way.

Review of the Literature

In the next section, I will review the literature to situate this study within the current research about technology integration in secondary schools. First, I will define technology in the context of this study. Then, I outline the current instructional practices, the institutional context in which teachers work, and how this impacts effective technology integration. Third, I will use the literature to provide a detailed description of how teachers effectively integrate technology into their practice by making the shift from a traditional teacher-focused practice to a more student-centered, constructivist view of education. Last, I will explore what the literature reveals in terms of designs of professional development that encourage teachers to embrace instructional technology and increase their sense of self-efficacy at integrating technology. Based on this analysis, I conclude that it is essential to support teachers in transitioning to a more student-centered practice in order to adequately and properly prepare students for the technological advanced world (Darling-Hammond, 1997; Zhao, Pugh, Sheldon, & Byers, 2002). In addition, I will explain the implications for district and school leaders who wish consider similar change efforts.

Defining Technology

The vague concept of educational technology in the literature convolutes the ability to study its impact in the classroom (Lei, 2010). With each new invention and advancement in technology, from the chalkboard to film strip projectors to the modern laptop computer, it is not uncommon for researchers, inventors, and educators to declare that it will disrupt and ultimately transform the practice of teaching (Cuban, 2001; Windschitl & Sahl, 2002; Zhao et al., 2002). As early as the 1910's, Thomas Edison famously stated, "Books will soon be obsolete in the public schools. Scholars will be instructed through the eye. It is possible to teach every branch of human knowledge with the motion picture. Our school system will be completely changed inside of ten years" (Smith, 1913). However, these sweeping declarations mixed with the nebulous and ever-changing nature of educational technology, create a challenge for teachers as it requires changes in pedagogy to manage the transition from one technology to the next (Cuban et al., 2001). As such, I defined technology for the purpose of this study to provide clarity and scope on how its influence was reviewed. Technology is defined as students' access to internet-connected mobile devices, such as Chromebooks, iPads or other tablets as well as a learning management system (LMS) like Google Classroom in the Coronado Unified School District. Most importantly, the technology alone cannot transform the classroom, rather, the teachers' ability to align their pedagogy to the effective use of technology is

what will provide for the innovation in the students' experience and is the focus of this study (Cuban et al., 2001; Zhao et al., 2002).

School and Society: Factory Model Schools

Before I discuss the integration of technology as a tool for fostering constructivist pedagogies, it is necessary to understand the institutional structure and historical context in which schools have developed. In this section, I will synthesize the literature related to the factory model of schooling, which continues to influence the design and culture of schools today. I will discuss the historical context for factory model schools, the influence of this history on the organization of the school day, and the resulting impacts on the role of the teacher in departmentalized settings. Based on this analysis, I argue that the cumulative result of the institutional structure of school creates significant obstacles to using technology in meaningful ways in the classroom.

The structure and intent of schools in the United States are the result of the needs of a society's economy (Beyers, 2009; Collins & Halverson, 2010). Since the advent of public education occurred almost simultaneously with the industrial revolution, the educational system reflects the need to develop workers who have the skills necessary for the factory (Collins & Halverson, 2010; Darling-Hammond, 2010). A factory model of schooling focuses on rote memorization and task-related activities that mimic a factory environment. As Collins and Halverson (2010) explain, "Deeply ingrained in the structure of schooling is a mass production of uniform learning. Age-grading and common assessments, for example, emphasize the belief everyone should learn the same things at the same time" (p. 19). A structure that emphasizes uniformity and conformity results in an extremely teacher-centered approach based on the concept that students should know a specific body of knowledge, which is transmitted to the student via the teacher (Collins & Halverson, 2010). A factory model of education has been perpetuated in part because most educators were themselves schooled in this traditional, teacher-centered manner (Foon Hew & Brush, 2007). In fact, many educators continue to believe that their role is to deliver material through direct instruction (Darling-Hammond, 2010).

Most schools still support the needs of an industrial economy where a worker's day was divided into segments and dictated by the factory bells; similarly to many middle and high schools that divide the day into fifty-minutes periods and use bells to move the student from class to class (Beyers, 2009; Collins & Halverson, 2010; Cuban et al., 2001). Unfortunately, because of such institutional practices, not only do students lack the opportunity to inquire, discover or learn in context; teachers also do not have the time within a class period to initiate, much less sustain, a classroom environment conducive to the integrated use of technology (Cuban et al., 2001; Earle, 2002; Foon Hew & Brush, 2007). As Cuban et al. (2001) explain, "The structure of the six period day made it difficult for teachers trained in separate disciplines to adopt innovations and engage in school reforms that require them to cross subject boundaries and team with other

teachers" (p. 827). Some schools are beginning to provide teachers with block scheduling which can address this contextual obstacle and ensure that each class period is at least 90 to 120 minutes (Foon Hew & Brush, 2007). Secondary schools in Coronado implemented a modified block schedule, which provided teachers with longer periods twice a week.

An additional effect of the separation of the disciplines into distinct periods of instruction is the endurance of the teacher as the main source of information (P. Ertmer & Ottenbreit-Leftwich, 2010). Separating the disciplines decontextualizes the content so the teacher can easily convey the topics through lecture or other traditional teaching techniques that do not require technology (Cuban et al., 2001). As a result, teachers maintain their stance as the expert and the center of student attention (P. Ertmer & Ottenbreit-Leftwich, 2010). This is true even of schools with abundant amounts of technology (Cuban et al., 2001; Zhao et al., 2002). As Cuban, et al (2001) explain in their study of schools with high levels of access to technology, " Consider how external tests, departmental organization, secondary teachers' disciplinary training, and self-contained classrooms encourage teachers to behave as academic specialists whose primary concern is covering the body of information contained within a text in 36 weeks" (p. 828). As a result, despite access to technology, teachers continue to practice in a traditional manner as well as present content in discrete pieces of information, which are many times out of context for students.

I conclude that the historical basis of schools designed on the factory model contributed to a structure that inhibits the teacher learning and change necessary for technology integration in ways that advance teacher pedagogy. I further argue that as long as teachers continued, as they did in Coronado, to hold the belief that they must be the main source of information, it will be difficult to shift toward a more technologically mediated instructional practice where the internet, social media and other electronic resources are viewed as critical sources of information for the classroom experience (P. Ertmer & Ottenbreit-Leftwich, 2010; King, 2002; Zhao et al., 2002). Such a shift requires teachers to simultaneously transform their pedagogy and to take advantage of the new instructional tools that technology provides.

Prevailing Pedagogical Beliefs and Practices

In this section, I discuss the literature related to prevailing pedagogical practices and beliefs of teachers that impact the effective use of technology in the classroom, including the persistence of privatized teaching practice and the belief in a teacher-centered practice. Then, I contrast these practices with a review of the literature on necessary pedagogical beliefs for the integration of technology into teachers' practice, including a belief in a student-centered practice, which focuses on developing student skills relevant to present economy. First, however, I will outline the prominent pedagogical beliefs that exist in the teaching profession and their impact on a teacher's likely use of technology.

The transformation of pedagogy and instructional strategies is not easily realized since the institutional structure of schools require teachers to work in isolation and, as a result, maintain an individualized practice that is not conducive to change (Little, 1990; Zhao et al., 2002). Teachers tend to persist in an individualized and privatized teaching practice and are resistant to meaningful collaboration with other teachers because innovation and attempting pedagogical change exposes the uncertainties of the classroom (Little, 1990). Further, when teachers are encouraged or otherwise pushed to collaborate, there is a danger of conflict arising, which may decrease the likelihood of teachers working with their peers to shift their practice (Achinstein, 2002).

When teachers work in isolation, particularly secondary teachers, they have little opportunity to integrate the content areas they teach which perpetuates the decontextualized and segmented nature of schooling (Cuban et al., 2001; Darling-Hammond, 2010; Zhao et al., 2002). An integrated approach to content, as opposed to dividing the school day into subjects like science, mathematics, English, etc.; provides for a ripe environment to incorporate technology in meaningful ways (Cuban et al., 2001; Darling-Hammond, 2010; Zhao et al., 2002). Further, teachers persist in a didactic and decontextualized instructional approaches because this style of teaching continues to be the norm and has been propagated and ultimately, rewarded by legislation like No Child Left Behind and the associated assessments (Newmann, Bryk, & Nagaoka, 2001; Roberts et al., 2012). Developing a technologically advanced teaching practice is a time-consuming process and may limit teachers' ability to manage the many tasks of the teaching profession (Cuban et al., 2001; Ertmer & Ottenbreit-Leftwich, 2010). As Ertmer & Ottenbreit-Leftwich (2010) explain, "Teaching with technology requires teachers to expand their knowledge of pedagogical practices across multiple aspects of the planning, implementation, and evaluation process" (p.260).

In addition, teachers' beliefs influence the way that they deliver instruction and their perceptions about how students learn (Lumpe, Haney, & Czerniak, 2000). Teachers tend to integrate technology in a way that is congruent with their current practice (Zhao et al., 2002). Such persistence in a traditional teacher-directed practice is also partially due to the belief that direct instruction will result in higher student achievement on standardized tests (Foon Hew & Brush, 2007). Again, with the initiation of the No Child Left Behind Act of 2001 and its emphasis on standardized tests as the measure of effective education, the frequency with which teachers use more traditional teaching methods has increased (Newmann et al., 2001). The belief that direct instruction and teacher-centered practice results in higher student achievement on standardized tests contributes to the increase of more traditional teaching methods and further constrains what teachers do in the classroom (Newmann et al., 2001). The perception is that in order for students to be able to reproduce discrete facts, teachers should provide a lecture-based pedagogy ensuring that the specific content is covered (Cuban et al., 2001; Foon Hew & Brush, 2007; Lim & Khine, 2006).

Since teachers develop instructional strategies based on their beliefs about how students learn, it is crucial that teachers have the opportunity to develop the pedagogical and content knowledge which supports the cultivation of beliefs of how technology can improve student learning (Hew & Brush, 2007; King, 2012) However, it appears that many teachers, particularly secondary teachers, hold strong beliefs that students learn best through a teacher-centered and traditional practice, which may lead to low-levels of technology use (Cuban et al., 2001; Mahiri, 2011; Tondeur et al., 2008). Furthermore, teachers' pedagogical beliefs influence the extent to which they will effectively integrate technology into their teaching practice (Cuban et al., 2001; P. A. Ertmer, 2005; Tondeur et al., 2008; Zhao, Y., Pugh, K., Sheldon, S., Byers, 2002). As Sugar, Crawley and Fine (2004) explain,

> Teachers' technology beliefs are influenced by their teaching philosophy. Resistance to adopting new technologies stem from teachers' existing teaching beliefs. For technology adoption to be successful, a teacher must be willing to change their role in the classroom. When technology is used as a tool, the teacher becomes a facilitator and students take on a proactive role in learning (p. 202).

A teacher who believes that students learn best through a student-centered and innovative practice is more likely to use technology in a more integrated manner (Dexter et al., 1999; Sugar, Crawley, & Fine, 2004; Zhao et al., 2002).

In summary, current-teaching practices, which emphasize teacher-centered pedagogies, grow from a resistance to collaboration and teachers' ingrained beliefs about what constitutes student learning and the best methods for maximizing student learning in that context.

Teachers' Core Practices for the Effective Integration of Technology

In this section, I will provide the contrasting picture, emerging from the literature, of how a constructivist pedagogy that places students at the center of instruction can potentially allow for the effective integration of technology. When teachers have the time and collaborative space to develop pedagogy, they are more likely to effectively integrated technology in ways that improve the students' experience (Foon Hew & Brush, 2007; Kay & Greenhill, 2013; King, 2002; November, 2012; Zhao et al., 2002). Below, I will outline core-teaching practices, drawn from the literature, that are effective for ensuring the appropriate integration of technology. Describing constructivist pedagogy and its relation to a technology-enabled classroom is a critical component of integrating technology in meaningful ways. Then, I will present the work of researchers who have outlined the skills necessary for teachers to develop curriculum aligned with technology integration. I conclude by describing the three major knowledge bases that teachers need

in order to be proficient at integrating technology which include: technological knowledge, pedagogical knowledge, and content knowledge.

Constructivist Approach and the Technology-Enabled Classroom

Educational theorists and researchers recognize that teachers are better able to integrate technology when they have a more constructivist approach to teaching where students are actively involved in the learning (Foon Hew & Brush, 2007; King, 2002; Mahiri, 2011; Zhao et al., 2002). The idea that students learn best when they actively participate in their own knowledge creation is not a new idea, educational philosophers have advocated placing students at the center of the learning for many generations. John Dewey (1902) argued that a student-centered pedagogy promotes authentic learning and is an integral part of creating a classroom that is aligned to the needs of students. A transition to a more authentic and integrated experience for students requires that teachers develop constructivist pedagogy.

Tondeur and colleagues (2008) found that there is a relationship between teachers' beliefs about education and their use of technology. Todeur's empirical study surveyed 547 elementary school teachers. The questionnaire was developed to glean from teachers "educational beliefs and about their use of computers in the classroom" (p. 2545). The researchers then utilized cluster analysis to group the teachers with others that were similar in terms of the beliefs, which they divided into two main categories: traditionalism and constructivism. They also analyzed the computer use of the different groupings of teachers. They found that there is a "consistent relationship between teacher profiles, based on their educational beliefs, and the frequency of class use of computers: a teacher profile with relatively high constructivist beliefs tends to show a high frequency of educational computer use" (p. 2549)

Teachers who define their role differently in the classroom and take a more constructivist approach are able to effectively integrate technology (Hadley & Sheingold, 1993) As Hadley and Sheingold explain from their observations of teachers who had successfully integrated technology into their practice,

> A third kind of change for many of these teachers is that integrating the computer has turned a teacher-centered classroom into a student-centered one, with the teacher acting more as coach than as information dispenser, and with more collaboration and work in small groups going on among students and between student and teacher (p. 277)

A teacher who facilitates the learning as opposed to providing direct instruction embodies a chief component of a technology-enabled classroom. This includes providing students with structured tasks that engage them in the discovery or inquiry of the core content (Lee, Linn, Varma, & Liu, 2010; Sugar, Crawley, & Fine, 2004)

Since constructivist pedagogy is conducive to the integrated use of technology, it is essential to describe the key attributes of this teaching philosophy. Some theorists argue that constructivism is simply a theory and does not provide the specificity necessary for designing instructional approaches, making it even more important to identify the distinct components of instruction (Richardson, 2003). Constructivist theory includes various schools of thought. For the purpose of my review, we will concentrate on the traditional theory of constructivism. Researchers and practitioners have identified key components of constructivist theory as it relates to instructional design which include collaboration, active and authentic learning (Hill & Smith, 1998; Karagiorgi & Symeou, 2005; Kay & Greenhill, 2013; November, 2012).

Active and authentic learning occurs when instruction is designed in such a way that students are able to construct meaning through the lens of their current experience and understanding. The learner is engaged in activities that mimic how knowledge and skills are applied in a real world setting (Darling-Hammond, 2010). Instructional technologies like simulations, social media and blogs provide teachers with the tools to accomplish a classroom that mimics some of the activities of the real world (Gerard, Libby; Matuk, Camillia; Linn, 2016; November, 2012; Philip & Garcia, 2013). Further, teachers provide students with problem solving opportunities which engage students in a satisfying learning experience (Karagiorgi & Symeou, 2005). As Hill & Smith (2005) describe:

> In this classroom in Manufacturing Technology, learning processes diverged sharply from traditional settings where the emphasis is on abstract and decontextualized concepts of little apparent relevance to the students. Instead, activity in the exemplary classroom resembled that of everyday learning where learning and context are inextricably linked as people engage in various forms of culturally relevant activity (p. 22)

Both active and authentic learning shift the traditional mode of teaching from a teacher-centered practice where student results and activities are pre-determined to a practice that takes into account the needs, background, experiences of the learners as well as engaging them in real life tasks and problems (Darling-Hammond, 2010; Hill & Smith, 1998; Karagiorgi & Symeou, 2005; November, 2012)

In addition, the constructivist theory shifts the way that information should be presented to include multiple perspectives (Hill & Smith, 2005; Karagiorgi & Symeou, 2005). As Karagiorgi & Symeou describe, "Any specific concept must be approached via a wide range of learning contexts to aim transfer of the knowledge in a broader range of domains" (p. 20). The philosophy of providing students with a variety of perspectives about a concept is akin to the multiple intelligences theory articulated by Howard Gardner (1983) that emphasized the importance of recognizing the unique differences of learners and providing them with learning experiences that engage a plethora of

intelligences or perspectives. The learner is able to engage in the learning in a way that is conducive to their specific intelligences. The development of a pedagogical approach that encompasses both a focus on students' individual interests and an integrated approach to the content is also critical to the constructivist theory as well as the effective integration of technology (Lei, 2010; Mishra & Koehler, 2006).

Collaborative learning is another central aspect of constructivist theory in that it provides learners with a forum in which to articulate and defend their learning to others and the opportunity to collaborate with other students to negotiate through complex problems (Petko, 2012). Cooperative learning where students are placed in groups is an essential aspect of creating collaboration within the classroom environment and provides students with the opportunity to develop their communication and diplomacy skills (Darling-Hammond, 2010; Mahiri, 2011; November, 2012; Petko, 2012). Moreover, it complements the authenticity of the learning by mimicking the nature of the workplace (Hill & Smith, 2005). By designing instructional activities where students have opportunities to construct and articulate their understanding of the content in a group setting, as promoted by a constructivist approach, technology can more easily be integrated (Chen, 2006; Petko, 2012).

Overall, constructivist pedagogies and instructional practices provide a ripe environment for the integration of technology (Cuban et al., 2001; Petko, 2012). Specifically, teachers who hold these beliefs about teaching are consistently adjusting their practice to the needs of the students, which allows them to similarly adjust their teaching to integrate new technology as well (P. Ertmer & Ottenbreit-Leftwich, 2010).

Technological Pedagogical Content Knowledge

The teachers' pedagogical, technological, and content knowledge is integral to their ability to create a technology-enabled classroom (Mishra & Koehler, 2006). Mishra & Koelher (2006) provide a framework on how to conceptualize this type of teaching and conclude that a teacher, who has appropriately integrated technology, will have what they have labeled as "technological pedagogical content knowledge." An individual's teaching practice requires an understanding of the complex relationship between three knowledge bases that include technological knowledge, pedagogical knowledge and content knowledge. Mishra and Koelher (2006) also contend that teachers who are competent at integrating technology have sufficient knowledge of these different components and are essential to the modern practice of teaching. In their words,

> However, the relationships between content (the actual subject matter that is to be learned and taught), pedagogy (the process and practice or methods of teaching and learning, and technology (both commonplace, like chalkboards, and advanced like digital computers) are complex and nuanced (p. 1025).

Further, they argue that these elements are inter-connected which necessitate teachers having a deep understanding of each as well as the perspective of how they are interrelated. Ultimately, when a teacher develops strong technological pedagogical content knowledge, they are able to integrate technology effectively while maintaining a strong teaching practice (Mishra & Koehler, 2006).

In addition, Mishra and Koelher (2006) found that teachers who have sufficient capacity with these different bodies of knowledge demonstrate the flexibility to integrate new technology as it is emerges. A fact that is particularly important since the arrival of new technologies is constant and rapid (King, 2002; Zhao et al., 2002). Teachers' abilities to navigate diverse bodies of knowledge is not a new idea for the teaching profession (Rosenholtz, 1989). The complexity of the classroom with the additional component of technology integration requires that teachers develop curricula that support student learning.

The core practices necessary for teachers to effectively incorporate technology into their pedagogy includes a set of skills as well as a constructivist approach to education (Sugar et al., 2004). An understanding of the new California state standards, Common Core State Standards (CCSS) and Next Generation Science Standards (NGSS), also requires that students use technology as well as the development of their 21st Century Skills (Kay & Greenhill, 2013). These practices will ensure that teachers and students benefit from an educational experience that is rich, engaging and infused with modern technology to appropriately prepare our students for the modern workplace as well as their personal and civic life (Mahiri, 2011; November, 2012). Student-centered or constructivist approaches to teaching stand in sharp contrast to the prevailing pedagogies that emphasized teacher-directed instruction.

Collaborative Professional Development as a Means of Shifting Practice

In the preceding section, I contrasted a set of traditional teaching practices, characterized by teacher center pedagogies grounded in an industrial age conception of schooling, with more constructivist approaches that foster the kinds of thinking skills that are increasingly required of people in our society. I argued that effective use of technology both requires and enables the later, while the former leads to only superficial use of technological tools. In the following section, I will outline key aspects of effective professional learning initiatives. There are several elements of effective professional development that will support technology integration as indicated by the literature. First, teachers need the time and structure to collaborate and learn from their peers in meaningful ways. Second, technology integration requires that teachers develop both technical and classroom management skills and a sense of self-efficacy or confidence in the use of technology. Last, the professional development should provide teachers with the time to reflect on their beliefs on how students' learn in a technology-enabled classroom. Each of these aspects of professional development was selected because, I

argue, they are particularly conducive to modeling and practicing the constructivist pedagogies necessary for effective technology integration.

Essential Components of Professional Development

Strategic professional development is required to assist teachers in navigating the complex electronic world so they can make informed choices on how to integrate technology appropriately into their practice as well providing teachers with the instructional support, reflective space and collaborative time to develop a technology-enhanced pedagogy (Darling-Hammond, 2010; Eaker, DuFour, & Burnette, 2002; Zhao, Y., Pugh, K., Sheldon, S., Byers, 2002). An emerging body of literature confirms that effective technology integration requires successful professional development (Fullan, 2013; Garet, Porter, Desimone, Birman, & Yoon, 2001; King, 2002; Mahiri, 2011). The exponential growth of technology available to educators can be overwhelming and, as a result, and oftentimes, teachers lack the proper support to make this pedagogical shift toward a more technology enhanced practice (Cuban et al., 2001; Dexter, Anderson, & Becker, 1999; Tondeur et al., 2008; Zhao, Y., Pugh, K., Sheldon, S., Byers, 2002). Certain characteristics of professional development are considered high quality and most effective at impacting teacher practice (Hilda Borko, 2004; Desimone et al., 2002). Teachers learn best when they have the opportunity to discuss, collaborate and participate in an environment that mimics the activities that they will conduct with their students (Chandrasekhar et al., 2012). Since the effective integration of technology requires that teachers shift their practice to a more constructivist approach, it is essential for professional learning to model this type of learning, allowing teachers time to work with the technology in an authentic manner (Dede, 2009; Matzen & Edmunds, 2007; Philip & Garcia, 2013).

According to Garet et al. (2001), effective professional development includes three core features; active learning, coherence and content focus (Garet et al., 2001). Active learning requires that teachers have opportunities to analyze and reflect on their own teaching as well as examining student work. Coherence refers to how well the professional development is consistent with teachers' experiences and beliefs. Finally, content focus is the degree to which the learning program is focused on improving and deepening teachers' content knowledge. Extending this notion of content knowledge, consistent with the concept of technological pedagogical content knowledge as described above, teachers' improved knowledge would also include technological and pedagogical knowledge.

By developing teachers' technological knowledge, their self-efficacy with technology will increase, as they grow more confident in their ability to use the technology in the classroom (Gerard, Libby; Matuk, Camillia; Linn, 2016; Mishra & Koehler, 2006). Accordingly, as teachers develop this sense of self-efficacy they are more likely to experiment with innovative approaches to integrating technology (Dexter

et al., 1999; Gerard, Libby; Matuk, Camilla; Linn, 2016; Mahiri, 2011). Additionally, professional development should allow teachers to go through the complex process of assimilating technology into their instructional practice, which requires that teachers gain knowledge about how to use technology as well as develop a deeper understanding of the content knowledge (Cuban et al., 2001; P. Ertmer & Ottenbreit-Leftwich, 2010; Foon Hew & Brush, 2007). As Ertmer and Ottenbreit-Leftwich (2012) explain, "But knowing how to use the tools is only the foundation. Teaching with technology requires teachers to expand their knowledge of pedagogical practices across multiple aspects of planning, implementation, and evaluation process" (p. 260). Giving teachers the knowledge and perspective on how to utilize technology is vital to ensuring that classroom practices change appropriately (King, 2002; Zhao, Y., Pugh, K., Sheldon, S., Byers, 2002).

Through modeling on how the content they teach can be delivered through technology, teachers are able to conceptualize pedagogical shifts inherent in this process (P. Ertmer & Ottenbreit-Leftwich, 2010). Hew and Brush (2007) describe three levels of how teachers shift their practice to accommodate the use of technology. In the first stage, teachers use technology consistent with their current practice, which usually consists of low-level uses to include skill based games or online assessment programs. The next stage is referred as amplification when teachers shift their practice to further infuse their practice with technology. The final step they describe as transformation when teachers actually are able to engage students' cognitive and problem-solving abilities through the use of technology. The objective of effective professional development would support teachers' transition through the three levels, resulting in a technology-enabled classroom practice (Garet et al., 2001; King, 2002; Mishra & Koehler, 2006).

Teacher Collaboration

The development of collaborative and constructivist-style learning opportunities provide teachers with the suitable professional development to make the shifts in their teaching and is a promising approach to develop technology-enabled practices (Eaker et al., 2002; Windschitl & Sahl, 2002; Zhao et al., 2002). Collaboration with peers further assists teachers in the pedagogical changes necessary to integrate technology since they encourage teachers to reflect on their own learning, which furthers teachers' conceptualization of what it is like to be a learner in a technology-enabled setting (Earle, 2002; Sugar et al., 2004; Zhao, Pugh, Sheldon, & Byers, 2002). Increased collaboration is important because it can support teachers in changing their practice (Eaker et al., 2002; Wineburg & Grossman, 1998) and for the effective integration of technology, the majority of teachers need to change the way in which they teach (Schalger & Fusco, 2003). Traditional teaching practice is grounded in autonomy and self-reliance; thus, there is a need to shift the nature of the work to ensure that there is an emphasis on collaboration and openness (J. Little, 1990; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006; Talbert & McLaughlin, 1994).

As with any shift in teaching practice, the creation of a technology-enabled classroom can be a lengthy process and requires teachers to have more than just the technological skills (Mishra & Koehler, 2006). Most teachers go through different levels of integration before reaching a level of pedagogical practice that allows for technology to be a main component of their practice (Matzen & Edmunds, 2007). Therefore, providing teachers with professional development in a collaborative, low-risk environment provides the support and reflection necessary for teachers to move through these different levels of technology integration (Darling-Hammond, 1997). Additionally, professional learning communities that are properly structured can enable teachers to conceptualize the role of students in a technology-enabled classroom (Darling-Hammond, 2010; Eaker et al., 2002). Teachers benefit from having time to collaborate and experiment with technology in low-risk, supportive environments that focus on the development of content, pedagogical and technological knowledge (Mishra & Koehler, 2006). The vision of the professional development should focus on 21st century outcomes for students, examining students' progress and reflecting on their own practice (Darling-Hammond, 2010).

Despite its promise, there are obstacles to teachers' ability to work effectively in groups, particularly if the school community, culture or values are not conducive to a collaborative environment (J. Little, 1990; Rosenholtz, 1989; Talbert & McLaughlin, 1994). Therefore, districts and schools must provide professional development that encourages and enables collaboration through positive reinforcement rather than coercion (Darling-Hammond, 2010; Lei, 2010; Mahiri, 2011; Matzen & Edmunds, 2007; Windschitl & Sahl, 2002).

Providing teachers with the time and space to collaborate and experiment with technology as well as with different approaches of teaching can lead to technology being utilized to its full potential (Eaker et al., 2002; P. Ertmer & Ottenbreit-Leftwich, 2010; Mishra & Koehler, 2006; Peters & Slotta, 2010). First, teachers need sufficient time to access the technology (Foon Hew & Brush, 2007). Second, the pedagogical practices of teachers must be congruent with integration of technology into their instructional practices. The shift of pedagogical practices can only occur if teachers develop the knowledge of how to integrate technology into their content and the self-efficacy in its use(P. Ertmer & Ottenbreit-Leftwich, 2010). These changes require teachers to have the support of their peers as well as the time to reflect, in a low-risk environment where they are comfortable to experiment (Darling-Hammond, 2010; Wineburg & Grossman, 1998; Zhao et al., 2002). Teachers also need a professional community where they can reflect on their practice and find the support to innovate and experiment with new technologies (P. Ertmer & Ottenbreit-Leftwich, 2010; Windschitl & Sahl, 2002; Wineburg & Grossman, 1998).

Conclusion

The modern workplace and our global world requires that students develop particular skills like critical thinking, creativity and the ability to productively collaborate while harnessing and managing the power of technology and the Internet (Chandrasekhar et al., 2012; November, 2012; Roberts et al., 2012). Unfortunately, the integrated use of technology in the classroom is still not a commonplace occurrence, and the increase of technology in schools does not necessarily result in an increase in the use of technology, particularly in an effective, coherent manner (Cuban et al., 2001).

The effective integration of technology requires that teachers shift their pedagogy from a student-centered, traditional practice to one that is more student-centered and inquiry based (Cuban et al., 2001). Constructivist pedagogy shifts the teachers into the role of a facilitator and provides for active and authentic student learning, collaboration while attending to the individual (Dewey, 1902; Richardson, 2003). Further, a constructivist or student-centered pedagogy requires that teachers develop a practice that engages students in activities that mimic the work of the modern workplace and require them to think critically and creatively about the complex problems (Dede, 2009; Philip & Garcia, 2013; Windschitl & Sahl, 2002). All of which require teachers to have sufficient content, technological and pedagogical knowledge to appropriately and effectively integrate technology (Mishra & Koehler, 2006).

The research reviewed here indicates that one powerful way to assist teachers in making the shift toward a more technology-enabled practice is successful professional development (Hilda Borko, 2004; Eaker et al., 2002; Wineburg & Grossman, 1998). Specifically, teachers should have the opportunity to interact and collaborate in a manner that allows them to work with the technology from a student's perspective through the support of their peers (Cuban et al., 2001; Darling-Hammond, 2010; Philip & Garcia, 2013; Windschitl & Sahl, 2002; Zhao et al., 2002). Such a perspective will provide teachers with the opportunity to reflect and shift their practice in a way that will ensure that students experience an education that prepares them for the modern workplace.

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In Chapter 2, I review the conceptual and theoretical framework for my study by laying out the theory of action of how this design development study intended to influence teachers' integration of technology. In Chapter 3, I outline the methods used and the methodology chosen for this study. I present my findings in Chapter 4. Finally, in Chapter 5, I present the findings and reexamine my theory of action in the context of these findings.

CHAPTER 2
THEORY OF ACTION

Introduction

My review of the literature suggests the effective integration of technology is dependent on a student-centered and inquiry-based pedagogy, which is the cornerstone of a constructivist style of teaching (Cuban et al., 2001; Petko, 2012; Philip & Garcia, 2013; Zhao et al., 2002). The intention of this study is to support the shift toward a more constructivist practice through a collaborative professional learning experience where teachers can experiment with both teaching strategies and technology (Hilda Borko, 2004; Cuban et al., 2001; Sugar et al., 2004; Zhao et al., 2002). By providing teachers the time to align their own practice with technology, they are able to build their understanding of how student-centered teaching strategies coupled with effective technology integration can improve student learning (King, 2002; Lei, 2010; Sugar et al., 2004; Zhao, Y., Pugh, K., Sheldon, S., Byers, 2002). In this section, I will present theory of action, which broadly outlines how the intervention, in this case a series of professional learning workshops, should work. Then, I will describe the design challenge; explain the problem and its causes. Last, I describe the theory of change, theory of the intervention design, and theory of implementation.

Design Challenge

Defining the Problematic State

The problem of practice selected for this design development study is that secondary teachers in Coronado Unified School District relied on traditional teaching strategies, which impeded the effective integration of technology. There are multiple reasons for this problem. For the purpose of this study, I focused on three main barriers to teachers' tendency to transition to a technology-enabled practice. First, secondary teachers worked in isolation with few opportunities to collaborate, consider different instructional methodologies, and build new curriculum that allows for the integration of technology (Rosenholtz, 1989; Sugar et al., 2004; Zhao et al., 2002). Second, the prevalent belief that students learn best through lecture, close-ended questioning, and other teacher-centered instructional approaches were commonly held and resulted in teachers' reluctance to shift to a more constructivist approach (Cuban et al., 2001; Newmann et al., 2001; Sugar et al., 2004). Last, teachers lacked the time to reflect on the students' perspective and consider how to incorporate technology in a way that would provide students with meaningful and relevant learning experience. Secondary teachers in Coronado Unified School District encountered similar barriers. As a result, they persisted in their use of traditional teaching strategies, had little time to develop an understanding of how to integrate instructional technology, and worked in isolation with few collaborative opportunities with their colleagues to experiment with instructional strategies or technology.

The structure of secondary schools maintain a isolated work environment for teachers with very few professional opportunities to increase their ability to understand how technology can enhance student learning (Cuban et al., 2001; Darling-Hammond, 2010; J. Little, 1990). Teachers' isolation in Coronado impeded them from observing, experimenting with, and using instructional approaches different from their own (Darling-Hammond, 1997; J. W. Little, 2006; Zhao, Y., Pugh, K., Sheldon, S., Byers, 2002). The limited interaction that teachers with their colleagues also inhibits teachers' ability to innovate both in the design of their curriculum and instructional approaches (Darling-Hammond, 2010). As a result, teachers tend to persist in the use of teacher-centered practices, and are not likely to use student mobile devices (Lei, 2010), and accordingly, the upsurge of available technology has not resulted in the effective utilization of technology (Cuban et al., 2001; Hadley & Sheingold, 1993).

The practice of teaching is extremely complex and teachers require time to make change to pedagogy, especially as it relates to technology integration (Darling-Hammond, 2010; Mahiri, 2011; Philip & Garcia, 2013; Sugar et al., 2004; Zhao et al., 2002). As the research indicated, teachers move through different phases of technology integration when they are able to align their current instructional practice and curricular goals with the use of technology (Cuban et al., 2001; Darling-Hammond, 1997; Foon Hew & Brush, 2007; Lei, 2010; Zhao et al., 2002). The misperception by many administrators, policy-makers, and educators that technology by itself will create an engaging and relevant environment for secondary students is part of the challenge. As Philip & Garcia (2013) explain " With the increasing presence of technology in the classroom, the role of an effective teacher is not diminished; instead it becomes even more indispensable" (p. 308). Rather, the technology is simply a tool and will not result in an innovative, it is the development of teachers' pedagogical and technological knowledge that will result in a innovate, technology-enabled teaching practice (Mishra & Koehler, 2006; Philip & Garcia, 2013). Correspondingly, teachers in Coronado lacked the time to innovate in their instruction, and had little incentive to change their teaching, which led to their low level use of technology.

In addition to the instructional and pedagogical skill of a teacher, a teacher's belief about how students learn also impacts their ability to integrate technology effectively (Dede, 2009; Mishra & Koehler, 2006; Windschitl & Sahl, 2002).The prevalent model of didactic instruction persists because many teachers' beliefs continue to be influenced by the external focus on accountability where a teacher-centered practice is considered to be most effective at ensuring high test results (Newmann et al., 2001). Teachers' beliefs about learning are also related to their own experiences as a student which further perpetuates a static instructional approach (P. Ertmer & Ottenbreit-Leftwich, 2010; Sugar et al., 2004; Windschitl & Sahl, 2002).

Theory of Action

In this section, I will explain the theory of action for teachers to develop the instructional and technical skills as well as teaching philosophy to effectively integrate technology, specifically student mobile devices. I will also describe the design of the professional learning experience intended for change to occur. The theory of action provides the rationale for how the intervention is constructed to initiate the theory of change; which includes the problem statement, problem etiology, theory of change, theory of intervention and theory of implementation. Specifically, I theorized that through the implementation of appropriate professional learning, where teachers have time to reflect on their teaching philosophy and beliefs, experiment with technology as well as the instructional strategies that are conducive to effective technology integration, will result in the creation of a technology-enabled teaching practice (King, 2002; November, 2012). These elements create the overall theoretical model for the operationalization of this design study. In the following section, I explain the theory of action for teachers to develop the instructional and technical skills as well as teaching philosophy to effectively integrate technology, specifically student mobile devices. I also describe the design of the professional learning experience intended for change to occur (see Table 2.1 for a simplified diagram of this process).

Table 2.1
Theory of Action

PROBLEM	**Secondary teachers utilize traditional teaching methods that limit the effective use of student mobile devices**		
PROBLEM ETIOLOGY	Secondary teachers utilized traditional teaching techniques, which provide few opportunities to develop efficacy in the effective use of student mobile devices and digital tools.	Secondary teachers worked in isolation with few opportunities to collaborate and expand their repertoire of teaching strategies.	The cultural context of secondary schools constrains the use of technology because of dominant beliefs about how students learn through didactic instruction.
THEORY OF CHANGE	As teachers developed more student-centered and constructivist practice, they are able to integrate student mobile devices and digital tools.	Teachers had time to collaborate with colleagues and experiment with technology.	Teachers developed an understanding that contributes to their belief that students can learn through more student-centered instruction.

THEORY OF INTERVENTION	By providing professional development, teachers developed efficacy in constructivist teaching strategies and increase the likelihood of technology integration.	Provide teachers with structured collaborative and laboratory time to • Experiment with technology • Develop and share teaching strategies conducive to the use of technology	Provide teachers with a professional development experience that • Increases teachers' tendency to use more constructivist practices • Expand their beliefs about how students learn • Increase teachers' efficacy with technology
THEORY OF IMPLEMENTATION	Minimal Conditions:		
	Stable school environment (non-crisis atmosphere).	Teacher interest in professional growth and working with colleagues to develop new curriculum and instructional strategies.	Teacher willingness to learn about new instructional strategies utilizing technology tools like Google applications.

Theory of Change

My theory of change focused on the need for teachers to have a professional learning experience that interrupts their isolation, influences their beliefs about how students learn, and provide them time to reflect on and ultimately, change their pedagogy. This would allow them to understand how the integration of technology through constructivist instructional strategies could enhance student learning (Lei, 2010). When teachers develop constructivist pedagogy, they are better able to integrate technology into their practice, ultimately providing students with deeply engaging and relevant learning opportunities (Foon Hew & Brush, 2007; Fullan, 2013; King, 2002; Mahiri, 2011; Zhao et al., 2002). In order to make this shift, the focus of professional development should provide teachers with the precious commodity of time to develop the understanding of how technology can impact student learning (Darling-Hammond, 1997; Elmore & Burney, 1997). When teachers have the opportunity to collaborate with their peers and experiment with new instructional strategies and technology, they are able to develop the technological and pedagogical knowledge to effectively integrate technology, which includes active and authentic student learning, collaboration while attending to the individual and teacher in the role of facilitator (Dewey, 1902; Fullan, 2013; Richardson, 2003; Zhao et al., 2002).

Theory of Intervention Design

The theory of intervention design included providing teachers with the instructional support, reflective space, and collaborative time to develop skill in the use of and integration of technology. The primary intervention tool for this design development study consisted of five professional development workshop sessions where I modeled the use of constructivist instructional strategies in a technology rich professional learning environment. In order to create a technology-infused learning environment for the teachers, the group experimented with a learning management system—a curricular tool that can organize and deliver content for teachers as well as provide students with a place online to communicate and collaborate — called Google Classroom. The teachers tested out the features of the tool with their students by creating classroom assignments in the learning management platform. By providing the teachers with the opportunity to experiment with technology from the student perspective, they also learned how to utilize Google Classroom for their own classroom practice. Essentially, the teachers developed technical skills with the technology, while simultaneously reflecting on how best to support student learning.

During each session, teachers were provided with time to discuss, reflect, and create curriculum within the Google Classroom platform. This assisted teachers in developing a sense of efficacy in the use of technology and provided them with the instructional skill to integrate student mobile devices effectively. Additionally, the teachers were able to experience the technology from the perspective of a student so they could see how the technology support student learning. Finally, the collaborative nature of the workshop sessions provided the teachers with the collegial support to experiment and take risks with the technology in a supportive learning environment.

In conjunction with developing teachers' comfort with technology, a critical component of supporting teachers to effectively integrate technology was to model student-centered or constructivist instructional strategies. The models of instructional strategies are most effective when coupled with time for the teachers to consider how they supported their own learning in the sessions and reflect on how to incorporate similar approaches in their own classroom.

Theory of Implementation: Minimal Conditions

This intervention was designed for teachers who were willing to participate in five professional development laboratory work sessions in order to develop a practice aligned with the new California Standards: Common Core States Standards or Next Generation Science Standards. In order to attract teachers who are more reticent or novice to the use of technology within the context of their daily classroom practice, the focus was on the development of Common Core aligned pedagogy through the use of Google Classroom. Additionally, each of the teachers had the support of the school principal in their

development of a technology-enabled practice as well as a school culture that did not impede the use of technology (P. Ertmer & Ottenbreit-Leftwich, 2010; Zhao, Y., Pugh, K., Sheldon, S., Byers, 2002). The teachers were willing to be released from their classroom for two full-day laboratory sessions. The teachers had to be open to collaborate with other teachers and reflect on their own practice in order to develop an understanding of how technology can enhance the rigor and engagement of their classroom (Denton & Hasbrouck, 2009). Fortunately, in this school district, the superintendent had clearly indicated a focus on technology and her desire to see an increase of its integrated use within the classroom.

Conclusion

In this section, I described how this design study was constructed based on the theory of action that in order for teachers to develop a technology-enabled classroom practice they must have access to a collaborative, supportive professional experience. I have implemented an intervention that strived to provide teachers with the time and space to develop the instructional skills and efficacy with technology to shift toward a more constructivist practice, which will ultimately lead to the effective integration of technology.

CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

Introduction

The purpose of this study was the development of a research-based professional learning experience that increased teachers' effective integration of technology. The professional development was designed to address a persistent educational dilemma by attempting to disrupt secondary teachers' tendency to work in isolation where they have little opportunity to shift their teaching practices, incorporate new strategies, or experiment with new technology. Specifically, this study was based on the theory of action that a teacher must have a professional learning opportunity that impacts their teaching practice as well as provides a model on how to integrate technology. Additionally, this professional experience encouraged the shift of the teachers' practice toward the use of more student-centered or constructivist teaching strategies and ultimately, was intended to support the effective integration of technology. As one of the aims of design development research, this study also attempted to provide insight into the design as well as effectiveness of the professional learning opportunity. In this section, I present the methodological choices for the study, the setting, the research questions, and selection of participants.

Methodological Choice

Design development research is an appropriate methodological choice for two reasons; first, it attempts to develop practical knowledge to solve an educational problem, and secondly, it is research in action, as I am the researcher and design architect of the intervention. Design development research rests on the theory that research should address the complexity inherent in educational problems through particular means. This includes being iterative in nature to allow for refinement (Plomp, 2010). Design development research includes preliminary investigation, theoretical embedding, empirical testing, documentation, analysis and reflection on process and outcomes (van den Akker, 1999). Each of these steps was followed through the design and implementation of this study, as I will describe below.

In preparation for this study, I conducted a thorough literature review to better understand the nature of this problem of practice as well as some of the contributing factors according to the research (van den Akker, 1999). Utilizing both action research and design development allowed me, as a participant researcher, to develop and implement multiple iterations of the intervention, which included several workshop sessions, with the intent of impacting the teaching practice of secondary teachers. Further, I was actively involved in the implementation of the process that provided the opportunity to analyze, document, and reflect on the intervention.

As Nieveen (2007) explains, design development research provides two types of results because the purpose of design development research is to apply an intervention to a prevailing practice to both improve the practice and determine if the intervention worked. First, design development research requires the creation of an intervention as a way to address a complex educational problem. Next, the iterative nature of design development provides insight into the purpose and function of the intervention process. As such, the effectiveness of the research design was tested both in the practical and empirical sense and provided evidence on how the intervention revealed itself to the participants. My active involvement in the implementation of the process provided the opportunity to analyze, document and reflect, which allowed me to contribute to the expansion and specification of the methodology of design and development (van den Akker, 1999).

Similarly, Plomp (2010) offers the following purpose for design development research: "to design/develop an intervention (such as programs, teaching-learning strategies and materials, products, and systems) with the aim to solve a complex educational problem and advance our knowledge about the characteristics of these interventions and the processes to design and develop them" (p.12). In this research study, I intended to address the complex process of impacting individual teacher practices—in particular, increasing the effective use of student-centered teaching strategies as well as increasing their effective use of instructional technology.

Research Questions

This study is situated in the theory of action and the research questions posed are derived from this theoretical framing of how a professional learning experience may be designed to encourage teachers to develop new instructional strategies aligned with the integrated use of technology. As Yin (1994) indicates, the theory of action of a study should inform the research questions. The list below represents the questions that guided this study along with the theory of action.

1. *What role does teachers' use of technology play in their tendency to employ constructivist instructional approaches?*

2. *How do teachers respond when they are given the time and space to work collaboratively to build curriculum in an online learning management system?*

3. *What are some ways that teachers use student mobile devices to support their curricular and instructional goals?*

4. *What changes occur in teachers' beliefs about student learning when they have time to collaborate in a technology-enabled professional learning environment?*

5. *What are the components of effective professional development to support teachers to incorporate technology?*

Research Design

Setting

The setting for this design study was Coronado Unified School District (CUSD), a small school district that served approximately 8,000 students in a suburban community. The city currently has a population of about 60,000.The demographics of CUSD differ slightly than those of the city primarily due to the fact that a group of mostly white, affluent students choose to attend private schools. Accordingly, CUSD serves a slightly more diverse population with 54.3% White students, 30.4% Hispanic or Latino, 4.9 % Asian, 3.5% Black, 1% Filipino, 1% two or more races, and 0.4% Native American and Alaskan Native. The district served 1,388 English Learners (ELs), approximately 17.2% of the student population. This is a 43% increase in the number of English Learners from ten years ago when the enrollment of EL students was 695 or 8.8%. (http://dq.cde.ca.gov/dataquest/).

The district had a total of 13 schools, which included one kindergarten (K) to 8th grade school, seven elementary schools serving K through 5th graders, two middle schools, two traditional high school schools, and one alternative school setting. About 15 years ago, with the support of a land-lease agreement with Comcast, the district had secured a strong technology infrastructure with robust Internet bandwidth. More recently, the district invested wireless capability at every school site. Most teachers had access to student mobile devices like iPads, Chromebooks, and other tablets through the use of carts on each of the campuses. With the exception of one teacher whose students had one-to-one access, for the purposes of the study, the teachers reserved the devices and brought them into their classroom. The number of student mobile devices has increased dramatically over the last three years with the student to device ratio moving from five students for every device to less than three students per device.

In addition, the superintendent supported and encouraged technology integration through full staff presentations about the importance of providing students the opportunity to use technology as part of the classroom experience. Further, the board and superintendent incorporated goals about increasing students access to technology into the strategic plan for the district. Many of the school sites had offered or paid for a variety of different trainings to support teachers' use of technology. This included tutorials on how to build teacher websites, integrate different online testing systems into their creation of finals, and the use of social media tools to advertise classroom activities. Efforts had also made it easier for teachers to allow the use of student devices in their classrooms through the adoption of a Bring Your Own Device (BYOD) policy. Although some schools had strict no cell phone policies during class time, most teachers could adopt a BYOD classroom policy at their discretion. Overall, the district culture was supportive in

encouraging teachers' use of technology, however; teachers lacked the time and space to develop the pedagogy that could align with the effective use of the technology.

Research Participants

I selected eight middle and high school teachers to participate in the study. These teachers taught core subjects, including math, English, social studies/history or science. The teachers represented four different middle and high schools within the district. Each of the participants had volunteered to participate in the study as well as the professional development opportunity designed to increase their use of student mobile devices. They were all interested in learning more about Google Classroom as a way to develop a curriculum aligned to Common Core State Standards or Next Generation Science Standards. The process for recruiting the teachers was through email communication and an attached flyer to all certificated staff in the district (see Appendix A). For this study, the teachers were required to have at least three years of classroom experience, teach in one of the core subject areas and be willing to utilize Google Classroom and student mobile devices in their classroom practice. The criteria was designed to ensure that the teachers had a sufficient amount of experience to focus on the objectives of the professional learning experiences as well as narrow the scope of the content that I would have to support in the workshops. Further, the study was intended to provide support both in the development of curriculum aligned to the new standards that focused on these four content areas. The teachers also had to be willing to reflect on their teaching practice and commit to twenty hours of professional learning. Approximately fifteen teachers responded initially with eleven teachers participating in portions of the training while eight participated in the full study. The final participants of the study had dedicated themselves to participation by signing the consent to participate, were able to attend all of the workshop dates, and met the criteria outlined above. These eight teachers are the focal point of desired change through the design.

Eight secondary teachers participated in the ten-week workshop series (Table 3.1). They met five times with three 2-hour after school sessions and two full-day sessions, resulting in approximately 20 hours of professional development time.

Table 3.1
Demographics of Participating Teachers

Name	Race/Ethnicity	Grade Level Grades Taught	Subject Area	Years of Experience
Sylvia	Mixed Race (Filipino, Mexican & American Indian)	High School 10th-12th grade	Math- Pre-Calculus Algebra 2	13 years

Giselle	White	Middle School 7th grade	Science	16 years
Jessica	White	Middle School 6th-8th grade	Science	5 years
Jack	Asian	High School 10th-12th grade	Chemistry	8 years
Gwen	White	High School 10th-12th Grade	AP Government History	5 years
Sissy	White	Middle School 8th grade	Science	3 years
Justine	White	Middle School 7th grade	English & History	12 years
Sydney	White	High School 11th grade	English and AP Literature	14 years

The eight participating teachers, all from Coronado Unified School District, included three middle school science teachers, one high school science teacher, one high school social studies teacher, one high school English teacher, one high school math teacher, and one middle school English and social studies teacher. There were also three additional teachers who were not part of the study but participated in some of the workshop sessions. These teachers were not included in the study because they did not attend a sufficient portion of the workshop sessions or were brand new teachers.

The teachers participating in the study had varying levels of experience, skill, and knowledge of Google Classroom and the associated Google Applications for Education. Their experience as a classroom teacher ranged from three to seventeen years with many of teachers spending most of their careers in Coronado Unified School District. The majority of participating teachers were from Rugato High School, which the largest and most diverse school in the district. One English teacher, two social studies teachers, one math teacher and one science teacher, all from Rugato High School, participated in the study. The English teacher had taught at the school for twelve years. The science and math teachers were mid-career teachers with eight and thirteen years, respectively. The science teacher had worked previously at a large urban district in a large high school and was the only male participant. The math teacher also had worked in another district. The two social studies teachers were younger with seven and five years of experience. Rugato High School is the more diverse high school in the district.

Three teachers participated from Feliz Middle School, the larger, but less diverse, of the two middle schools. One veteran science with sixteen years of experience, one English teacher with twelve years of experience and the least experienced teacher of the participant being the science teacher from Feliz who was in her third year of teaching. Finally, there was one science teacher participating from the only K-8 school in the district, Melendez School. She had five years of experience.

Unit of Analysis

My design was an intervention, in the form of a professional learning experience, designed to increase teachers' technological, pedagogical knowledge as a way to support the effective integration of student mobile devices in classrooms. The unit of analysis was at the individual level of the eight focus teachers of the study as they were the focal point of desired change through the design. Their pedagogical practices, self-efficacy, and integrated use of the technology within their teaching practice were analyzed for change through the use of baseline and impact data.

Data Collection Strategies

Data were collected on both the design's impact on teacher's practice and thinking as well as on the design implementation process. In Table 4.2 below, I outline the data collection administration for each of these components.

Table 3.2
Data Collection Administration

Data Collection Strategies	**Baseline Data**	**Concurrent Data**	**Impact Data**	**Totals**
Interviews	Pre Semi-Structured interview with each teacher		Post semi structured interview with each teacher	Two rounds of interviews
Observations	Pre-Observation of full class period		Post-Observation of full class period	Two rounds of classroom observations
Field Notes		Observation and reflection notes from each workshop session		Field Notes from five workshop sessions

Documents	Assignments posted to Google Classroom (goals and reflections on assignments)		Feedback Form about Professional Development and Google Classroom Curriculum	Goal forms, reflective assignments and open-ended questionnaire and evidence in Google Classroom
Researcher Documents		Researcher field notes from workshop sessions		5 Field Notes

Types of Data

This study utilized qualitative data collection through observations, field notes, interviews, and surveys (Creswell, 2013). Baseline and impact data provided evidence about the effectiveness of the intervention and design principles, addressing the question of whether or not the intervention had an impact on the teachers' practices. Process data provided insight into the how the actual intervention process was progressing. Consequently, data were collected both to provide information about the impact of the design on teacher practice and thinking, as well as on the design implementation process, providing information about the relative strength of design elements.

Design Impact Data

Baseline and impact data provided evidence to establish the feasibility and effectiveness of the intervention for the intended group (van den Akker, 1999). To avoid bias, baseline and impact data needed to be low-inference to clearly identify the behaviors that teachers were expected to exhibit. I collected both baseline and impact data to evaluate the influence the workshop sessions had on the teachers' classroom practices. I examined these data to determine whether the design contributed to the teacher's development of a more student-centered, technology-enabled classroom practice. Data were collected to evaluate how and if teachers' shifted their classroom norms, structures and developed their technical skills to allow for the increased tendency to incorporate student mobile device.

I conducted an individual interview with each of the teachers before the first workshop session to gain baseline data about the teacher's perspective and belief about how students' learn, the impact of technology and relative importance of technology on their teaching practice and insight into the consistency or flexibility of their teaching practice as well as their tendency toward the use of student-centered instructional strategies to meet the learning needs of their students (see Appendix B). The questions

were designed to elicit teachers' initial thoughts and beliefs about the efficacy of technology in reaching their desired learning outcomes as well as broad insight into their perceptions of how students learn best. In addition, the questions were open-ended to provide teachers with the opportunity to articulate their practice generally. I interviewed the teachers again after the nine-week professional learning experience in order to determine the impact of the workshop sessions on their beliefs and perceptions about a technology-enable, student-centered teaching practice.

In order to determine the degree to which the professional development session impacted aspects of the teacher's classroom practice, I observed each of the teacher's classrooms for a full class period that ranged from forty minutes to an hour and a half at the start of the study. I utilized an observation protocol (see Appendix C) to guide the collection of field notes during each of the observations. I collected data regarding their use of student-centered strategies, including the classroom norms and structures, frequency of student discourse, the teacher's questioning techniques, the role of technology in the class and general field notes to provide rich data about the interactions between students and teacher. I focused on indicators for a student-centered classroom practice as well as how well the teachers integrated the design principles into their practice. In addition, I made notes related to instances of student collaboration and discourse, active online interaction between students or students and teacher, demonstration of student learning through production and increased use of technology to guide students' learning. I coded my field notes to identify specific behaviors that indicated design elements being integrated into the teacher's practice.

Two types of impact data were collected at the conclusion of the study, semi-structured interviews and observations of the teachers' classroom practice. Each of these data sources was designed to determine the teacher's self-efficacy in their use of technology and their teaching routines, classroom norms and instructional strategies as they relate to technology integration. Additionally, each of the data sources provided information about the teacher's tendency to utilize student-centered or constructivist instructional strategies. The observation protocol was designed to elicit information about classroom norms, structures and general instructional strategies. The interviews provided insight into the observational data by prompting teachers to further explain their beliefs about how students learn and the instructional strategies they use to elicit this learning, their perceptions of the benefits and disadvantages of technology. Impact data were collected using the same observation protocol for my field notes. Differences in baseline and impact observation indicated change in the teacher's practice toward a more student-centered or constructivist practice. Baseline data were collected in early March and outcome data collected in late May.

As a way to collect and more objectively measure baseline and impact data, I designed a series of rubrics (see Appendix E) to evaluate the baseline and impact data to determine the extent to which the teachers shifted toward a more student-centered,

technology-enabled practice. I operationalized the rubrics by placing all teachers on one of three levels. These levels were developed and incorporated from Dreyfus' (2004) five-stage model of adult skill acquisition. For the purposes of this study, I utilized three stages of skill acquisition: competent, proficient and expert. My goal was to determine impact in two dimensions: first, the teachers' creation and use of student-centered instructional practices, routines, norm and secondly, procedures that support technology integration and teachers' skills in technical and normative aspects of technology integration.

The first dimension included five elements:

- *Student Choice*
- *Classroom norms that Support Student Collaboration*
- *Instructional Procedures and Classroom Organization*
- *Real-Life Connection and Student Personal Experience*
- *Student Discourse, Inquiry and Problem Solving*

The second dimension was comprised of two elements:

- *Technology Use and Management*
- *Technology Integration, Innovation and Risk-Taking*

As a result, this study had multiple baselines; the teachers scored differently in each element as well as the two dimensions. The intervention was designed to either explicitly provide teachers with the opportunity to develop skills in these dimensions, or the instructional strategy was modeled through the course of the workshop sessions. Teacher learning emerged through collaborative discussions, demonstrations or explicit instruction.

Since I was acting as a participant researcher, I was deliberate in reflecting on my judgment and biases as I reviewed the data and considered the placement of teachers based on observed and objective examples of their teaching practice.

Design Process Data

Process data were collected to encapsulate the intricacy of the change process intended by the design of the study and were used to assess the quality of the intervention and modify as necessary. As van den Akker (1999) explains, " ...formative evaluation holds a prominent place in development research, especially in formative research. The main reason for this central role is that formative evaluation provided the information that feeds the cyclic learning process of developers during the subsequent loops of a design and development trajectory" (p. 10). Accordingly, as the lead architect and implementer of the design, I took an active stance in order to utilize the process data during the course

of the intervention (Plomp, 2010). The different opportunities for formative evaluation allowed me to continue to reflect on and improve upon the quality of the intervention.

According to Plomp (2010), high quality interventions include three main components that include "content validity", "construct or consistency validity" and "practicality". The content validity of an intervention is developed in the preliminary design of the intervention since it requires a deep understanding of how the literature characterized the problem of practice and a resulting theory of action on how to address the problem in context. As such, this intervention was designed based on the "state-of-the-art" knowledge as described in the literature regarding teacher professional development and the effective use of technology in the classroom. Each workshop session had opportunities for feedback and reflection from the participants, which allowed me to modify and change future iterations of the workshop sessions. The design of the intervention was flexible to allow for these changes. The construct or consistency validity is the degree to which the different components of the intervention were logically linked to each other. The logical design of the intervention was evaluated after each of the professional development meeting sessions and based on that insight, they were improved upon based on teachers' feedback and reflection on the structure of each of the sessions. Finally, practicality in design research refers to how realistic the intervention is in terms of its usability in the setting that it has been designed developed (Plomp, 2010). My role as a researcher and active participant in the workshops allowed me to design an intervention that is practical as well as easily re-created in a similar setting.

Qualitative methods are most conducive for collecting process data about the intervention. At various points in the workshop sessions, I relied on online feedback and informal discussions to elicit teacher's goals for the sessions as well as their feedback about previous sessions. I also conducted structured discussions with the participants about their reflections on the sessions and how the sessions could be improved and enhanced. I also utilized field notes to capture my reflections from each of the sessions. The design development data provided insight into the participant experience and influenced the design of the agenda for the workshop sessions.

The process data was analyzed simultaneously with the implementation of the design development study as well as after the final baseline data was collected (Coghlan and Brannick, 2007). The ongoing data analysis informed the design process and helped shape the action research process. My study had a total of five workshop sessions and the process data was analyzed after each of these sessions and this data was utilized to make adjustments to the study. I reflected on the data and shared my informal analysis with the instructional coaches, who supported the workshop, for their own thoughts and input on the design structure. Then, I adjusted the future design workshops to incorporate appropriate tweaks.

Data Analysis

Data analysis in a qualitative study is an interactive process between the researcher and the data (Creswell, 2013). First, I organized and prepared the data for analysis. The interviews were transcribed and the field notes were typed up. Then, I read through all of the data, recorded general impressions and ideas about it, and developed an initial understanding of the themes and contextual relationships between these themes. Once I had read through the data several times, I coded the data or organized it into the segments (Creswell, 2013). Lastly, after the data were organized and coded, I wrote a preliminary narrative outlining my initial findings. Finally, the data were organized and analyzed to determine if the intervention or professional learning experience produced the expected outcomes.

Reliability, Validity and Transferability

To provide for reliability in this study, all interview and observation notes were standardized and the procedures were precisely documented (Yin, 2009). The professional learning sessions' agenda and proceedings were documented and logged to allow for a clear representation of the process, which allowed for procedures that can be followed by others. After each workshop session, I collected process data from reflective questioning through structured discussions and online questionnaires or short feedback forms. I also utilized field notes, agendas and my reflections to collect routinized process data. Baseline and impact data were collected from pre-implementation and post-intervention and followed a prescribed format. The interviews and observations were structured and the protocol followed. The main dimensions of the teacher's practice that I was trying to impact were defined through the use of rubrics and the learning outcomes were measured through the use of these rubrics.

I ensured validity by collecting multiple sources of evidence that allowed for the triangulation of the data and ultimately I was able to justify and verify the different themes that arose through the data analysis. I also utilized detailed or "rich, thick descriptions" to communicate the findings to allow a clear picture of the classroom settings, interviews and the workshop environment to provide information on the different themes that arose from the data. The transcripts of the interviews were also transcribed verbatim and I took detailed, descriptive notes during the course of the classroom observations (Maxwell, 2013).

Avoiding Bias, Ensuring Rigor

The threat to rigor and bias inherent to design development research required that I reviewed each iteration as well as the procedures utilized and document them carefully

as a way to reflect upon the process. My multiple roles as designer, researcher, and implementer could lead to an advocacy bias or that I would try to advocate for the successfulness of the intervention. As a way to address and counter this advocacy bias, I sought out "negative or discrepant information" in the data to run counter to my main themes. This allowed me to reflect on the major themes I found and present an account that is more realistic and ultimately, more valid (Creswell, 2013). Another way to constrain my interpretations of the data to favor particular outcomes, I designed rubrics to collect low inference baseline and impact data.

In addition, to the advocacy bias, my role as district administrator in the research setting also posed the possibility of an authority bias or where the study participants will perform in order to impress, called the halo effect (Patton, 1990). I served in an administrative capacity in the district, although not as a supervisor or evaluator for the teachers who participated. As a result, I spent time reflecting and journaling to recognize when these issues emerged (Coghlan & Brannick, 2009). Another way to address the influence of my biases is a constant reflection on the implications, findings and further iterations of the study through conversations with the coaches, advisors and other members of the school community (principals, other district administrators) who can provide insight into the study. Further, as a way to address the threat to validity that my own theories, perceptions and values would have on the study, I reflected how the results could have been shaped by my experiences, background and other personal characteristics.

Conclusion

This design development study endeavored to develop a research-based professional development workshop experience for teachers to increase their use of teaching strategies as they relate to student-centered instructional practices and a technologically enhanced classroom. The goal of this intervention was to provide teachers with a model on how teachers could utilize a learning management system like Google Classroom to organize their teaching practice while simultaneously experiencing the norms, structures and practices that allowed for the effective integration of this technology. This chapter described the methodology that tested both the effectiveness of this professional development experience as well as how well the actual design worked. I reviewed the data analysis strategies I used and the steps I took to minimize bias and ensure rigor. In the next chapter, I present my findings from this data collection and analysis.

CHAPTER FOUR
FINDINGS

Introduction

This design development study analyzed the effectiveness of a series of professional development workshops created to increase teachers' use of student-centered instructional strategies and instructional technology, specifically student mobile devices and the earning management system, Google Classroom. The purpose of this study was to provide teachers with a collaborative, low risk-learning environment to reflect on their teaching from the student's perspective, to experiment with technology, and to design lessons or curriculum that integrate technology.

This chapter presents the findings of my study. I will synthesize and analyze the process and impact data collected. I will review this data for two purposes. First, I will compare the baseline and impact data to analyze how the teachers responded to the workshop series. Second, I will review the process data to detail how the professional development worked and review how effective the experience was at meeting the learning outcomes for each of the sessions.

Section 1: Design Impact Data

This section will provide the overview of my analysis of the baseline and impact data. To review, I collected baseline data on the teachers' existing classroom practice by conducting a classroom observation and administering a semi-structured interview. I collected impact data by conducting a semi-structured interview and classroom observation at the conclusion of the professional learning opportunities. Impact data were collected in order to assess the feasibility of the design as well as a way to determine if the professional development workshop series impacted the teachers' practice and ultimately led to teachers' increased use of constructivist and technology-enabled teaching practice.

As indicated in Chapter Three, I utilized rubrics to review and reflect on the interview and observation data to identify key themes and indicators of how the professional learning experiences impacted the teachers' classroom practice. The workshop sessions were designed to impact teachers' practice in two dimensions: first, teachers' use of student-centered instructional practices, routines, norms and procedures that support technology integration, second, technology-enabled instructional strategies, norms and organization. In the following two sections, I will present the findings from each of the elements that the professional development focused on as well as the overall findings of the two dimensions.

Dimension 1: Student-centered Instructional Practices, Routines, Norms, and Procedures that support technology integration

The first dimension refers to how well the intervention supported the teacher's development of student-centered practices, routines, norms, and procedures as they relate to the integration of technology. The rubric was used to review teachers' relative skill in these areas as demonstrated through one of the data sources; interviews and observations. The elements of the rubric in this dimension include:

- Student Choice
- Classroom norms that Support Student Collaboration
- Instructional Procedures and Classroom Organization
- Real-Life Connection and Student Personal Experience
- Student Discourse, Inquiry, and Problem Solving

The intervention demonstrated to teachers how a classroom or learning environment could be structured to include strong examples of the above elements. The professional learning experience modeled how to create a collaborative and innovative space for learners while demonstrating the implementation of student-centered instructional practices, norms, instructional organization, expectations, and efficiency in the use of technology. Teachers were provided a structured space in which to experiment with technology and the time to consider ways that it could be incorporated into their practice. Teachers' growth in this dimension was developed implicitly through demonstration as opposed to explicit directions.

Element One: Student Choice

This element refers to how much student choice the teacher provides in their classroom. This includes the extent to which the teachers allow students to discover and learn through providing a variety of choices meant to guide students through the content. Teachers may provide flexibility for students by allowing them to choose their own topic within the content to learn about. Expertise in this element is also displayed by the degree to which a teacher allow students choice in the way that they demonstrate proficiency or mastery. In addition, teachers provide opportunity for students to utilize technology to demonstrate their understanding as well as learn through the use of the technology. Further, teachers provide students with the space to experiment with technology as part of the learning process and as a way for students to display their mastery or understanding of concepts.

Data from the observations and interview provided the most insight into this element and were used to assess teachers on this rubric. If I observed a teacher providing students a choice in how and what they learned during a lesson and it was not explicit that students could use technology as part of their choice, I would follow-up in the

interview to ask for the specifics on whether teacher did this with the intention of allowing students to utilize technology as part of their choice of method.

Table 4.1
Student Choice (Element One)

Level	Descriptor	Baseline	Outcome
1	Teacher does not appear to provide for student choice in what or how they will learn. Teacher does not provide students with time to develop their own learning through the use of technology. Little Emphasis on classroom activities that allow for students to construct their own understanding and may focus on the process of communicating knowledge.	Giselle Justine Sylvia Jack	Jack
2	Teacher may provide for some student choice in how or what they learn. Teacher may provide students with time to demonstrate their learning through the use of technology. Some emphasis on classroom activities that provide students time to construct their own understanding of content.	Jessica Gwen Sydney	Giselle Jessica Gwen Sydney
3	Teacher provided students with choice on both how and what they will learn. Teacher encourages and facilitates opportunities for students to demonstrate their understanding through the use of technology. Strong emphasis on creating classroom activities that requires students to construct their own understanding of content.	Sissy	Justine Sylvia Sissy

Baseline

Sissy Petrol (Level 3) began this study with a strong orientation toward providing students choice in their learning both on how they would learn and what content they

would learn. During the course of the classroom observation and in the interview, it was clear that engaging students by providing them with opportunities to choose the way that they learn was an integral part of her teaching practice. During the initial interview, she described a project she designed for her science class where students had the opportunity to choose a chemical element and use a creative method to show the different states of matter for their element. Through this description of a project, it was evident that she provided students with choice on how they wanted to demonstrate their understanding. In addition, during the initial observation Sissy also provided students with the opportunity to play with technology by encouraging them to experiment with a simulation of wavelengths and exercise choice on how they would manipulate the simulation. Through this activity, the students were expected to demonstrate their understanding of the content through the use of the Chromebooks by manipulating the wavelengths.

Jessica, Gwen and Sydney (Level 2) had some orientation toward providing students with choices on how and what they learned. Each of them devoted some of their class time to providing for choice on what the students would learn through the course of the lesson. Sydney provided students with a choice on what Supreme Court case they could review and analyze for a writing assignment. Gwen indicated through the interview that she was working toward a more inquiry-based instructional approach where students are able to have some choice over how they developed their understanding of the content. In her words,

> I'm trying to take myself out of the equation more and make it more inquiry based, analysis-based, evidence-based way that the students can learn. Often, we'll have a chance-today we didn't because it was a short period-to go back and touch on what the students were able to get out of it. And any students who didn't understand, fill in the gaps (personal communication, March, 17, 2015).

Jessica, like Sydney, began the study at a Level 2 as demonstrated by her efforts to provide opportunities to students that gave them choice on what and how they would go about learning the content and develop their skills related to the course. During the course of the interview, she describes how she had made a conscious shift from more direct-instruction to a modeling technique that she had learned through her work with a student teacher. As she explained it,

> They're really into this training at Arizona State University called "the modeling" way of doing things. So you go to modeling workshop and stuff. Basically, modeling is a science technique where students develop understanding through their personal experiences in the classroom, and then they make the model themselves. It's very similar today, where they took the pictures, they looked at the pictures, they decided what the characteristics were, and then together we all said, here's what the different parts of this are. So that's the pattern of modeling. I didn't go to the training, but everyone's always talking

> about it, so I picked up stuff there and shifted the way I taught. (personal communication, March 17, 2015)

Additionally, observation data of Jessica's teaching practice also provided evidence that students had some choice over how they completed portions of their assignments. However, unlike a Level 3 teacher, she still controlled much of the content and some of the specifics on how the students would demonstrate their learning and understanding.

Four of the eight teachers, Justine, Giselle, Sylvia and Jack, provided little time or space for student choice in how or what they learned, nor did they demonstrate the use of technology as a way for students to construct their learning. As an example, Giselle allowed students to use technology to find answers to a worksheet. The students did not have a choice on how or what they were learning, and she provided one website for them to glean information from and there are clearly right and wrong answers (Observation, March 24, 2015). Similarly, the observation data from Justine's class indicated that the students were expected to cover specific material, and even though they were put into groups, which covered different topics, they did not have a choice on what they would learn more about. In addition, during this observation, the students did not utilize technology as part of the lesson. They relied on their textbooks to fill out a worksheet as a group (Observation, March 17, 2015). Her description of the lesson during the interview reiterated the focus on discrete pieces information that students needed to know based on the way the textbook was laid out. As she explains in this interview:

> We're going to start working on changes over time. So we're going to be looking at all of those different areas. It's a funny little chapter because they're such little sections. One if the reasons I do that is so we can cover a lot in one day, and then we can spend more of our time on looking at that it once was and now what it's going to be" (Personal communication, March 17, 2015)

As she mentions, the focus was on how to cover the material in the textbook and not necessarily on how to organize for students' choice in how or what they learned. Further, she did not utilize technology to further deepen students' understanding or allow them to demonstrate their understanding through the use of technology.

Sylvia and Jack also did not allow for student choice in what or how they learned. Although Sylvia spoke extensively about how the math curriculum had shifted her practice from a focus on lectures to a more collaborative approach, this shift did not necessarily provide for student choice. In addition, during the observation of class the students did not have a choice in how or what they were learning that day (Observation, March 19, 2015). They used some technology in the form of graphing calculators but they were used to answer the specific questions and inquiries within the textbook. Similarly, the observation of Jack's lesson did not indicate that the students had a choice

on how they would demonstrate their understanding or in this case, what they would learn during the course of the day. The students had the opportunity to complete a lab in groups, but the procedures were scripted in a way that each group would come to the same conclusions in the same way (Observation, March 11, 2015).

Outcome

Three of the four Level 1 teachers demonstrated an increased focus on providing students more choice on how and what they learned as well as the use of technology as a way to demonstrate student understanding or learning. Giselle explained her goal of doing more project-based learning with her classes as well as lessons that allowed students to be more hands-on approaches when applied their knowledge. She specially described a seventh grade project:

> There's a unit that I would like to expand on for seventh grade, which will be to construct an ecosystem. I want them to learn about microorganisms on up. When we restore a watershed or we restore an area that's been pit mined, we pour dirt in it, stick a few trees in the ground and walk away. But what about the macro and microorganisms that need to be in there?" (personal communication, May 27, 2015).

Although the description did not specifically include that students would have the choice in what they learned, through a project-based, real life classroom experience such as this, students would have the opportunity to choose how they would demonstrate their understanding and most likely, provide them with flexibility on whether they would utilize technology to complete such a project.

From the observation of Sylvia's (Level 3) class, there was a definitive focus on allowing students a choice on how and what they would like to learn. In the final observation, students were demonstrating their understanding of a variety of topics through a medium of their choice. As an example, one presentation consisted of a student composing music and a demonstration of a mathematical concept while another group of students made a video with voiceover to show their understanding of another concept to the rest of the class. Through the implementation of this lesson, it was clear that Sylvia had provided students with the choice on how and what they would demonstrate their understanding. In addition, the students were encouraged and supported in the use of technology during the course of the project, and the majority of the presentation utilized some type of technology to demonstrate that particular group's articulation of the concept (Observation, May 29, 2015).

Data from Justine's (Level 3) observation and interview indicated that she also provided more choice for students in how and what they learned. In the final observation, she had designed a project where students were working in groups or individually to display visually an interpretation of a poem that they wrote or they could choose one that

they had read for class. During the observation, the teacher was active in supporting students using technology to display their understanding, choices for the project included video creation with time lapse functions, edited pictures through different applications and Google images to create a presentation (Observation, May 28, 2015). This definitive focus on student choice was also reiterated in her second interview as she explained the project they were working on:

> They got to choose what they wanted to try to do. I challenged them to stretch themselves, knowing that this is the last creative thing that they get to do this year. What do you want to attempt, that you haven't tried yet; that you think would be fun and interesting way to do this? (Personal communication, May 28, 2015)

Jack continued to provide little space or time for student choice in either how or what students learned. He also provided limited time for the use of technology to be utilized as a way for students to demonstrate their understanding of the content or development of skills related to the content. Jessica, Gwen and Sydney also continued to allow for some student choice in how and what they learned as well as continued to provide space for the use of technology but there was not growth as demonstrated by the outcome data. Sissy (Level 3) continued to demonstrate a strong practice in terms of allowing for student choice in how and what they learned. The last observation indicated that students also were expected and encouraged to demonstrate their learning through technology.

In this element, the impact data indicated that two teachers moved up two levels while six of the teachers maintained their practice at the level they began the study with.

Element Two: Classroom Norms to Support Student Collaboration

This element refers to the extent to which a teacher provides students with time to meaningfully interact with each other in a way that supports a learning task. It also refers to how the teacher establishes and reinforces classroom expectations and cultural norms to support student collaboration. Additionally, to show expertise in this element a teacher should display the ability to keep distractions to a minimum so as not to interrupt the flow of the class as well as have procedures for the way in which students interact with each other. The combination of appropriate instructional procedures, classroom norms and students' expectations resulted in the teacher being able to manage student collaboration in the classroom. Interview and observation data were analyzed to place teachers in this element of the rubric at the onset of the study (baseline) and at the conclusion of the professional development to determine the impact of the study.

Table 4.2

Classroom Norms to Support Collaboration (Element Two)

Level	Descriptor	Baseline	Outcome
1	Teacher provides limited or superficial time for students to collaboration, there are not specific structures for student collaboration. There are not clear classroom norms for how students interact with each other or the teacher either online or in person. Demonstrates a weak understanding of how to provide for student-to-student interaction, indicates the infrequent use of classroom activities to allow for collaboration.		
2	Teacher provides some time for student collaboration and demonstrates some instructional strategies for students to work in groups. There are some classroom norms on what is expected of students during particular group activities and there are some expectations on how students interact with each other, the teacher and online. Demonstrates an understanding of how to provide for student-to-student interactions, indicates the occasional use of classroom activities that require collaboration.	Justine Jessica Gwen Sydney Sylvia Jack Giselle Sissy	Gwen Sylvia Jack Giselle Jessica Justine
3	Teacher effectively promotes student collaboration and provides students with the necessary structure to learn how to work in groups in a productive and positive manner. Collaboration is meaningful and deliberate where students are given roles specific to topic and activity. There are clear classroom norms on how students interact with each other, the teacher, and online as well as clear, effective and appropriate expectations of students		Sissy

	during the different classroom activities. Demonstrates a strong, daily emphasis on the importance of creating classroom activities that allow for student-to-student interaction.		

Baseline

All of the eight teachers had some orientation around collaboration and demonstrated that they organized some of their class time to provide students with collaborative opportunities to work with other students. Each of them began the study with proficient skill (Level 2) at organizing and structuring their classroom to provide the students with opportunities to collaborate. This was evidenced through the first classroom observation where they had provided students with time to collaborate, and some indicated in the initial interview that it was important to provide students with time to collaborate as part of the learning process. As an example, during the first observation, Jack encouraged students to get into groups in order to work through several chemistry problems. However, he did not specifically structure the collaborative activity in a way that the students were clear on their roles or that there was a specific expectation on how they would collaborate (Observation, March 111, 2015). Similarly, Jessica promoted group work, placing the students in pairs and encouraging them to work as a team on different portions of the day's activities. She explains the rationale for the use of the pairs: "Here's one thing that I've always done just because someone taught me it early and it worked. Talking to your partner as much as you possibly can" (Personal communication, March 17, 2015).

Justine also provided students with the space to work together. Students were randomly called off and placed in groups during the first observation and they worked together to complete a worksheet based on the textbook. The students were clearly comfortable and used to working in groups; however, they did not necessarily work productively in the groups. Nonetheless, Justine was clearly dedicated to collaboration, as she explains the importance of student collaboration to her practice:

> You can do so much more with them when they're willing to work together. I don't have to worry about so and so. When we're on one team and everybody is on the same page and we have a common goal, there's nothing I can't do that they won't be game for" (personal communication, March 17, 2015).

Similarly, Sissy also a Level 2, describes the importance of students working together and peer teaching:

> Sometimes I want them to ask the questions that they get stuck, but I think it is better if they're starting to ask their peers because sometimes the peers are better

able to explain it better, or already have gone through it and are struggling with the same things that I could have missed (personal communication, March 19, 2015).

An expert teacher in this element would have dynamic examples of student collaboration and a strong orientation toward ensuring that students had the opportunity to interact with each other in meaningful ways on a daily basis. Additionally, an expert teacher would structure collaboration so the students would have an opportunity to develop different skills depending on the topic or content being covered.

Outcome

Seven of the eight teachers continued to demonstrate a solid orientation toward encouraging student collaboration. Each of these teachers—Gwen, Sylvia, Jack, Giselle and Jessica—articulated in their final interview that group work was important to their practice, but the classroom observation indicated structures that were inconsistent in providing for productive student collaboration. The teachers clearly provided students with the time to work together on class assignments and have discussions about the work. However, the expectations for student interactions were inconsistent, and the teacher was generally still the main focus for feedback while peer interaction might or might not support the skill or content development.

One teacher's practice moved up by one level: Sissy moved from Level 2 to Level 3. Sissy created classroom structures and instructional norms that effectively supported productive and dynamic examples of students collaborating. As an example, in Sissy's classroom, students moved directly into group work from the start of the class and began to discuss their project work. There were clear expectations about their collaboration together and how to utilize the Chromebooks to complete their work. The teacher set aside the whole class period to collaboratively work on the project and indicated in her interview that the students had been working in groups for a few days. The structure of the class also provided students with plenty of time to work in the groups; the teacher utilized particular instructional strategies like having the students put their computers at "half-mast" when she needed to give directions or updates on the amount of time or expectations for the assignment. Sissy had a strong orientation toward group work at the onset of the study, and it was evident during the final data gathering process that she utilized group work in a way that students constructed their own understanding about content without her having to intervene or directly instruct. As she described in her final interview,

> We were modeling some things, and I had each group get up and do it, 'Show me with your bodies how the movements of them work.' A group would do it and it would be wrong. And then another group would do it and it would be wrong. Then a group would do it right and everyone would be like, 'Oh!!'" (personal communication, May 19, 2015).

In addition to student collaboration, Sissy found that she would learn best when she had a chance to talk to other teachers. As she explained,

> I think the biggest thing is just talking to peers. It's the same thing that I want to happen in my classroom. I try to have it happen outside of classroom. Just talking to other science teachers or other teacher in general. 'How do you do this? How do you organize this?' (personal communication, May 19, 2015).

Element Three: Instructional Procedures and Classroom Organization

This element refers to teachers' skill at implementing strong organization within their classroom instructional practice. Strong organizational and instructional procedures are integral to a technological-enabled as they provide for smooth transitions when moving from tasks that require technology. Additionally, organizational skills and clear instructional procedures also provide students with the structure needed within a constructivist classroom. These procedures include having a clear, student-friendly objective and engaging introduction or 'hook' into the lessons as well as utilizing consistent means to get student's attention and transition students from one task to another. Ideally, through modeling and demonstrating effective organization, the workshop sessions provided the teachers with ideas on how to implement basic instructional and classroom organization.

Although, this element does not necessarily indicate an innovative or collaborative introduction to the day's activity, a Level 3 teacher displayed a strong orientation toward ensuring students understood and were comfortable with a structure on how each class period would progress. During the observation, I documented the different ways that teachers began the class period looking for how well students followed the structure, I also noted the ways that teachers transitioned students from one task to another and got their attention. Through the interviews, many teachers also reflected on the structures that they had found to be successful in guiding students through the course of a class period.

Table 4.3:
Instructional Procedures and Organization (Element Three)

Level	Descriptor	Baseline	Outcome
1	Demonstrates some organization and evidence of routines and procedures to support and organize student learning; however they are inconsistently used or not clear to students. There is an objective but it may or may not be clear or written in student-friendly language, there is a not a clear hook or		

	introduction into the day's activity. There not clear classroom norms on how the teacher will transition students from one task to another or how the teacher will get students' attention or these strategies may be ineffective.		
2	Teacher demonstrates some organization, there is sufficient evidence of routines and procedures to support and organize student learning. There is an objective and a prompt or hook into the day's activity and there is an agenda for the tasks or activities for the day. Teacher demonstrates some ability to transition students from one task to another, redirect during a course of an activity and get students' attention.	Sylvia Sydney	Sylvia Sydney
3	Teacher demonstrates strong effective classroom organization. There is strong evidence of routines and procedures to consistently support and organize student learning. There is a clear objective for the class and there is a relevant and engaging prompt or hook into the day's activity. Teacher uses consistent and effective techniques to get students' attention, to transition students from one task to another and to redirect during the course of an activity.	Jack Jessica Justine Gwen Giselle Sissy	Jack Jessica Justine Gwen Giselle Sissy

Baseline

The majority of the teachers, six of the eight, demonstrated a strong and effective teaching practice in terms of their instructional organization. Specifically, these eight teachers, Jack, Jessica, Justine, Gwen, Giselle and Sissy had classroom structures and norms in place to transition students from one activity to another. These teachers also used consistent means of engaging students as well as introducing the day's objective to the class. Justine, Jack and Jessica each effectively used a countdown method to focus students' attention again after working in groups or during class discussions. Giselle utilized techniques like choral response to check for students' understanding of the

procedures for the day. Each of these teachers also had an agenda displayed for the day and provided an overview to the students for the expectations for the day. As Gwen explained in the initial interview,

> In doing that from day-to-day, the classroom procedures that you observed. So an opening question, talking about the opening question. Showing the students an agenda and giving them any sort of heads-up about the week or the coming weeks" (Personal communication, March 19, 2015)

Through the observations and interviews, the majority of the teachers (both at Level 2 and Level 3) also included the review of homework as a part of their opening structure- this was sometimes done as a whole class, with partners or individually. Jessica describes how she may organize one of his class periods,

> We usually start the day, like we've had homework the night before. Either students will do a warm-up where they're working on something like answering a couple questions or studying on flashcards on their I pad. Then I'll go around and check their homework. Then they'll check their homework together with their partners, and we'll go over it together to reinforce whatever we've done. So that's the review for the day (Personal communication, March 17, 2015)

Similarly, Justine described how she organized her daily practice; "I'm very organized in that I like my students to be very aware of what's coming next. So we have a pretty typical routine" (personal communication, 3/17/15).

Each of the Level 3 teachers demonstrated skill in transitioning students from one activity to another. Usually, this transition would take less than two or three minutes which included an introduction to the next activity.

In contrast, Sylvia and Sydney both Level 2 teachers had less consistency in their classroom structures. At times, many students were not clear on what the current task was and the teacher may struggle to get the students attention and transition students from one task to another in an efficient manner. However, both teachers did have structures in place. Sydney did have an agenda and described the process and expectations for the day.

Outcome

Since the majority of the teachers did begin this study with a fairly strong organizational teaching practice, there was not a noticeable shift in terms of strengthening this element for these teachers. Both of the Level 2 teachers, Sylvia and Sydney, continued to demonstrate reasonable skill in organizing their classroom. However, they did not show noticeable increase in their organizational skill or ability to transition their students from one activity to another. Altogether, there was not a significant difference in terms of teachers' organizational skills through the course of the study.

Element Four: Real-Life Connection and Student Personal Experience

This rubric refers to the extent to which the teacher create classroom activities, lessons or projects that provide students with connections to their own life experiences and individual interests. This includes creating learning experiences integrated with technology that students understand how and why particular activities would relate to the real world in terms of careers or practical skill development. Teachers who display mastery in this element create authentic activities where students are able to apply their own practical knowledge as well as develop skills as they relate and connect to the real world. This provides for a rich context for learning and ensures that teachers are integrating technology in a way that is engaging and appropriate for student technology skill development.

Table 4.4

Real Life Connection and Student Personal Experience (Element Four)

Level	Descriptor	Baseline	Outcome
1	Demonstrates limited understanding of how to create learning experiences that are relevant and based in real world context. Teacher may show limited effort at connecting classroom experiences to students' life experiences.	Jessica Gwen Giselle Sydney Sylvia	Gwen
2	Demonstrates some understanding of how to create learning experiences that are relevant and based in real world context. Teacher may connect some of the classroom experiences to students' life experiences.	Justine Jack Sissy	Sylvia Sydney Jack Jessica Giselle
3	Demonstrates a strong understanding of how to create learning experiences that are relevant and based in real world context. Teacher explicitly and consistently connects the classroom experiences to students' life experiences.		Sissy Justine

Baseline

The majority of teachers, five of the eight, did not provide students with a clear connection on how their content or classroom activity related to the real world or students' real life experiences or interests. Additionally, during the classroom observations, these teachers did not connect the classroom activity to practical skill development. However, during the initial interview with the teachers, many of them expressed the desire to connect more of their teaching practice to the real-life experiences of students. Each of these teachers, Jessica, Gwen, Giselle, Sylvia and Sydney, related to the students on a personal level in terms of their relationship with the students. For example, knowing that they had a dog or performed in a play over the weekend, however, the teachers did not connect this insight into students' interests and experiences to the content or activities within the classroom.

Three of the teachers, Sissy, Jack and Justine (Level 2), did present students with connections to their own experiences or asked how something may have related to their own experiences. At the beginning of a lesson about wavelengths, Sissy had students brainstorm waves that they have experienced in their own lives (Observation, March 19, 2015). She also described in her interview on how she had learned to incorporate connections to the real world in her teaching practice. As she explained, "And the way everything is set up with questions. So it's not just, 'Why are we learning this?' There's a reason why we're doing all of this stuff" (Personal communication, March 17, 2015). Similarly, Jack explained how he works to consider examples that relate to students' lives or lived experiences,

> In terms of organizing the learning process, I also try to relate these things to everyday life as much as possible. At least for concentration, I talked about mixing a drink and how there are different concentrations. There's like diluted and it just doesn't taste very good (personal communication, March 10, 2015).

During the classroom observation, Jack related the topic of concentration in chemistry to students' personal experiences with Kool Aid. He asked the students what happened when they added too much sugar and they responded that it would be too sweet. The students then mentioned that if there was too much water, the Kool Aid would taste diluted. (Observation, March 11, 2015). Justine also related the lesson's topic to students' real-world experience.

Outcome

Four teachers, Sylvia, Sydney, Giselle and Jessica, moved from Level 1 to Level 2 through the course of the professional development experiences. The teachers appeared to have implemented activities and assignments that took student's personal interests and passion into account. Justine and Sissy moved from Level 2 to Level 3, as they demonstrated strong examples of incorporating students' interests and personal experiences into their classroom practice. Jack maintained a fair amount of focus in his

instruction on providing students' with classroom experiences that related to their lives, however through analysis of the final interview and observation, he maintained a Level 2 practice in this element.

Sylvia, who moved from Level 1 to Level 2, re-designed a project through the course of the professional development. It was a review project that provided students with the chance to utilize a technology of their choice while presenting to the class a mathematical concept they had mastered. Many of the students' utilized tools like Google Slides and voice over functions to present their own understanding of a topic of their choice from the semester. One student was able to incorporate his love for music into his project by composing an original piece of music that displayed the math behind the music. Giselle, who also moved up one level from Level 1 to Level 2, through the use of Google classroom, she had students reflect on questions about how and what they would like to learn with the intention of incorporating this information into her future lessons. As she described in her interview,

> So they reflected on what they've learned and also given me an indication of what they would like to learn in the future. My last question was, "What is something you haven't learned so far that you'd like to know? (personal communication, May 27, 2015)

Giselle also indicated, in her interview, that she asked students to consider and make decisions about scientific ethical questions. This included if it is justifiable to dissect different organisms in order to learn and teach.

Justine, who moved from a Level 2 to Level 3, created a project where students wrote their own poetry based in their own personal experiences as well as read poetry from other famous poets on similar topics. Then, the students used a medium of their choice to visually display the meaning of the poem. As she explains it,

> They started by looking at other people's poetry. So what do you like? All these are out there, what are you drawn to? Then we did some copycatting of that. But where I think they really started getting excited and especially led us into this was, we did a project where I had them bring something in that was very meaningful to them. It could be anything. It could be a photograph, a stuffed animal, some equipment for their sport of choice, whatever (personal communication, May 28, 2015).

Through this final interview and observation, there was strong evidence that Justine's lesson and larger project was closely connected to the lived experiences of the students as well as real world.

Sissy also moved from Level 2 to Level 3, she created a project during the workshop sessions where the students researched and inquired into space exploration. She explained to the students how it related to the real-world field of astronomy as well as students' future. As part of the project, she asked the students to identify two places in in the Universe: one where they might find life and another where humans could potentially live. Then, the students create their own water bottle rockets. As she explains it, "I'm hoping they realize about how important space exploration will be especially in their lifetime," (personal communication, May 28, 2015). Sissy expressed that it was important to her to make the projects relevant. She explained that in the past the students had just build the water bottle rocket but they had not been rooted in a real-world inquiry. Jack continued at Level 2 through the course of the study, he incorporated students' interests into his practice, but not consistently.

Element Five: Student Discourse, Inquiry, and Problem Solving

In order for technology to be effectively integrated, students need to have the opportunity to think critically, have meaningful discourse and utilize technology to inquire and research about open-ended, in-depth questions. This rubric examines teachers' skill at designing learning experiences that provoke student discourse and inquiry that naturally require the use of the Internet and other technology to answer open-ended questions. In this context, student discourse is defined as how often and to what extent students have the opportunity to discuss, consult each other and the Internet. In order to create student discourse within the classroom, teachers design activities that require students to work through problems aloud in a group or in partners. I utilized both interview and observational data to determine how a teacher structured their practice to provide for student discourse, inquiry and problem-solving opportunities. I also made notes through the observation on how much time was set- aside for student talk versus the amount of classroom time was devoted solely to teacher talk. Finally, I tracked the type of questions were explicitly or implicitly posed to students and whether they had the opportunity to work through these problems collaboratively.

Table 4.5
Student Discourse, Inquiry and Problem Solving (Element Five)

Level	Descriptor	Baseline	Outcome
1	Teacher did the majority of talking during the class period with few opportunities for students to discuss or interact. Teacher asks mainly close-ended questions and students may or may not use technology to answer these questions. There is little evidence of students using critical thinking or problem-solving skills.		
2	Teacher provides students with time to discuss and interact during the course of the class period. Teacher uses a mixture of close-ended and open-ended questions and students may have some opportunities to utilize technology to research and inquire into these questions. There is some evidence of students using critical thinking or problem solving skills	Jack Jessica Justine Gwen Giselle Sissy Sylvia Sydney	Jack Giselle Gwen Sydney
3	Teacher provides students with ample opportunity to discuss and interact during the class period. Teacher prompt students with primarily open-ended questions and students utilize technology frequently to research and inquire into these questions. There is strong evidence of students using critical thinking and problem solving skills.		Justine Sissy Sylvia Jessica

Baseline

All eight of the teachers began the study at Level 2. Each of the teachers provided students with ample time to discuss in partners or groups; however, some students did not utilize this time to interact with their peers. As an example, through the observation of Sissy's class, the students were encouraged inquire and simulate different wavelengths using the Chromebooks but some of the students did not talk at all during the course of the class period and it was not the expectation that they utilize their peers to work through the problems and questions posed to them (observation, March 19, 2015). Sissy explained that the question for this particular lesson was " How can we transmit information using waves?" which provided students with an opportunity to critically think.

Students had ample time to work in groups in during the initial observation of Justine's classroom and each of the students did spend some of the time discussing in groups the questions posed to them; however, the worksheet posed close-ended questions that required students to simply review and reiterate information from a textbook. This particular lesson did not use technology to provide students with the opportunity to inquire further about the topic (observation, March 17, 2015). She explained that this particular lesson was something fairly routine in her practice where students would participate in "just information gathering" (personal communication, March 17, 2015). Similarly, the observation of Gwen and Giselle's practice indicated that they allowed for student discussion and interaction. They also presented mostly close-ended questions, and the students did not utilize technology to inquire further into the content.

Sylvia, Jack, Sydney and Jessica created clear opportunities for students to interact and discuss mostly close-ended type of questions and inquire into topics further through science labs (Jessica and Jack), Internet research (Sydney), or student discourse (Sylvia). Further, their students also had an opportunity to problem-solve through a few of the more open-ended questions posed to them. Jessica and Sydney also had students utilizing technology, I pads or chromebooks, during the course of the observation.

Outcome

Four of the teachers moved up from Level 2 to Level 3: Justine, Sylvia, Sissy, and Justine. During the final observation, each of these teachers provided students with an open-ended or inquiry prompt into the class activity and allowed students plenty of time to discuss and verbally work through these problems. They also required students to demonstrate their ability to discover answers through research or demonstrate their understanding in ways that activated critical thinking skills. Sissy described the project that students in her class were working on and how the use of the Chromebooks supported this type of instructional approach,

> I do really like the Chromebooks, especially with science. You know PBL-based (Project Based Learning), having them be able to pick something and focus their research on that instead of me telling them a whole bunch of stuff. So I like the

> Chromebooks where they can find current things, especially some of the things I've known. Then they'll get on the Chromebooks and be like, 'Oh, look what I found!' I'm even outdated (personal communication, May 21, 2015).

During the post-observation of Sissy's classroom, students were constructing arguments based on evidence they found through Internet research about where in the universe they thought there was most likely life as well as a location where life could be sustained. The students spent the majority of the class period discussing and at times, arguing, with their group members about which planet or object they would choose. Through this activity, Sissy posed an open-ended question and students utilized Chromebooks for the majority of the period to inquire into this question. Similarly, Justine presented students with a broad, open-ended question to guide the class activity over the course of a period of days and brought in to support students' inquiry through the project. As she described it, " They're not limited to what I have in my little toolbox today in class. In the past, when I want them to go out and research more or explore something more or bring me information that wasn't in our textbook, I had to rely on them doing it at home" (personal communication, May 28, 2015).

Jessica also focused on providing the students with time to discover through the course of the observation. Students were using the iPads to analyze the speed of an egg drop they created. Again, similar to Justine and Sissy, she explained the importance of inquiry or discovery, "Discovery, then you debrief it, then you understand it, and then we apply it" (personal communication, June 1, 2015). During the course of the observation, the students spent the majority of the time discovering and analyzing their own product and through this process; Jessica wanted them to build their own understanding to the larger open-ended question.

Finally, Sylvia also demonstrated growth in the dimension although she found that her Algebra 2 students struggled some with the open-ended nature of the project. In her words, "I try to make it open, and I don't think they're used to that. They're used to being told exactly what to do and what I want. I try to make it open so they could use anything they wanted as long as it had a media" (personal communication, May 29, 2015).

Four of the teachers — Jack, Giselle, Gwen and Sydney — did not show growth and maintained Level 2 practice in this element. Each of these teachers continued to use a mixture of open-ended and close-ended questions. They provided limited time for student discovery and inquiry during the course of the observation. Further, during the follow-up interview, these teachers continued to indicate their reliance on more static-knowledge sources and restricted their questions in a way that limited student's ability to inquire deeply into topics.

Impact for Dimension 1: Student-Centered Instructional Practices, Routines, Norms, and Procedures that support Technology Integration:

One of the objectives of the study was to increase teachers' use of student-centered instructional practices, routines, norms, and procedures as a way to ensure the effective integration of technology into their classroom practice. This dimension included five elements: Student Choice, Classroom Norms that Support Student Collaboration, Instructional Procedures and Classroom Organization, Real-Life Connection to Student Life Experience and Student Discourse, Inquiry and Problem Solving. Each of these elements was articulated with rubrics 1 through 5. I analyzed baseline and outcome data utilizing the rubrics and assigned each of the teachers a level based on evidence in the data. The following table displays the overall numerical change for each of the teachers as well as the intervention as a whole by determining the percent of teacher growth for each element within this dimension. This provides information about the growth within each element. Due to the small sample size, this does not provide information about the statistical significance of the effectiveness of this particular professional learning intervention.

Table 4.6
Summary of Baseline and Outcome Data and Teacher Growth for Dimension One

Teacher	Level and Subject	**Element One** Student Choice			**Element Two** Classroom norms that Support Student Collaboration			**Element Three** Instructional Procedures and Classroom Organization			**Element Four** Real-Life Connection to Student Life Experience			**Element Five** Student Discourse, Inquiry and Problem Solving			Total Individual Growth
		B	O	**G**	B	O	**G**	B	O	**G**	B	O	**G**	B	O	**G**	
Gwen	HS S.S	2	2	**0**	2	2	**0**	3	3	**0**	1	1	**0**	2	2	**0**	0
Sissy	MS Science	3	3	**0**	2	3	**1**	3	3	**0**	2	3	**1**	2	3	**1**	+3
Giselle	MS Science	1	2	**1**	2	2	**0**	3	3	**0**	1	2	**1**	2	2	**0**	+2
Jack	HS Science	1	2	**1**	2	2	**0**	3	3	**0**	2	2	**0**	2	2	**0**	+1
Sylvia	HS	1	3	**2**	2	2	**0**	2	2	**0**	1	2	**1**	2	3	**1**	+4

	Math																
Justine	MS English	1	3	**2**	2	2	**0**	3	3	**0**	2	3	**1**	2	3	**1**	+2
Jessica	MS Science	2	2	**0**	2	2	**0**	3	3	**0**	1	2	**1**	2	3	**1**	+2
Sydney	HS English	2	2	**0**	2	2	**0**	2	2	**0**	1	2	**1**	2	2	**0**	+1
Total Growth		13	19	**6**	16	17	**1**	22	22	**0**	11	17	**6**	16	20	**4**	
% Growth			46%			6%			0%			54%			25%		

B= Baseline data. O = Outcome Data. G= teacher growth from baseline.

The rubric scores indicated that seven of the eight teachers demonstrated some growth from the baseline, and that no teachers declined in any of the elements in Dimension 1. There were five elements with varying levels of impact in each of them. As noted earlier, none of the teachers made growth in the element of *Instructional Procedures and Classroom Organization* as the majority of teachers already had strong and effective procedures and organizational techniques at the onset of the study. *Classroom Norms that Support Student Collaboration* was also an element where very little growth was observed with only one teacher, Sissy, making gains in the element. The lack of substantial growth in both of these elements indicates that the intervention did not impact the teachers' organizational skill as well as the development of classroom norms that support student collaboration.

The greatest growth occurred in the element, *Student Choice,* with almost all of the teachers incorporating more opportunities for students to make choices on how and what they learned. All but two of the teachers made growth in *Real-Life Connection to Student Experiences* with many of the teachers creating more classroom activities that were relevant or related to the students' personal experiences. Half of the teachers increased their score in *Student Discourse, Inquiry, and Problem Solving* while all of the teachers began the study with at least a proficient level of practice in this element.

In terms of individual teacher growth, Gwen did not demonstrate growth in any of these elements. Jack and Sydney demonstrated growth in one element. Sylvia and Justine had the most growth in this dimension and showed growth in three elements. Sissy also demonstrated growth in three elements, but to a lesser extent. Giselle and Jessica both moved up one level in two elements.

Dimension 2: Technology-Enabled Instructional Strategies, Norms and Organization

This dimension refers to how well the professional learning experience influenced the teacher's' skill in integrating technology as well as the efficacy and efficiency with which teachers use technology in their class. It is comprised of two elements, which have corresponding rubrics:

- Technology Use and Management
- Technology Integration, Innovation, and Risk-Taking

The intervention provided teachers with the time to develop these skills and to design curriculum within the learning management platform. The intent was that teachers would develop these skills as they increased their use of technology in the context of their normal curriculum building process. In addition, I modeled how to manage technology through the use of the learning management system. Each of our session's agendas was outlined in Google Classroom with live links to different activities. Further, I modeled taking risks with technology such as applications that I was not extremely familiar with such as Flubaroo, Doctopus and others.

It was important to demonstrate to teachers how technology can be integrated into a learning environment. Simultaneously, we spent time in the workshops considering how technology can support and enhance student learning. In this section, I consider the impact for this dimension by analyzing the baseline and outcome data gathered from the observations and interviews.

Element Six: Technology Use and Management

This element refers to teachers' management of technology and their demonstrated level of technology use for students. Through the course of the classroom observations, I noted how teachers distributed and collected devices to and from the students, the structures they use to prepare their students for a technology-enabled lesson and how they supported students' effective and appropriate use of the technology; specifically student mobile devices and the learning management system. This included how effectively or explicitly the teacher modeled how to navigate a particular site or technology.

To determine the levels for teachers, I relied mostly on observational data since my field notes included notes on how long it took a teacher to distribute technology as well as the process they used to distribute it. I also indicated in my field notes how a teacher structured the use of technology in his or her class and how its use was modeled for students. If it were a single instance of distributing or collecting technology, I would time the event. I relied on some interview data and reviewed the transcripts for any reference to their management of technology and how it evolved through the course of the study.

Table 4.7
Technology Use and Management (Element Six)

Level	Descriptor	Baseline	Outcome
1	The teacher does not have a system or it is inefficient in distributing and/or utilizing technology. Does not use a learning management system or website that provides a way for students to use technology to complete classroom assignments or interact with the class online. The teacher did not use technology during the course of the observation and did not indicate a system for technology management in the interview.	Jack Justine Giselle Sissy Sydney Sylvia	
2	The teacher has a system and the technology is utilized quickly and efficiently within a few minutes of the need for the use of technology. Teacher utilizes some type of learning system or website to provide a way for students to use technology to complete classroom assignments or interact with the class online.	Gwen Jessica	Giselle Jack Sylvia Sissy Jessica
3	The teacher has an effective and efficient system for distributing technology and it requires little or no class time. The integration of technology is seamless Teacher has an effective system for students to interact online, submit assignments		Gwen Justine Sydney

Baseline

Six of the eight teachers (Jack, Justine, Giselle, Sissy, Sydney, and Sylvia) were at Level 1 in *Technology Use and Management* at the onset of the study. None of these teachers had a system for students to complete assignments or a consistent way in which students interacted online. Most of them also did not have a class website or it was not referenced explicitly during the interview or during the classroom observation. In addition, I observed inefficiency in the way that the teachers distributed the technology to

students. Jack, Justine and Sylvia did not utilize technology or reference technology at all during the observation, although this did not automatically indicate a Level 1 teacher. I also analyzed the interview transcripts for indications of how the teachers utilized technology to organize student learning and how they distributed and collected student mobile devices.

Sydney used Chromebooks during the initial observation and the distribution and collection of the devices took approximately ten minutes of class time. She called each student to the front of the room and the number of the chrome book and the student's name and then handed them the device. She expressed her frustration aloud during the collection of the chromebooks at the end of class when she stated, "... this is a little annoying but you are only doing it for one" (observation, March 16, 2016). In addition, once all of the chromebooks were collected, she could not account for a charger and she shushed the class and said, "Please look for the charger. It is kind of annoying but it is important" (observation, March 16, 2015). She also indicated that she did not have a consistent means for students to turn assignments in and developing a system was one of her goals during workshops.

Giselle and Sissy (Level 1) also both use Chromebooks, but they did not have a specific system to manage students' use of the technology. Sissy provided the website that students would use for the class period by instructing them to search a specific phrase and then chose the first choice in the search results. During the initial observation of Giselle's class, she provided the students with tiny URLS to access the websites that she wanted them to use during the activity; however, the students did not submit the assignment electronically.

Jack, Justine and Sylvia (all Level 1) did not use technology during the first observation. Jack and Sylvia had a class website, but it was not interactive and had fairly static content. Further, none of the teachers had a specific system for students to submit assignments electronically.

Gwen was at Level 2 at the beginning of the study as she did have a comprehensive website that she expected the students and parents to use frequently as a way to access class material. Although there were not functions within this website to interact online with her or other students, she utilized it as a way to organize her content. As she explained:

> So realizing that I was setting them up short by not providing them access to my class outside of class...That prompted the website, and to make it as extensive as mine is. Basically, there's nothing we do in class that they don't have access to online. If we do a slideshow, this is up there in a Google Doc that is scanned and put into a link. Their whole textbook is there, all of their quick links (personal communication, March 19, 2015).

Jessica, also a Level 2 teacher, demonstrated the ability to manage student devices effectively as the students in her school were provided I pads to take home. During the first observation, it was clear that she had an effective and efficient system of managing the devices. Students were able to interact seamlessly with the technology during the course of the observation. As Jessica explained during the initial interview:

> We usually start the day, like we've had homework the night before. Either student will do a quiet warm-up where they're working on something like answering a couple questions or study on flashcards on their I pad (personal communication, March 17, 2015).

During the observation, Jessica also demonstrated the ability to seamlessly transition to and from the use of technology. She effectively and efficiently modeled how the students should take a picture with the Ipads through a microscope. After this demonstration, the students were able to successfully complete the activity.

Outcome

Seven of the eight teachers showed growth in this element; five of the eight teachers — Jack, Sylvia, Giselle, Sissy and Gwen — moved up one level. Two teachers, Justine and Sydney, moved up two levels from Level 1 to Level 3. Gwen moved from a Level 2 to a Level 3. While Jack, Sylvia, Sissy and Giselle all moved from a Level 1 to a Level 2, Jessica stayed constant at Level 2.

Jack, Sissy, Sylvia and Giselle began to use Google Classroom or Drive to organize their teaching. As an example, they all used Google Classroom or Drive as a way for students to submit assignments electronically. Sissy developed a new system to distribute the device: she called off by group numbers that the students were already familiar with, a method that took approximately four minutes. She also utilized Google Classroom to organize student content and as a way for students to interact electronically with the class. During the final interview, she explained how the sharing capability of Google Drive benefitted her practice,

> The sharing ability between the students, especially with Google, having them work in Classroom posting things, so everyone can get that resource. Like, 'I saw this great website.' Everyone is able to see it, and I think that's really powerful for them to just be helping each other (personal communication, May 21, 2015).

Unfortunately, Sissy encountered an obstacle during the final observation that impacted her ability to manage technology in her class: her teacher computer took over twenty minutes to boot up. In fact, she had to call another teacher to the room in order to find another computer to use. Once, Sissy was able to secure a computer, she easily

transitioned into displaying the students' work in Google Classroom and moving into the next phase of the activity.

Jack, Jessica and Giselle utilized student mobile devices during the second observation. Each of them created opportunities for students to interact with content online and submit assignments through the Google Classroom platform. However, they all struggled for different reasons: either ensuring that access to their assignments was seamless or having technical glitches that inhibited the integration at some point in the process. Each of them also had said during the interview that the technology was benefitting their practice. For example, during the second observation, Jack had students use the Chromebooks, but he had problems loading the template for students to submit through the platform. Because of this, the students were able to access the prompt and materials for the assignment online; however, they ended up submitting their work through a hard copy.

This was the first time that some of the students in Giselle's class had access to the Google Classroom platform, and she was able to get all of her students access to an assignment that they submitted electronically. One of the students began to use the platform inappropriately when they wrote comments in the stream for the class like "what's up dawg?" Giselle was not aware of some of the functions of the platform such as the students' ability to make real-time comments to the whole class. As a result, she had not modeled appropriate use with the students or monitored the platform to check that these norms were followed. Overall, Giselle appeared appreciative of the functions of the Google Classroom as she mentioned in the final interview, "It streamlined things. I love getting the immediate feedback. During my first period class, I was able to go online and see who was turning things in" (personal communication, May 27, 2015).

Sylvia (Level 2) designed a lesson where students completed a review of the unit through the use of technology. I was not able to observe her distribution of devices. However, it was clear from the observation that she required students to submit their assignments electronically and that the students demonstrated their understanding of the content through different technologies such videos and screencasts. She struggled with managing and effectively utilizing technology as the students did their presentations.

Jessica stayed constant at a Level 2. She continued to use I pads efficiently, but struggled to utilize the Google Classroom as a vehicle to deliver content to students. Specifically, she attempted to give students access to a video for a model, but it did not work. As such, she had to revert back to using a paper and pencil graphs instead.

Gwen, Justine and Sydney, all Level 3 teachers, demonstrated efficient and effective use of technology. In each of the observations, the students were able to access the technology seamlessly from the beginning of class and the teachers facilitated the different activities utilizing Google Classroom. Gwen was able to navigate the different

aspects of the platform and explain the logistics of submitting and un-submitting assignments clearly to the students and was effective at supporting students in completing these tasks. Sydney utilized different add-ons to support her students in their writing assignments. She also encouraged them to use the comment and chat functions with Google to engage with the assignment after class. Sydney explained,

> When they're on the Chromebooks often if it's more tangible, I can sit and just see as they type, and interact with them that way, which allows them to converse with each other. And they tend to be focused a lot of the time, so I like it in that way. I like being able to see the drafting process, which I can see on the document, but I can also see through the comments that they make. I find that really helpful" (personal communication, May 28, 2015)

During the second observation of Sydney's classroom, the distribution and collection of devices was more efficient than the initial observation (when it took her over 10 minutes to distribute the devices). The students were able to pick up the chromebooks as they entered the classroom and they were ready to go as the bell rang.

Justine provided students with the opportunity to use technology in several different ways including the camera function on an I pad and her own phone to access an application for the project. At the same time, other students were utilizing Chromebooks to search for images to relate to their class project. Throughout the class period, Justine was comfortable in supporting and managing students use of the variety of technology available to them (observation, May 27, 2015).

Element Seven: Technology Integration, Innovation, and Risk-Taking

This element encompasses the teachers' level of comfort with taking risks and innovating with technology in their class. Integrating technology at high levels includes utilizing it as a learning tool for students as compared to simply a teaching tool to deliver the content. Further, taking risks and innovating in the use of technology exposes teachers to technical glitches and a sense of uncertainty. The level of integration depended on their ability and willingness to problem solve on their own as well as see the support of knowledgeable students to help them work through issues. Finally, the innovative use of technology includes teachers' design of activities that support students in exploring, creating, and inquiring in a variety of ways online rather than just directing and closely managing how students will use the technology. I relied on data from my field notes of the observations as well as the interviews to get a clearer picture of how teachers were innovating, taking risks, and integrating the technology into their practice. This rubric looks specifically at how the teacher utilizes technology in new, innovative ways.

Table 4.8
Technology Integration, Innovation and Risk Taking (Element Seven)

Level	Descriptor	Baseline	Outcome
1	Teacher uses technology as a tool for themselves to deliver content to students or teacher may not use technology. Teacher may display concern about controlling students while online, may express uncertainty or nervousness about the use of technology. Teacher does not take risks in the use of technology, does not attempt to problem solve or use students to problem solve when problems arise. Teacher focuses on providing more procedural or close-ended tasks through technology.	Giselle Jack Gwen Justine Sydney Sylvia	
2	Teacher views technology as tool provide students with learning experiences but may still view it as a vehicle for the delivering the content. Teacher may try to problem solve when using technology, may or may not ask students to help problem solve when problems arise. Teacher takes some risks in their use of technology but still expresses need to control and limit. Teacher creates activities online for students and demonstrates some skill in creating learning experiences that integrate technology to allow for student inquiry online.	Jessica Sissy	Gwen Giselle Jack
3	Teacher problem solves when technology is not working properly or the way intended, teacher also relies on knowledgeable students to problem solve when issues arise. Teacher is confident in the use of		Justine Sissy Sydney Jessica Sylvia

	technology and taking risks by trying new instructional approaches with technology and providing students with time to explore. Teacher demonstrates a strong understanding of the facilitative nature of integrating technology into their practice, skill in creating learning experiences that integrate technology that facilitate and encourage student inquiry online.		

Baseline

According to the review of the baseline data, six of the teachers were at Level 1 at the onset of the study. Jack, Sylvia, Gwen and Justine did not use technology in the first observation and it was clear from the interviews that they did not integrate technology as a student tool. Giselle and Sydney did use technology in the initial observation but they did not utilize it in a way that allowed students to explore. Rather, their students had close-ended activities to complete.

Jessica and Sissy began the study at Level 2. They both had created activities that provided students with the opportunity to create with technology as well as play with it. As an example, Sissy had created an activity where students were encouraged to work with a simulation on wavelengths and she encouraged students to play. As she stated during the observation, "I want you to take three minutes to play with the simulation, play with all of the controls to see what you can get the wave to do" (class observation, March 19, 2015) She also mentioned that the students could "snap chat" their wavelengths to their friends.

Similarly, Jessica described an open-ended activity that she had created for her students to utilize the I pads for inquiry,

> The students had to last week make a movie where they were video conferencing with a patient and there was a doctor and they were explaining to the patient what was wrong with them, why their hair was breaking and why their nails were breaking and stuff. Basically, we took a regular assignment and framed it in the iPod way, and the students were super into it" (personal communication, March 17, 2015).

Jessica integrated the use of the I pad's camera application into a more traditional science activity where students had to learn how to focus a microscope and document this learning with the I pad camera (observation, March 17, 2015).

Outcome

The outcome data indicates that seven of the eight teachers moved up at least one level in this element. Jessica and Sissy began this study at a Level 2, as both teachers began the study with the technical skill and confidence to support students' use of devices. However, by the end of the study, only Sissy moved up to a Level 3. Sissy demonstrated an orientation toward providing students with experiences that would allow them to explore online. She problem-solved through glitches like a non-working teacher computer. She also was clear in her interview that she wanted to create opportunities with technology to facilitate student learning rather than controlling the manner in which students used the technology (personal communication, May _, 2015). On the other hand, although Jessica continued to utilize technology during the second observation, she expressed concern that students could utilize the technology to cheat on tests if she allowed too much freedom with students' access to her website. As she explained during the interview,

> Something that's been throwing me off is if you put it on the website or Google Classroom, everyone has access to it and you can't see who has started it .You can only see who submitted it. In terms of security and stuff, I don't know. This would probably never actually happen, but if someone knew we were having a test that day, they could start looking at the test and not do it (personal communication, June 1, 2015).

Justine, Sylvia and Sydney moved up two levels from Level 1 to Level 3. For each of the teachers, they provided students with opportunities to explore online and encouraged them to experiment with different technologies. They both also took risks themselves in order to provide students with these opportunities. As Justine explained,

> So they're not just looking to me for information. So it forces me to be out there constantly looking for new places for information as well. So the comfort I guess in being comfortable with students possibly knowing more than I might know on any subject matter, depending on what they've brought in (personal communication, May 28, 2015).

Sydney utilized one of the add-ons from the workshops as an innovative way to give her students' feedback. As she stated about the impact of using technology in her classroom, "… I think that the Chromebooks are more of a reminder to me that it's student-centered… I don't think I felt that I needed to be in front of them in that way" (personal communication, May 28, 2015).

In the final observation, Sylvia took risks by encouraging students to work with different technologies, even though she was not completely comfortable with the technology herself. This included: YouTube, Screencastify and other applications. As a way to manage this uncertainty, Sylvia asked students to support each other in the use of

these different technologies. She created an activity that facilitated students' learning as opposed to just presenting students with the information and utilizing technology to submit assignments or as a teacher tool. She explained the activity:

> I didn't give them all those parameters, so a couple of them felt like they didn't know enough. They wanted it spelled out. 'Tell me I have to have five slides. Tell me I have this. Tell me how I could do this'...I try to make it open so they could use anything they wanted as long as it had a media. If they had any questions, they could come to me (personal communication, May 29, 2015).

At the same time, she realized that some of the students were hesitant with using the technology. In her words, "A couple kids that were frightened about Google Classroom were like, 'Can't I just email it to you?' I said no… Once they were in, they were pretty good. There are only a few that resist technology" (personal communication, May 29, 2015).

Gwen, Giselle, and Jack all moved from Level 1 to Level 2. They demonstrated an increased use of technology and they took risks in the types of activities they used the technology for. Gwen and Jack both had sufficient technical skills; they were able to maneuver within the Google Classroom platform and had background in using Google Docs personally, but they utilized it as an organizational tool as opposed to a way to facilitate student learning. Jack ran into a small problem with the graph template he attempted to upload and had the students create it with pencil and paper instead. Gwen had students submit their assignments via the Google Classroom platform; however, the Chromebooks were not utilized any further than this. Jack also indicated in the final interview that he knew students were using technology as a study tool but he did not emphasize how it was used or how this could impact his own teaching. As he explained, "I know that some students have told me that for some assignments they went online. I hear students talking about going on Khan Academy. Some students really like Crash Course" (personal communication, May 21, 2015).

Giselle also demonstrated an increase in the use of technology for students and she began to utilize the Google Classroom platform, which for her was a challenge and demonstrated taking a risk outside of her usual classroom practice. She described how her previous experience with technology really impacted how she viewed it:

> I mentioned to you before, we come from an era...when I worked at NASA way, way back. I worked in a biomedical research lab. We had the first computer on campus…. But if you pressed the wrong button, if you did something wrong, you could crash the whole thing. And that doesn't happen any more. You have so much technical support and they heal themselves. So that's one reason why people of my generation are afraid to use computers. We remember when they used to

> smoke and burn, right on our desk. Literally! So that's a huge fear to overcome (personal communication, May 27, 2015).

Giselle problem solved as issues came up. For example, as students were entering the platform, one of them had made comments to the class "what's up dawg!", and she was comfortable enough to problem solve, with support from the researcher, to change the settings. Overall, she demonstrated the ability to integrate the Google Classroom platform into her practice and had all students log on; but the tool was simply used to submit an assignment.

Impact for Dimension 2: Technology-Enabled Instructional Strategies, Norms and Organization

One of the intended outcomes of the professional learning workshops was to increase the teachers' effective use of technology. Teachers learned how to organize their content in the learning platform, Google Classroom as well as utilize different add-ons to extend and engage students by allowing them access to discover and explore online. Additionally, the professional learning experience was designed to provide teachers with the space to take risks and find innovative ways to use technology to enhance their teaching practice. The table below shows the growth of teachers in Teaching Norms and Structures and Instructional Strategies related to Technology Integration.

Table 4.9:
Summary of Baseline and Outcome Data and Teacher Growth for Dimension Two

Teacher	Level and Subject	**Element Seven** Technology Use and Management			**Element Eight** Technology Integration, Innovation and Risk-Taking			Total Individual Growth
		B	O	**G**	B	O	**G**	
Gwen	HS S.S	2	3	**1**	1	2	**+1**	+2
Sissy	MS Science	1	2	**1**	2	3	**+1**	+2
Giselle	MS Science	1	2	**1**	1	2	**+1**	+2
Jack	HS Science	1	2	**1**	1	2	**+1**	+2
Sylvia	HS Math	1	2	**1**	1	3	**+2**	+3

Justine	MS English	1	3	**2**	1	3	**2**	+4
Jessica	MS Science	2	2	**0**	2	3	**1**	+1
Sydney	HS English	1	3	**2**	1	3	**2**	+4
Total Growth		10	19	**9**	10	21	**11**	
% Growth				90%			110%	

By the end of the professional learning workshop intervention, all of the teachers had used Google Classroom to organize students' work and to conduct class activities online. Jessica did not increase her use of technology or create more efficient ways to interact with her students online; as a result, she did not show growth in Element 1, *Technology Use and Management.* All of the teachers showed growth in the second element in this dimension, *Technology Integration, Innovation and Risk-Taking*. Additionally, the teachers showed the most growth in this element, with an increase of 110 percent.

Gwen, Sissy, Giselle and Jack all moved up one level in each of these elements. Justine and Sydney moved up two levels in each of the elements and demonstrated the most growth in this dimension. Sylvia moved up one level in *Technology Use and Management* and two levels in *Technology Integration, Innovation, and Risk-Taking*. Jessica showed the least amount of growth and moved up one level between both elements. However, she began the study with the most skill.

Design Impact Conclusions

The series of workshops were designed to provide teachers with a collaborative and learner-centered experience. The teachers were provided the time and technical support to both design curriculum within an online learning platform and to experiment with different technologies and teaching strategies. After analyzing the baseline and impact data, I conclude that the intervention impacted the participating teachers' practice. Specifically, the teachers increased their use of constructivist or student-centered teaching practices. Also, the teachers used technology more frequently and/or were better able to effectively and efficiently manage technology in their practice. The data also suggests that teachers attempted to use technology in innovative ways to facilitate student learning as well as organize their teaching practice in an online environment.

SECTION 2: PROCESS DATA DESIGN DEVELOPMENT ANALYSIS

As a review, in design development research, process data is used to reflect on how well an intervention met the intended outcomes. In this study, the process data will provide insight into the experience of the eight participating teachers during the course of the professional development workshop series. The intent of this professional learning experience was to impact teacher's use of constructivist teaching practices as they relate to technology integration. The review of process data will provide insight into the experience of the eight participating through the 20 hours of collaborative professional learning over the course of 10 weeks. By reviewing development of the design protocol and analyzing the process data, a story will unfold on how the teachers developed an understanding of a technology-enabled teaching practice. I frame this development in the context of the impact data reviewed in the previous section. The majority of teachers demonstrated an increased use of the teaching practices, norms and classroom practices needed for technology integration and the process data will show how the experiences in the professional learning experience contributed to this growth. However, since this growth varied between the teachers, there are aspects of the intervention that should be modified for future sessions. This is another function of the process data in that it will provide insight on how to tweak the design protocol and inform modifications to future iterations.

First, I provide a short overview of each of the workshop sessions' activities and agendas and link them to the corresponding learning objectives[2]. I will also utilize process data to describe the experience of the teachers during the course of the workshop sessions. There were five workshop sessions that included three after-school 2-hour sessions and two full-day 6-hour sessions. I utilized different reflective tools during the course of each of the sessions to provide information on their experience.

Workshop Session 1: Introduction to Google Classroom and Creation of Group Norms

The main purpose of the first workshop session was to orient the teachers to the functions and purpose of Google Classroom as well as provide them insight into the student perspective of the tool. Secondly, it was essential to provide teachers with time to develop trust with each other as a way to encourage them to take risks as learners. The constructivist practice of providing learner choice on what and how they learned was also modeled by asking the teachers what they would like to learn and how they learn best. This was also the first introduction for the group to the collaborative functions of Google Forms and Documents.

Table 4.10:

[2] A more detailed description of each workshop session is available in Appendix F.

Workshop One: Learning Outcomes and Activities

Learning Outcome	**Activities**
1. Develop collaborative environment to increase comfort in playing with and taking risks with technology both here and in the classroom 2. Understand purpose of dissertation research study, laboratory sessions, and participants' role in the study (teachers, instructional coaches, researcher) 3. Introduce teachers to the Google Classroom environment through both student and teacher perspective 4. Participate in classroom activity associated with constructivist practice (Socratic Seminar) and utilize technology to support this practice 5. Develop an understanding of teachers' needs for the laboratory sessions 6. Reflect on how students interact with technology and its place in their life 7. Teachers will develop skills in the use of Google Classroom, shared documents and Google Forms 8. Teachers will develop understanding of how open-ended work time supports learning	**First Hour** ❖ Introductions and Icebreakers ❖ Overview of Research Study: Provide participants orientation about the dissertation ❖ Develop Group Norms ❖ Written Reflection through Google Survey "What do you want to learn?" **Second Hour** ❖ Introduce Google accounts (administered through the district domain) ❖ Support teachers in accessing Google Classroom environment for the study **Third Hour** ❖ Review Pew Research on Student Use of Technology (citation) ❖ Collaboratively create student survey to administer to students ❖ Become familiar with the editing functions of Google Forms **Fourth Hour** ❖ Teachers interact with each other's assignment within Google Classroom ❖ Play and experiment with a new piece of technology and consider ways to utilize in teaching practice ❖ Reflect and discuss how the use of Google Classroom could benefit their teaching practice **Fifth Hour** ❖ Participate in Socratic Seminar about reading "Courage to Teach" ❖ Begin to brainstorm project for the workshop based Common Core State Standards or Next Generation Science Standards **Sixth Hour** ❖ Introduce Genius Hour and give teachers to time explore different technology possibilities together ❖ Share out on project and the integration of the Genius Hour time

	❖ Reflection and share ideas for the next session

Analysis

To gain insight into the teachers' experience during the first workshop session, I reviewed my field notes from the session, the detailed write-up I created from my field notes (Appendix F) and the documentation that the teachers provided through the Google Classroom platform. The content on the teachers' Google Classroom sites also provided documentation of the teachers' learning. One of the goals for the first session was to orient the teachers to the Google Classroom platform. That objective was accomplished. Each of the teachers created their own Google Classroom site and was able to interact with each other through it as well as see the teacher as well as student perspective.

An ongoing goal of the series was to develop a collaborative culture to support teachers to take risks with the technology and their teaching practice. Teachers began to get to know each other and build relationships in the first session as they begin to interact with each other in person as well as within the Google Classroom. There were two activities that explicitly required them to work together. First, they designed questions together for the student survey with all of the teachers working in groups of two or three with the exception of Giselle who worked with the instructional coach. The second activity that required collaboration occurred when they shared classroom codes for their Google Classroom and interacted with each other online in a Google Document. All of the teachers interacted with each other during this activity. Overall, the level of interaction and collaboration in the first session was not at a level that indicated that the objective was met. However, this objective was an outcome for the entire series of workshop sessions so progress is tracked through each of the workshop sessions.

Another objective of this session was to model constructivist-teaching practices as well as provide them with the experience of being in a student role in a constructivist activity. Each of the teachers participated in a Socratic Seminar. The structured, open-ended time to explore the different technology tools also provided teachers with the time and space to reflect on the possibilities for learning in this manner. This objective was met in that all of the teachers participated in the different activities. However, I did not explicitly describe how I structured our time together to support their learning and I did not give them enough time to reflect on how their own experience relates to how they could support student learning in their classroom. I believe this impacted their ability to apply their experiences to their classroom practice.

Through the design of the student survey, we were also able to meet another objective of the first workshop session, which was to provide the teachers an opportunity to reflect on the role that technology plays in their students' lives. The design of this

survey provided an opportunity for robust discussions amongst the pairs of teachers as they constructed the questions.

Workshop Session 2: Collaboration and Learner-Centered Reflection

The second session with the teachers was a two-hour after school meeting. The goal for this session was to continue work on the overall learning objectives with a specific focus on further developing the collaborative environment in our workshop setting to support teachers' comfort in experimenting with technology. The second objective was to provide teachers with time to reflect on how they learn best and how they provide students with time to understand themselves as a learner. Finally, I introduced them to the concept of growth mindset as it relates to developing skill with technology (Dweck, 2006).

T**able 4.11:**
Workshop Two: Learning Outcomes and Activities

Learning Outcomes	**Activities**
1. Continue development of collaborative environment to increase comfort in playing with and taking risks with technology both here and in the classroom 2. Review of Two Research Concepts a. Professional Capital (Hargreaves & Fullan, 2012) b. Growth Mindset (Dweck, 2006) 3. Reflect on the ways that we learn best and how do we support students in having the opportunity to learn the way that suits them	**First Hour** ❖ Review group norms ❖ Present and discuss concept of Professional Capital (Hargreaves & Fullan, 2012) ➢ Teacher Appraisal ➢ Professional Development ➢ Collaborative Cultures ❖ Present and discuss concept of Growth Mindset (Dweck, 2006) ❖ Watch Video about Body Language and Public Speaking **Second Hour** ❖ Discussion: What are the ways that you learn best? How does this influence your work with students? ❖ Collaborative work time within Google Classroom and other technology tools

Analysis

The main objective for the second workshop session was to extend the teachers' learning from the first session by providing them with reflection time about how they

learn best and relate this to ways to support student learning in their practice. I guided the group through a couple different activities as a way to reflect on their own learning and what some research indicated about how teachers improve their practice. We also discussed about how "mindset" can influence individuals' motivation and desire to learn. I outlined these two concepts with the teachers. I would assert that the teachers understood both of these concepts; however, I do not have enough information to theorize on whether they were able to relate these concepts to their own teaching.

The teachers also reflected on their learning and made connections to their classroom practice through our review and discussion of a video clip about body language. During the conversation, seven of the eight participants discussed how this video made them reflect on their own body language. The majority of the teachers also indicated that they planned to share this video and discuss the implications of it with their students. After this discussion, the teachers moved into work time, at which time, I explicitly prompted the teachers to reflect on what they learned and incorporate this learning into their teaching practice and interactions with students. Overall, I theorize that this activity did provide teachers with sufficient time to reflect on themselves as a learner.

The other objective of the session was to continue to cultivate a collaborative and supportive environment for the teachers to support them in taking risks in their teaching practice. This objective was not explicitly approached during this session. The session provided the teachers with the time to reflect, share, and ultimately develop more personal connections with each other, all of which contributed to a collaborative culture. However, it was clear that some of the teachers still were uncomfortable with taking risks or asking for support. Specifically, as a follow-up to this session, Sydney emailed me and indicated her reluctance to admit her misunderstanding or confusion. In her words,

> I'm writing because I know that I just have to be honest and say I got confused today. For some reason, I couldn't sign in while the other teacher was showing his setup and I missed it. Then, I just felt self cons chili (sic) about asking for all the help I needed. I'm going to watch the classroom tutorial, and spend a couple hours on this over the weekend. If I still need help, I will be sure to ask! (personal communication, March 16, 2015).

It was a positive indication that Sydney was asking for help, that she felt comfortable to reach out to me with these questions, and that she admitted her confusion. Overall, this objective was not met during this workshop session.

Workshop Session 3: Building Student-Centered/Constructivist Technology-Enabled Lessons

The third workshop session was another two-hour after school meeting that took place two weeks after the second session. The focus of this session was to continue to

build a collaborative culture between the teachers to support their risk-taking with technology. The intent was also to provide them further opportunities to reflect on the student experience in their classroom. The final goal of the session was to provide additional work time to build a project or unit that incorporated the use of technology in a constructivist manner.

Table 4.12

Workshop Three: Learning Outcomes and Activities

Learning Outcome	**Activities**
1. Development of collaborative environment to increase comfort in playing with and taking risks with technology both in workshop and in the classroom 2. Reflect on student experience in schools and consider ways to engage students more in their own learning 3. Demonstrate different examples of teaching strategies to support participant discussion and connection to real world experience 4. Develop skills in Google Classroom by developing standard aligned curriculum within the platform	**First Hour** ❖ Energizer ➢ Read Student Shadow account from Grant Wiggin's website by anonymous (2014) ➢ Respond within Google Classroom through assignment ➢ Participate in String Activity ❖ Review of Common Core State Standards as they relate to previous activity **Second Hour** ❖ Identification of focus standards from CCSS or NGSS ❖ Work Time on Google Classroom or other technology related lesson

Analysis

One of the intended outcomes of the workshop series was to provide the teachers with examples of constructivist teaching strategies. I utilized three examples of discussion techniques to provide teachers with different ways to support student discussion and collaboration within their classroom. I would assert that the objective of presenting teachers with an example of constructivist teaching strategies was met in that each of the teachers engaged in the discussions and they all agreed that the strategies were aligned with the CCSS for literacy.

The written responses of teachers within the Google Classroom platform indicated that teachers had reflected on the student experience within their classroom. Six of the

eight teachers indicated in their response how they would consider changing their practice based on their reflection on the reading. Jack and Giselle were less specific on how they would consider changing their practice in light of what the reading covered. Overall, this information suggests that the participants reflected on their own practice in the context of student experience. Further, the teachers responded positively to the constructivist teaching practices demonstrated during this workshop session. I conclude that this objective was met.

Each workshop session was designed to support collaborative space to support risk-taking and experimentation with technology. During this work session, the teachers completed their first full assignment within the Google Classroom platform. They also interacted with at least three other teacher participants during the course of the session. The interactions were positive between the teachers, and all of the teachers had a chance to share their perspective on the discussions in their small groups or with the larger group.

Another important goal of the workshop sessions was to increase teachers' efficacy with technology. Based on their responses to the journal prompt in Google Classroom, all of the teachers were able to navigate the platform and interact online. This signified an increased in the technical ability of the group. Giselle, who had struggled with using the platform during the first session, was able to submit the assignment. However, one of the teachers, Sydney, did not submit the assignment. I will continue to review how and to what extent each of the sessions met this objective.

Workshop Session 4: Collaborative Project Work Time

The fourth session of the workshop series was the third and final two-hour after school meeting. It took place four weeks after the third session. One of the reasons for the longer break in between these sessions was due to the spring break for the schools. The main activity for this session and the final full day session was to provide the teachers with open-ended work time to complete their project and utilize the collaborative environment developed through the previous sessions. Again, a major objective was to develop this collaborative environment to encourage teachers to experiment and take risks with technology.

Table 4.13
Workshop Four: Learning Outcomes and Activities

Learning Outcomes	**Activities**
1. Continue development of collaborative environment to increase comfort in playing with and taking risks with technology both here and in the classroom 2. Provide an example of open-ended project work time to encourage participant learning 3. Provide space for reflection on the student experience and consider ways to incorporate constructivist-teaching practices.	**First Hour** ❖ Review group norms ❖ Check-on project progress and quick demonstration of technology tool ➢ Kaizena add-on ❖ Begin work time in collaborative groups **Second Hour** ❖ Time to develop standard aligned and technology-enabled projects ❖ Share progress with partner during walking collaborative time

Analysis

The main objective of Session 4 was to continue development of a collaborative and supportive workspace to support the teachers' integration of and experimentation with technology. Ultimately, as a result of this collaborative, low risk environment, the goal was for teachers to increase their use of technology and constructivist-aligned teaching strategies. An activity in this workshop session that substantiated this objective was the demonstration of two different technology tools: Kaizena and Screencastify. I modeled how each of these tools worked as well as facilitated a discussion on other ways that they could be incorporated into their practice. All of the teachers were able to utilize this technology, including Sydney and Giselle, who had previously struggled to incorporate other technologies. Additionally, after the demonstration, the teachers were actively playing with this technology and considering how to incorporate it into their practice. Finally, based on the impact data that indicated that all of the teachers increased their tendency to play with technology and take risks in their teaching practice; I would conclude that the objective was met during this session.

Another outcome for the workshop series was to increase teachers' understanding of constructivist teaching strategies; specifically how collaboration and peer-to-peer interactions can be used to support student learning as opposed to relying on direct instruction. In order to accomplish this, the teachers were provided with open-ended work time and were encouraged to collaborate in groups or pairs. Each of the teachers worked in pairs or in a group during the work session. As indicated by the impact data, only one teacher increased their use of norms to support student collaboration, which indicates that this objective was not met.

The final objective for the fourth work session was to give teachers the opportunity to reflect on students' experience in their class. This was another approach to support teachers' shift toward constructivist teaching strategies. Since there was not an explicit activity to support teachers' reflection, I was not able to conclude whether the teachers met this objective during this workshop session. However, I did work individually with Gwen and provided her with examples of how to consider the student experience in her project, which allowed her some time to reflect on students experience in her classroom. Overall, there was not a consistent opportunity for the teachers to do this reflection.

Workshop 5: Project Completion and Technology Tool Playtime

The fifth workshop session was a six-hour full day session. It occurred ten days after the fourth session and was the final, concluding session for the series of workshops. As with the preceding sessions, the goal of the session was to provide teachers with a collaborative space to support risk-taking and experimentation with technology. This session also continued the teachers' work on the projects, which were the product for the workshop series and demonstrate their incorporation of Google Classroom into their practice. Another important goal was to provide teachers with reflection time to consider their students' experience in the classroom as a way to provide incentive to shift toward constructivist practices. The final objective, which continued from previous sessions, was to provide teachers with the time and space to reflect on students' experience in their classroom.

Table 4.14

Workshop Five: Learning Outcomes and Activities

Learning Outcomes	**Activities**
1. Continue development of collaborative environment to increase comfort in playing with and taking risks with technology both here and in the classroom 2. Demonstrate possible use of educational technology tools and provide teachers with supported time to play and experiment with new technology 3. Develop and further enhance Google Classroom environment to support the implementation of CCSS or NGSS aligned project 4. Reflect on students' perspective of technology through analysis and review of	**First Hour** ❖ Review group norms ❖ Submit assignment via Google Classroom ➢ Goals for the day ❖ Share intentions for the day ❖ Review Student Technology Survey **Second Hour** ❖ Time to play with technology ➢ Demonstration of Screencastify ❖ Work Time to integrate technology tool into workshop session project **Third Hour**

student survey on technology use 5. Develop further understanding of how open-ended work time supports learning 6. Increase teachers' effective use of technology to support student learning	❖ Refresh with a walk and reminder of the group norms ❖ Finalize project within Google Classroom or other online forum ➢ Collaborative work time **Fourth Hour** ❖ Reflect on ways to continue learning and engage in further professional development ➢ Teachers review different opportunities for training **Fifth Hour** ❖ Teachers continue work on project integrating new technology tools and structuring the project within Google Classroom or another online platform ❖ Share with partner an elevator speech of the intended student outcomes for the project **Sixth Hour** ❖ Provide reflection on how to incorporate student voice into project ❖ Open-ended, supported work time to finalize project ❖ Reflect on workshop sessions through closure questionnaire ❖ Final discussion and completion of workshop series

Analysis

During this session, all of the teachers worked with a new technology that they had not incorporated into their practice before. Sydney, who had struggled to work with some of the components of Google Classroom, utilized a new add-on, Kaizena, to provide her students feedback. Giselle, who was the other teacher who had difficulty accessing portions of the training, created a Google Classroom platform to provide her students with an opportunity to submit assignment online. The other participants utilized a variety of different technologies that were new to them, including Screencastify, Kaizena, Educator's Assessment Data Management System (EADMS) and Goobric. From this data, I conclude that this objective was met. Additionally, the objective of providing teachers with different examples of technology tools was also met as the majority of the teachers incorporated or experimented with the technology exhibited during this portion of the workshop session.

The results of the student technology survey that the teachers designed together and administered to their students provided local information about students' perspectives regarding the use of technology in school. Teachers had time to reflect on and discuss this

information during our workshop session. Some of the teacher's skepticism of the validity of the student responses would indicate that the teachers were still uncertain about how to incorporate students' perspectives and lived experiences into their practice. As a result, it is not surprising that impact data indicated that four of the eight teachers increased their tendency to create learning experiences that were relevant to students. Overall, I would assert that this objective was also met.

The final questionnaire completed during this workshop session provided specific insight into the teacher's experiences during the workshop session. Seven of the eight teachers responded the questionnaire. It is not clear why Jack did not participate. The first question asked the participants to describe their project. Seven of the participants described how they were using Google Classroom to manage the assignment in their project. Sydney did not mention Google Classroom, instead she focused on how she was using Google Documents as a way to have students collaborate in real-time with each other.

The second question asked the teachers to "Reflect *on how this professional experience impacted your teaching?"* All of the teachers mentioned how the experience had provided them with the opportunity to learn more about Google Classroom or Google Drive. Further, three of the teachers, Justine, Sissy and Jessica specifically mentioned how the training provided them time to consider how to incorporate technology to support student learning, as opposed to just using technology for technology's sake. As Jessica explained, "It also just helped me transition to a more tech-based classroom" (personal electronic communication, May 15, 2015). In addition, two of the teachers mentioned how the experience had provided them with the time to reflect on their practice and discuss ideas with each other.

Another objective of this workshop session was to provide teachers with a model of how open-ended work time can contribute to learning. Six of the eight teachers indicated that they would have appreciated more structure for the workshops. This includes providing novice teachers with more tutorials beforehand or to watch in between sessions. A couple of the teachers also mentioned that having a more rigorous presentation of their work at the conclusion of the workshop series would have provided them more structure. From this information, it was clear that this objective was not met.

Summary of Findings

To support the analysis of the process data and to determine the extent to which the teachers met the learning outcomes for the session, I considered the teachers' learning in the context of the elements utilized in the impact data. As a reminder, there were two dimensions. The first dimension encompassed student-centered instructional practices; routines, norms and procedures that support technology integration and the second dimension included technology-enabled instructional strategies, norms, and organization.

The design process data allowed me to reflect on and analyze the various activities of the workshop session.

The intersection of the impact and process data provides insight into how the ten-week workshop series influenced the teachers' instructional practices in terms of the degree that they shifted toward a more constructivist pedagogy and the extent to which they integrated technology. Overall, the impact and process data strongly suggest that the workshop series increased teachers' use of technology as well as impacted their tendency to use constructivist-teaching approaches. The data indicated that the workshop sessions influenced about half of the teachers by increasing the degree to which they provided for student choice in their teaching practice. This element was modeled throughout each of the sessions by providing teachers with choices on what applications and types of technology to utilize.

I did not explicitly model how to create the instructional procedures and classroom organization skills to support technology integration during the course of the workshop sessions. However, based on the theory of change; it was an expected outcome. Yet, the workshop series had no impact on teachers' instructional procedures or classroom organization (Element 3). Additionally, I modeled collaborative activities for the teachers; but I did not explicitly described how teachers could design collaborative activities for their students. Consequently, this was an element (*Classroom Norms that Support Student Collaboration*); for which there was very little impact on teachers' practice. In fact, only one teacher, Sissy showed growth in this element.

The teachers demonstrated the most growth in two elements within the first dimension: *Real Life Connections to Student Life Experience* and *Student Discourse, Inquiry and Problem Solving*. During the course of the workshop series, several activities were designed to impact teachers' practice in these two elements. First, the teachers participated in two facilitated discussions about how to create relevant learning experiences for students that both relate to their interests and lived experiences. Second, I provided several examples of discussion techniques that could be used in the classroom to increase the level of and frequency of student discourse. Last, I was explicit, more than the other elements, on how the techniques could be incorporated in part or as a whole into the teacher's practice.

The impact and process data indicated that the most growth occurred for the teachers in the second dimension, teachers' effective use and integration of technology. Specifically, the intent was to increase teachers' use of and effective management of technology as well as their tendency to innovate, integrate and take risks with that technology. One of the main goals of the workshop series was to provide teachers with a low-risk, collaborative space to design curriculum that effectively integrated technology. From all indications, this was accomplished.

Conclusion

Overall, the impact and data process data findings indicate that this workshop series contributed to some of the participants' increased use of constructivist teaching strategies. The impact and process data also strongly suggest that this intervention had increased all of the teachers' use of and innovation with technology. The process data indicates that the workshop series unfolded in a way that it met the majority of the intended learning outcomes for the participants.

In the next chapter, I will summarize the findings of the design development study in relation to the literature on effective integration of technology. Then, I will outline how well the workshop series met the design challenge set forth in this study. Further, the theory of action will be re-examined. Finally, I will discuss the implications for future design development research on technology integration in schools.

CHAPTER FIVE
DISCUSSION AND CONCLUSION

Introduction

Teachers' access to instructional technology has the potential to create rich learning environments where students are able to construct and demonstrate their understanding through the use of digital tools in ways not possible in the traditional classroom (G. Hull et al., 2014; Lei, 2010; Mahiri, 2011; Philip & Garcia, 2013). However, secondary teachers are often constrained from effectively integrating and ultimately, revealing the transformative nature of technology by their continued use of traditional teaching approaches and persistence in certain beliefs about how students learn best (Cuban et al., 2001; P. Ertmer & Ottenbreit-Leftwich, 2010; Zhao, Y., Pugh, K., Sheldon, S., Byers, 2002). This design development study was created to provide teachers with a professional learning experience to increase their use of student-centered instructional strategies and instructional technology.

I assert that the design of the professional workshop sessions met some of the intended learning outcomes for the teachers. Furthermore, I contend that the result of the teachers' learning in the series of workshop sessions presents important insight about how to impact the effective integration of technology in secondary teachers' classroom. I begin with the summary of findings in which I highlight the key features of the series of workshop sessions. Next, I outline the ways in which the design study addressed the design challenge and the design principles. I reexamine the Theory of Action and study limitations. Last, I discuss future iterations and implications for practice.

Summary of Findings

Eight secondary teachers from the Coronado Unified School District participated in the series of five workshop sessions that represent the first iteration of the intervention. After a thorough analysis of the impact and process data, the findings suggest that the teachers developed additional technical and instructional skills that allowed them to integrate technology more effectively. However, only about half of the teachers increased their use of student-centered or constructivist teaching strategies which provides the context for more effective integration of technology. In fact, Sydney, the teacher who showed the most growth in her ability to integrate and use technology, had only increased in one element in the first dimension, which focused on the development of constructivist or student-centered instructional strategies. Interestingly, Sylvia, the teacher who demonstrated the most growth overall, began the study with the least tendency to use constructivist strategies. Through the course of the study, she increased the most in her use of three critical instructional strategies related to constructivist approach, which included *Student Choice, Real-Life Connection to Student Life Experience and Student Discourse, Inquiry, and Problem Solving* (Richardson, 2003).

An intriguing trend emerged in the growth of two teachers exhibited through the study, Sissy and Gwen. First, Sissy began the study with the most overall skill, displayed an average amount of growth, and maintained the most skill during the course of the study. In contrast, Gwen did not show any growth in the first dimension, made modest gains in the second dimension, and demonstrated the least amount of growth overall. An interesting intersection between their pedagogical, technological, and content knowledge emerges through these results. Gwen demonstrated both technological knowledge with her sophisticated use of a website and the ease in which she utilized Google Classroom. Further, she apparently had deep content knowledge based on the fact that she taught an Advanced Placement course and had been teaching the same courses for over six years. However, the classroom observations and interview indicated she still relied heavily on traditional teaching techniques and believed that lecture and direct instruction were important to student learning. Sissy, although a less experienced teacher, demonstrated high levels of technological, content, and pedagogical knowledge. The dichotomy between Sissy and Gwen coincides well with Mishra and Koelher's (2006) work that presented that teachers require skill and knowledge in the three areas, content, technology and pedagogy. Generally, the professional learning experience appeared to have impacted teachers use of technology, but from the comparison between these two teachers, it looked to a be a more complicated process to influence the types of instructional strategies that teachers choose to use.

Comparably, as Philip and Garcia (2013) argued, the process for incorporating technology in ways that are meaningful for students requires a deep understanding by the teacher of how technology intersects with their current practice. I would argue that since the findings suggested that all of teachers made growth in the second dimension, they were able to reflect on their practice and as a result, enhanced their practice through the use of technology.

However, the higher level growth of the teachers in the second dimension suggest that teachers may need a certain level of technical skill before they begin to incorporate technology with the support of constructivist strategies. The teachers all increased their use of technology and were considering more ways to incorporate it, however the teachers tended to integrate in a way that was congruent with their pedagogy. Similarly, Sugar, et al. (2004) recognized in their study of teachers' decision to adopt new technology that a certain level of technical know-how was necessary for teachers to consider new and innovative ways to adopt the technology. Further, the research also indicates that teachers tend to adopt technology in a way that aligns with their current practice (Cuban et al., 2001; King, 2002; Zhao et al., 2002). Accordingly, the lower level of growth in the first dimension is interesting, but not necessarily surprising.

As a whole, the element that the teachers began the study with the most skill in, *Instructional Procedures and Classroom Organization,* was the only dimension that none of the teachers showed growth in. This would indicate that the intervention had not provided sufficient opportunities for teachers to develop skill, or it may possibly indicate

that the intervention was not successful at impacting teachers who began with a reasonable amount of skill in this element.

The process data indicated that teachers increased their comfort with the technology tool featured in this study, Google Classroom. Aspects of the series of professional workshop sessions provided teachers with the structure and support to experiment with the technology as well as consider ways to incorporate it into their practice. However, the intersection between the process and impact data indicated that the teachers were not given enough collaborative time and reflective space to develop their tendency to use constructivist-teaching strategies. However, as the literature indicated, teachers need professional learning that is coherent, provides for active learning and content based in order influence their practice (Desimone et al., 2002). With this in mind, the workshop series provided coherence, active-learning opportunities, and time to develop content related instructional strategies.

Last, the teachers did develop their confidence or self-efficacy in the use of technology in their classroom as demonstrated by the majority of teachers' growth in the second dimension. By simply providing teachers with time to learn how the technology works, it appeared that they are more confident in the use of it, as many of the teachers considered ways to continue their use of technology and expressed this intent in their final interview.

Meeting the Design Challenges and the Design Principles

The design challenge of my study was shifting teachers' practice from a traditional teacher-centered practice, where there are few opportunities to integrate technology in meaningful ways, to a more constructivist practice where students were able to use technology in innovative ways. The solution to support the pedagogical shift is multi-faceted. First, teachers need time to collaborate, reflect and experiment with new technology and instructional strategies as a way to disrupt the isolation they face in their day-to-day teaching practice (Cuban et al., 2001). Second, when teachers are isolated they tend to maintain a static teaching practice, in this case a practice that relies heavily on direct instruction. Accordingly, the intervention was designed to provide teachers with a collaborative workshop environment where they could experiment with technology and new instructional approaches.

The teachers' reliance on traditional, teacher-centered practices was also rooted in the belief that students learn best through direct instruction like lectures and close-ended questioning (Collins & Halverson, 2010; Cuban et al., 2001; Darling-Hammond, 2010; P. Ertmer & Ottenbreit-Leftwich, 2010). As a way to deconstruct the teachers' belief about student learning, one of the principles of the design promoted more constructivist instructional strategies by walking teachers through activities that would demonstrate how students learn through more learner-centered techniques. In addition, the group reflected on descriptions of student experiences in secondary schools, high or middle schools, as a way to provide insight into why the structure of classes may not promote student learning or even the retention of content. Giving the teachers a chance to reflect

on students' experiences provided the teachers with another aspect integral to the design. The theory was also based on the idea that a way to shift teachers' beliefs about student learning, they need the opportunity to understand from a learner's perspective about how different constructivist activities may enhance student learning (P. Ertmer & Ottenbreit-Leftwich, 2010; Mishra & Koehler, 2006). When teachers see the activities from the learner's perspective, it initiates reflection on the types of activities that could support technology integration.

Six of the eight teachers demonstrated growth in the element of *Real-Life Connection to Student Life Experience*, which indicated that the teachers did begin to consider ways to incorporate students' interests and experiences into their practice. Four of the eight teachers adjusted their practice to allow for more student choice (Element One). As a whole, these were the two elements in the first dimension, *Student Choice* and *Real Life Connection to Student Experiences,* where the teachers showed the most growth. Although my sample size was small (n=8), based on the growth that the teachers displayed, I believe that the intervention impacted teacher's understanding of how particular instructional strategies can impact student learning. On the other hand, the design study appeared to have very little or no impact on elements related to the norms, instructional procedures of teachers, most likely, because the teachers had a strong organizational practice, there was little room for improvement.

Because many teachers lacked confidence and a sense of self-efficacy with instructional technology, the intervention was designed so that teachers had time to experiment with different digital tools in order to gain efficacy in their use as well as develop an understanding of how the tools could promote student learning in their classroom. The process and impact data indicated that teachers increased both in their management, use, and integration of technology that implied that the professional learning series positively influenced teachers' confidence in the use of technology. The intervention workshop sessions focused on several technology tools with a particular focus on Google Classroom. As a result, the teachers appeared to increase their classroom use of technology while improving their management of the student devices during the course of the classroom observations. Further, the majority of teachers took risks and attempted to innovate with different tools in their classroom. All of the teachers, except Jessica who was in a one-to-one environment, made growth in the element *Technology Use and Management,* which suggests that providing teachers with time to work with technology in a collaborative setting has the potential to increase their use of technology.

Another important component of the design was to disrupt the relative isolation that teachers experienced in the classroom. The teachers were provided with a collaborative, supportive workshop environment to encourage risk-taking with both technology as well as in the creation of their own curriculum and instruction. The process data showed that the teachers developed some collegial relationships to support their experimentation; particularly between teachers that taught in similar grade levels and subject areas. Further, I claim for the duration of the study, the participating teachers had significant more opportunities to collaborate with each other and as a result, expand their

repertoire of teaching techniques. Although some of these relationships existed at the onset of the study, the teachers had more time in a structured, collaborative setting to further develop their collegial interactions.

In addition, in terms of the impact data, one element stands apart from the rest in the degree of impact that the design intervention appeared to have on teachers, *Technology Integration, Innovation, and Risk-Taking.* All of the teachers exhibited growth in this element and I argue this was the most impactful feature of this design. During the course of the workshop, teachers had time to experiment with the different technologies that enabled them to utilize the tools in new and innovative ways. Teachers were able to move from more traditional techniques to incorporating the digital tools in ways that provided students with different ways to demonstrate their knowledge as well as inquire about the content. The teachers shifted their planning for lessons to include opportunities for students utilize the technology as well as consider ways that students could use the technology in ways that expanded their ability to communicate with the teacher and their peers. Many of the teachers expressed that they begin to think about how digital tools could improve the classroom experience for students.

Overall, there were certain design features that I would incorporate if doing a similar study in the future. Most importantly, there was a clear need to strengthen the collaborative nature of the workshops. Many of the teachers emphasized the importance of having teachers from similar disciplines to collaborate with during the course of the session. Likewise, the teachers expressed that they felt they would have benefitted from differentiated support to address the varying degrees of technical expertise that the teachers had. As indicated in the process data, some of the teachers were not able to follow portions of the training and as a result, were not able to use some of technological tools until later in the series. Based on the feedback of both novices and teachers who were more comfortable with technology in general, the professional learning workshops should cater to the level of teachers. Overall, some of the teachers struggled with following some of the demonstrations of technology while others were able to follow along easily and could have delved deeper into the tools.

Another notable design feature would be to provide more structure to the teachers. In the attempt to provide open-ended discussions and workspace, the teachers did not have enough guidance to set instructional and technical goals for themselves. Further, the teachers were directionless at times and appeared anxious about what they should work on. I believe that by providing teachers with guidance on reasonable goals as well as strategies for setting goals for the amount of time set-aside for the workshops, the end-products may have been more distinct as well rigorous. Part of the challenge is to provide guidance while maintaining a learner-centered environment as a model for the teachers.

Reexamining the Theory of Action

The theory of action for this design study rests upon the idea that teachers who have the collaborative time, reflective space and instructional support may shift toward a more student-centered, technology-enabled practice (King, 2002; Mahiri, 2011; Zhao, Y.,

Pugh, K., Sheldon, S., Byers, 2002). The problem is that teachers reside in an isolated and static teaching environment that impedes their ability to effectively integrate technology as well as increase their use of student-centered teaching strategies (Cuban et al., 2001; Darling-Hammond, 2010). Further, the cultural context of secondary schools limits teachers' ability to utilize more constructivist strategies and results in the persistence of the more didactic instruction.

The interplay between the two dimensions of the study, teachers' use of constructivist strategies and their effective use of technology; is critical to understand how the theory of action was realized through the course of the study. Specifically, the intervention was meant to support teachers in the development of constructivist strategies as a way to encourage the effective integrated use of digital tools. However, based on the analysis of the impact data, it appears that the series of workshop sessions successfully impacted teachers' use, management and ability to integrate technology. In contrast, the impact on teachers' development of student-centered instructional strategies was not as clear. As such, I would revise the theory of action and consider how teachers' increased use and innovation with technology may influence the types of instructional strategies that teachers choose to deploy. The hope would be that teachers would create learning experiences that allow for students to be an active participant in their learning as technology is introduced.

Finally, an integral aspect of the problem was the institutional structure of secondary schools in Coronado. The intervention endeavored to provide teachers with models of student-centered instruction that would ultimately shift their beliefs about how students learn. After analyzing the impact and process data, I am not able to conclude whether or not teachers' beliefs about how students learn shifted. Consequently, the theory of action should also be reviewed to account for this.

Study Limitations and Feasibility

One key limitation of this study was the unintended emphasis on the digital tool of Google Classroom. While the study was designed to increase teachers' use of student-centered instructional strategies in order to support the effective integration of technology, this objective was not clear to the teachers. Rather, the teachers saw the professional learning workshops as an opportunity to learn about Google Classroom and have some time to design curriculum. Again, the research emphasized the importance of developing instructional skill, rather than focusing on the technology itself (Cuban et al., 2001; Lei, 2010; Philip & Garcia, 2013; Zhao et al., 2002). I conclude that this limited the scope of the study by narrowing the focus on the technological tool rather than on the development of instructional strategies. Ultimately, this redirected the attention away from building teacher' understanding of how student-centered instruction in conjunction with technology can greatly enhance student learning. Increasing teachers' use of particular instructional strategies is critically important to their ability

Additionally, the data collection techniques had limitations. Both the interviews and observations provided rich insight into the classroom practice and perceptions of the

participating teachers. The study would have benefited from another perspective into the teachers' practice either through structured daily journaling from the teachers' perspectives or another view into how the teachers viewed the experience. Insight into how they incorporated ideas from the professional learning experience into their practice would also have offered another way to assess the professional development (Borg, 2001). The short-term nature of the data collection timeline also constrained how sustainable some of the shifts in the teachers' practice might be over the course of years.

My dual role as an implementer and researcher also has the potential to influence the interpretation of the findings. As a researcher, my role is to be as objective as possible when interpreting the data, particularly when the data may align differently to my theory of action as well as when the data does not correspond with anticipated or expected findings. Although researcher bias and subjectivity are important and relevant concerns, they are also an expected as well as acceptable in action research as long as they are recognized and efforts are made to minimize their influence. For my part, I thoroughly analyzed both interview and observation data to verify or dispute findings from the intervention results. I ensured that the evidence for the level of the teachers' practice was indicated in both data sources.

I strived to collect and analyze process data to maintain my research orientation. First, I recorded details of each of the workshop sessions in order to reflect on the sessions and ensure that I was following the research protocols. Second, I reflected on each of the sessions through the use of researcher journals to consider ways to improve I addition, I reviewed the feedback the teachers provided during each of the sessions to monitor how the professional learning unfolded from their perspective. Finally, I elicited feedback through email exchanges with the participants and through informal discussions to continually reflect on how to tweak the workshop sessions.

Implications for Professional Development

This study examined a group of teachers' journey to increase their effective use of a digital tool, like Google Classroom through their participation in a collaborative professional learning environment. By modeling the technology as well as constructivist-type instructional strategies during the course of the workshop sessions, teachers were able to increase their classroom use of technology, specifically, student mobile devices. By providing teachers with the time and structure to experiment with technology, they began to consider ways to incorporate technology into their practice on a more regularly basis. Further, the unstructured but guided work time was conducive to teachers' development of curriculum that allowed for the integration of students' use of technology. Overall, from the impact data, specifically the classroom observation, the teachers appeared to have moved through different levels of technology integration toward utilizing the digital tools in ways that support students' problem solving and critical thinking skills (Foon Hew & Brush, 2007).

A critical component in considering the implementation of a similar professional learning experience would be to ensure that the participants are using the Internet, digital

tools and mobile devices. Specifically, the teachers should have the experience of using the technology similar to how their students would be expected to use it in their classroom. All of the teachers developed some technical skill in the use of technology in this study because they had time to develop curriculum and they had to interact online in order to meet the expectations of the series. However, the teachers would have benefitted from a more rigorous and structured share-out of their learning, as it would have required them to create something more tangible through the new skills with the different digital tools.

On the other hand, the second component of this study was to incorporate the technology in a way that transforms the student experience to better match the way that they use technology in their everyday lives. This outcome was more difficult as it depended on influencing teachers' beliefs about how students learn which is a common challenge in the creation of professional learning experiences for teachers (H. Borko, 2004; Lawless & Pellegrino, 2007; Vavasseur & MacGregor, 2008). A possible solution to more effectively impact teachers' beliefs would be to allow for more teacher reflection specific to the students' experience in their classroom. Being explicit and transparent about the importance of allowing students to have more time to inquire about open-ended questions, create and demonstrate their learning through the use of technology would have also brought this idea to the surface and possibly initiated rich conversations about how to support student learning in a technology-enabled classroom. By giving teachers time to talk about and reflect on how to incorporate technology, they will innovate and release some of the control over the content as students have more access to the Internet.

The professional development implemented in this study occurred at the district level which provided some benefits, like increasing collaboration across the district and providing teachers an environment devoid of the possible distracting politics of a school community (Achinstein, 2002; J. Little, 1990). However, there are also possible benefits to embedding the professional learning within the school community (Darling-Hammond, 1997; Zhao, Y., Pugh, K., Sheldon, S., Byers, 2002). This would include either a traditional department where the teachers are divided by content or as part of a larger school-wide focus on effectively incorporating digital tools to enhance the student experience. The existing relationships between teachers at the same school community could allow for the faster development of a collaborative, low-risk culture for teachers to experiment with digital tools and similar to some of the research around technology integration, would contribute to a school-wide culture around how best to incorporate technology and support teachers in their attempts at innovation (Darling-Hammond, 2010; Mahiri, 2011; Zhao et al., 2002)

Conclusion

Our society's instantaneous access to information is invigorating as well as overwhelming. Technology has the potential to transform students' experience in the classroom if incorporated in an effective manner. However, if technology is not implemented with proper teacher training, the costs, both monetarily and instructionally, may not be worth it. Most important, this online world created by the Internet is where

students create, inquire and begin to build their understanding about the world as well as develop an online identity. We must meet students where they are at, in this digital world, and be the guide to support their growth into productive, positive citizens of the digital world, as we have always done as educators. In order to support the important shift towards a classroom that better mirrors the current workplace, teachers require support in understanding how to shift the static and antiquated system in which they work. Disrupting a didactic style of teaching, which is perpetuated by structure of secondary schools, is too much for individual teachers to take upon themselves. Teachers need support in the form of effective professional development as well as a school environment and culture that allows for this critical shift in the way that we educate our children.

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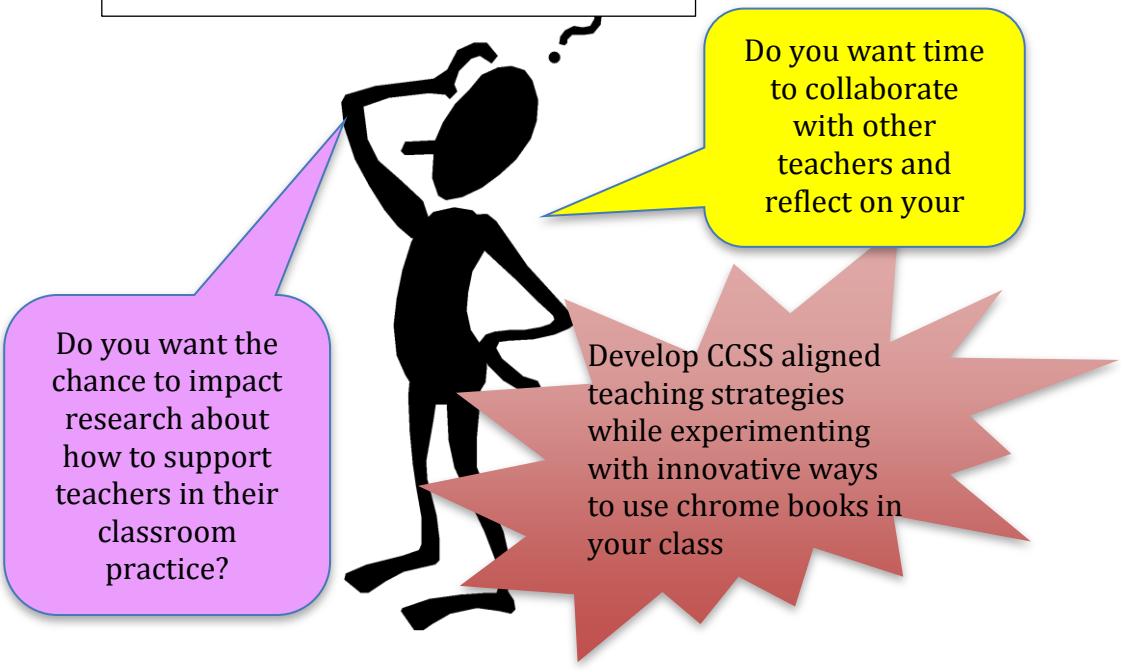
APPENDIX A: Flyer



During a series of collaborative laboratory sessions, you will have time to work collaboratively on CCSS aligned lessons while experimenting and learning about resources available through Google

Information session: March 4th or contact Julia Kempkey

APPENDIX B: Observation Tool

Use of descriptions above to collect classroom observation data

<table>
<tr><td>Teacher:</td><td>Grade/s of students:</td><td>Subject Taught:</td><td>Time Observed: (Start and End Time)</td></tr>
<tr><td colspan="2" rowspan="2">Type of activity observed/Classroom Practices:</td><td colspan="2">Date:</td></tr>
<tr><td colspan="2">Classroom configuration:</td></tr>
<tr><td colspan="2" rowspan="2">Structures/Norms:</td><td colspan="2">Student talk time</td></tr>
<tr><td colspan="2">Teacher’s description of lesson’s objective:</td></tr>
</table>

APPENDIX C: INTERVIEW QUESTIONS

1. Demographic information: How long have you been teacher? Credentialed to teach? (Age, gender?)

2. Suppose I was in your classroom on an average day. What would I observe students doing? What would I see you doing? How would the students' desks be configure?
    a. Describe your class today.

3. There are many different ways to organize the learning process in a classroom. Students can work individually, in groups or the teacher can provide direct instruction to the whole group. What do you think is the best way for students to learn?

4. There are both advantages and disadvantages to using technology. What do you believe is the impact of providing students with access to technology (chrome books, google apps, email, etc).

5. What are some of your teaching practices that have stayed consistent regardless of the student demographics, technology available, class level or subject? What has had the greatest impact on your teaching practice?

APPENDIX D: Workshop Sessions Notes

Workshop 1: Introduction to Google Classroom and Creation of Group Norms

During the first workshop, which was a full day session, I began by ensuring that the participants had an opportunity to introduce themselves and become acquainted with everyone in the group. Many of the teachers did not know each other if they were not from the same school. I reviewed the purpose of the dissertation research study and the format for the Google Classroom workshops. I described the theory of change and intervention and my role as a researcher and participant through the study. I explained the activities for the day and the layout of sessions. This includes the focus on cultivating an environment of collaborative, risk-taking in the workshop sessions to encourage the use of technology by teachers. I also provided a quick overview of the Google Classroom environment.

After the initial introductions and the overview for the session, we collaboratively developed norms for our sessions together. I asked the teachers to move their computer screens down so we could speak with other in person. I took notes on a Google doc and displayed the development of the norms on a projector. I encouraged the participants to consider the conditions in which they learned best. As a group, the teacher identified the following norms for collaboration and as guidance for how the sessions should be structured:

- *Screens down when we are having person-to-person*
- *Make sure people are ready to move on*
- *Coffee will always be available*
- *Walking and talking as part of the norms*
- *Hear about what others are working on*
- *Space for everyone to talk*

The teachers were clear that it is important that they have time to think and collaborate as well as the opportunity to reflect on their learning. Sydney, Sissy, Sylvia, Gwen and Giselle all voiced that it was important to them to have time to move around and process through walking or other physical activity. The rest of the participants indicated agreement with this by either verbally agreeing or shaking their heads in affirmation. As a group, it was also clear that it was important to have time to interact and share with other teachers. This was laid out as one of the components within my theory of change- that collaboration and teacher discourse was important to the development of a technology-enabled practice.

Once we had set the group norms for the workshop sessions, I asked the teachers to go to the agenda, which was a shared Google, document and start to set their goals for our workshop. This activity was important in modeling learner choice in the design of lessons and activities. I asked them the simple question, "What would you like to learn?" I initiated this activity by encouraging them to consider how they would like to learn as well as what they would like to learn. Each of the teachers wanted to learn more about Google Classroom as well as how it could enhance some of things they were already doing. The majority of the teachers also wanted to understand how Google Classroom could support student-to-student interaction. As Jack explained,

> I would like students to be able to interact with each other electronically when discussing lab results and see how much each student is actually contributing rather than going along with his or her lab partners' conclusions

Similarly, Jessica stated, "generally, I'd like to know how Google classroom could connect my students and facilitate their learning" (3/20/15). Each of the participants also indicated the desire to learn how they could organize their curriculum and students assignments through the use of Google Classroom. After the teachers had completed this short writing activity, I introduced the Google Classroom platform and had teachers enter the course for the workshop sessions. During this phase of the training, the teachers could see the student view of the stream of activities as well as the log of assignments. At this point, the teachers could interact with the Google Classroom environment and set-up their own classroom.

The next main activity was for the teachers to review a research study released by the Pew Institute for Education about students' use of technology (citation). After reviewing this document individually, I facilitated a discussion of the results of this survey in the context of our local setting, particularly how they corresponded to students experience in the district. All of the teachers agreed that they felt students in our district would have similar responses and they agree that they would like to create their own survey to elicit similar responses from the students in their classes. From there, the group decided what should be included on a survey for our own students. As a way to display the capacity of Google Docs, I asked the teachers to pair up and the teacher groups identified the topics for the different questions together. The different question topics included the following:

- ➔ Students level of access to technology at home
- ➔ Social media use
- ➔ The reasons they access the internet
- ➔ The type of constraints that their parents put on their technology use including TV screen time
- ➔ How they use technology at school with specifics on the amount dedicated to their different classes
- ➔ Whether they are distracted by their phones or technology
- ➔ Where they get help with technology

- ➔ How their parents use technology
- ➔ Level of use of non-internet technologies in their classes
- ➔ If they set their privacy settings on their social media pages

After the teachers had identified which topics they would design questions for; I shared a Google form with the whole group. They worked simultaneously on the Google Form to create the survey for their students. The resulting survey is included in Appendix _.

Once the teachers completed their questions, it was time for a break. As we had discussed during the norming process for the group, the break was long enough to allow the teachers enough time to do a variety of activities so they could stay focused during the daylong workshop session. Many of the teachers left the room to take a short walk, take a restroom break or catch up on email.

After the break, I showed the teachers how to set-up their own Google Classroom through the district's domain. I asked them to create a separate Classroom for the purposes of our workshop so they could experience the platform from a teacher's perspective. They had experienced some of the student view from their interactions with the Classroom that I had set-up for the workshop. Once the teachers had created a sample Classroom, they copied the unique class code onto our shared agenda so a couple other teachers could join their class. This allowed them to see how they could interact with students within the Google Classroom platform. A couple of the teachers (Giselle and Sydney) had difficulty with this activity so either one of the instructional coaches or I supported them in finding the code and copying into the shared document.

As teachers finished copying their class code onto the shared agenda, I shared a link to a video for an add-on called Flubaroo. This allowed teachers, who were done creating their own Google Classroom and interacting on other teacher's platforms, time to play with a slightly more advanced piece of technology that they could use within Google Forms. Most of the teachers had a chance to review the video and start trying the add-on.

As a follow-up to this introduction to Google Classroom, I facilitated a discussion about their initial impressions of the platform and some ways that they could possibly utilize it for their own teaching practice. Gwen, Sylvia, and Sydney indicated that they saw some promising applications in terms of organizing students' responses in Google Docs. Jessica was not sure how the Google Classroom platform would work with I pads and we talked about how to access it through an application rather the website. Most of the teachers indicated that it seemed useful for sharing links and organizing student responses. However, these same teachers were concerned about the streaming nature of the front page as it could make it difficult for them to organize their assignments for both the current year as well as they wondered how they could capture the work they put into the site for future use. At this point, one of the instructional coaches indicated that we could provide Google with feedback through the Google Classroom platform about

different features that would be useful for teachers. We showed them how to do this and we also discussed other functions that would be useful such as grade book syncs, a more organized daily agenda and a way to draft assignments so students could not see them immediately.

After this discussion, lunch arrived and we took a break to eat and refocus per the group norms. Again, some of the teachers took a short walk, checked their cellphones for messages or simply chatted with each other. During the norming process, the teachers had agreed to a shorter lunch in return for ending the first day earlier.

When the group reconvened after lunch, I showed a short clip to engage the teachers into the afternoon session. This video was called "Medieval Help Desk" and several of the teachers laughed aloud during the viewing. We moved directly into the next activity, which was a semi-structured Socratic Seminar discussion about an excerpt from the Courage to Teach (citation). The teachers accessed the electronic version of this excerpt through the Google Classroom platform. The objective of this activity was to provide teachers with time to reflect on the beginnings of their teaching practice as well as demonstrate some of the principles constructivist teaching practice by focusing on the learner perspective and providing time for open discussions about personal experiences. I begin this activity by allowing them time to read through the excerpt and giving them a quiet space to reflect personally and professionally on the excerpt.

Once all of the teachers were finished reading the excerpt and had a chance to think. I opened the Socratic Seminar. I explained that this was a powerful activity that I had used with my own students when I was introducing a particularly dense reading. I introduced some of the norms that I used with my students for our discussions which included 1) being comfortable with silence to allow for thought as well as space to invite quieter participants time to respond 2) respecting the speaker and listening fully 3) creating discourse by having each comment or question to build upon each other. I was clear that a critical aspect of this type of discussion was that I worked on not interrupting or responding to students' questions and encouraged them to work together as a class to come to a collective understanding instead of relying on me. I also explained that I often allowed students to share quotes as a more accessible way to enter the discussion. I indicated that our discussion was different in that we had read a fairly accessible piece of reading in terms of content and complexity so our discussion would be brief, however the intent was to provide a model of how the Socratic Seminar could be set-up in their own classroom. Finally, I invited teachers to also share their experience with discussions. Some of the teachers explained that they had used fishbowls or more traditional discussions with their classes.

I opened the discussion simply by asking for any of the teachers to reflect on their reactions to the reading. Most of the teachers shared their reflections about their master teacher and how they had influenced their teaching. Sydney explained how her master

teacher had encouraged her to always be honest with her students and admit to being a learner herself. Giselle mentioned how her mentor teacher had provided an example of how important it was to build strong relationships with students and the influence that this had on her own teaching. Other teachers mentioned how their mentors had provided support in the areas of classroom management, setting-up of classroom norms and structures. Overall, the discussion was brief, about fifteen minutes, which I explained was shorter than what I would conduct with my students. However, it did provide an introductory glimpse at the Socratic Seminar model. We also reflected as a group on how this model could benefit their classroom and when they could use a similar type of activity.

As a way for the group to bring together their learnings and reflections for the day, I asked the teachers to begin deciding upon the project or unit that they would create through the course of the workshop sessions. This included what they would expect their students to learn by the conclusion of the unit or project by crafting a learning objective or driving question for their students as well as identifying the standards that they would cover during. The teachers were also instructed to find a reading to post as an assignment in their Google Classroom for their project. As part of this reading activity, I asked the teachers to incorporate open-ended questions to encourage student discourse, similar to what we modeled during the Socratic Seminar. The teachers worked independently or in pairs on their lessons. I reminded them during this work session that they would continue to build their work through the course of our time together so they should consider a unit scheduled for later in the semester. The teachers had about a half an hour to start work on their project. At the conclusion of this activity, I asked each of the teachers to share the It was clear that all of the teachers were able to identify the standards and learning objectives for their focus project/unit.

The final hour of the first full workshop day was designed to allow the teachers time to play with technology and a quick closure activity for the day. I introduced this activity by showing a short video about the concept of "Genius Hour" which is a technique used by Google to encourage innovation and creativity in their workers by allowing for twenty percent of their time to be used on a project of their choosing. After watching the video, I encouraged the teachers to consider a technology that they always wanted to try out in their teaching and start to learn about it and play with it. I also gave them the option to continue their discovery of Google Classroom for the duration of this activity. I provided several examples of different options including website builders like Weebly, Google sites or online creation applications like Sketchpad or Avatar. The objective of this was to provide teachers with the experience of being a learner in an open-ended activity where is choice for how and what they would learn. I also wanted to emphasize the use of technology for creation of learning and content as opposed to just consumption. The teachers worked in teams or individually on their Genius Hour projects. Several of the teachers decided to focus on a new assessment platform that the district was piloting called Educator's Assessment Data Management System (EADMS). Both of the

instructional coaches in attendance were able to help teachers on this tool. A couple of other teachers decided to focus further on the Flubaroo add-on. Others continued to work within Google Classroom to better understand the features available there.

Once the teachers had a full hour to discover and play with different technologies that interested them, we concluded our day by having a full group discussion. I asked them to consider what went well and what I could improve for our future sessions. Sylvia indicated that she liked the pacing of the day that there was time to work individually with some time for instruction from me. Several of the teachers shook their heads in agreement as she shared this feedback. Sydney shared that she felt like EADMS seemed to have a lot of functions that would be helpful for her teaching and she also liked that Google Classroom seemed like it would be great at organizing her Google Drive. Other teachers also indicated that they had learned a lot from each other. Gwen had shared with other teachers her class assignment organization through the use of a Google Doc and other teacher was interested in learning more.

In terms of items to improve for future sessions or things that the teachers had indicated that they wanted to learn, they shared several. First, Jack wanted to understand how to support students' development of content knowledge through the use of the technology integration and focus on the standards. Giselle indicated that she wanted some support in making the log-on into Google Classroom and the Google accounts smoother so she could be confident with the use of them with her students. Justine wanted a reminder to bring documents or materials to use during the development of their projects during the next session. Sydney shared that she would like some support in her distribution of devices when she used them with her classes. Finally, Gwen shared that she would like time to organize her Google Drive and many of the teachers indicated agreement with this.

Workshop 2: Collaboration and Learner-Centered Reflection

The second workshop session occurred approximately a week after the first workshop and was two hours in length. The second session began with a careful review and consideration of the group norms. Then, I presented a concept from the research of Michael Fullan and Andy Hargreaves (2012) to reinforce the key principle of teacher collaboration as a critical component of our work sessions. With this short overview of the principle, I asked teachers to consider how collaboration supports their professional growth and whether they see collaboration playing a similar role in their classroom practice. Giselle mentioned that she encouraged students to interact in order to review assignments and they learned well this way. Similarly, Sissy agreed in that her students were often better able to explain concepts to each other as they could use 'kid speak' in their explanation.

Next, I transitioned the conversation to the concept of growth mindset as an essential idea for workshops in terms of supporting each other to experiment and grow in understanding how to use technology to enhance students' experiences. I displayed a chart with the some of the main components of these concepts. I outline them below.

Fixed Mindset	
Leads to a desire to look smart and therefore a tendency to	Leads to a desire to learn and therefore a tendency to...
Avoid challenges	Embrace challenges
Gives up easily	Persists in the face of setbacks
Sees effort as fruitless or worse	See effort as the path to mastery
Ignores useful negative feedback	Learn from criticism
Feel threatened by the success of others	Finds lessons and inspiration from the success of others

(Dweck, 2006)

This led into another short group discussion with Sylvia mentioning how she worked with her students to give them an understanding of the concept. Other teachers, Gwen, Jessica and Justine also mentioned how they have briefly introduced the idea with their students as well. We discussed as a group how this concept could be applied to our own adult learning the workshops. Many of the participants agreed either verbally or by shaking their heads affirmatively that they felt it was important to remember to encourage a growth mindset in students as well as for themselves personally. After this brief discussion, I showed the group a portion of a Ted Talk about how we present ourselves as a way to engage the teachers in further self-reflection. This video described how body language communicates and how we can reconsider the ways that we present ourselves in order to ensure that we are non-verbally communicating in a deliberate way. I showed a small three minutes clip of the speech as a way to take the group further into self-reflection. Gwen remarked, " I realize that I always hold myself in a pretty defensive and closed off fashion and I want to be more aware of that." Other teachers shook their heads in agreement. Other teachers also mentioned similar realizations about how their body language could communicate different things to their students. Five of the participants also indicated that they thought this would be a good video to show to their students. Overall, seven of the eight participants shared how this could relate to their teaching as well as their own approach to teaching and learning.

From here, I did not prompt further conversation, I instructed the group to reflect a moment and consider how each of these concepts relate to the way that they learn best. I also encouraged them to think on how these concepts may influence the way they design lessons for their students. After giving them a moment to consider, I moved them into the last portion of the session where they were given time to work on their project for our workshops. They worked for another thirty minutes in groups of two or three. We closed the session with a short demonstration from one of the teachers about how to organize their different accounts within Google and I finished the session with a short reminder of the schedule and encouraged them to bring more resources to use in the next workshop.

Workshop 3: Building Student-Centered/Constructivist Technology-Enabled Lessons

I began the third session with a review of the norms that the group had set during our first workshop. From here, the teachers were asked to log-in to the Google Classroom site for the workshop sessions and read an online blog from Grant Wiggin's website. The reading described one teacher's experience when he shadowed a high school student for a day. The assignment in Google Classroom provided the link to the article and then prompted the teachers to answer these questions:

1. Do you think that a student experience at your site would be similar to what was described in this article? Why or why not? Provide evidence to support your answer.
2. Reflect on your own teaching practice, which of his take-aways from his experience resonated with you?
3. How could you support students in staying engaged in the school day and combating the exhaustion that he describes?

All of the teachers responded to the prompt within the Google Classroom platform. Most of their responses were consistent in that they felt that students at their school have similar experiences to what was described in the blog piece. Some of the teachers had even shadowed students at their school, as Sylvia described, "it is especially grueling day…. teachers can do more to get students out of their seats and involved" (personal communication, 4/8/15). As Gwen stated,

> There are very few opportunities for my students to get up and move around. I usually require that they 'stay in their seats' at all times, which must become exhausting. About once a week I allow the get up for a minute or two, but that is not enough (personal communication, 4/8/15)

Jessica had a different perception about the activities at her site, she writes, "I think a students at my site would likely not identify with the students in the article," (electronic communication, 4/8/15). She believed that students would not be passive in most of their

classes and that the culture of the kindergarten through 8th grade school ensured students had more interactions in each of their classes.

In terms of their reflection about their practice, there was more variety in the responses. As Jack described in his answer for number two, "I don't now about providing little breaks for students in the middle of the period. I wonder if that might be more distracting than anything else" (personal communication, 4/8/15). Both Giselle and Justine mentioned in their reflection that they would consider setting timers to remind themselves to move onto another task as a way to ensure they are providing enough variety in their lesson.

After the teachers had completed the reading and writing activity, I facilitated a 15 minute discussion in a way that was meant to energize them and give them an opportunity to see another type of activity that they could use with their students to engage them in the content by connecting it to their personal experiences. I started our discussion about the article by stating that we would use a ball of string to ensure that everyone had the chance to speak and asking the group a question about the reading. From here, we toss the ball of string to each other. Ultimately, it created a visual, physical web of our conversation. Each of the teachers made similar comments to their written ones. At the conclusion of the activity, I debriefed by indicating how each of our thoughts and were connected through our conversation. Many of the teachers were laughing and commented on how they liked the activity. Sydney noted that she was a little uncomfortable with the tossing of the string and thought that the students may be as well. Giselle agreed and said she thought the activity might distract students. Justine mentioned that she thought students would be engaged and Sissy and Jessica indicated agreement with verbal "yeah" or an affirmative shake of the head. I concluded the activity by reiterating how it visually demonstrated the connections between each of the participant's ideas and contributions.

From here, we moved into another short (15 minute) example of student-centered discussion activity, called a snowball discussion. The groups started in pairs and then combined the pairs to form groups of four and then moved the discussion into the large group. The discussion prompt was a brainstorm on the major shifts within the new standards, with a choice between CCSS in math or ELA or the Next Generation Science Standards (NGSS). The second part of this brainstorm was to identify teaching strategies that support these shifts within the Google Classroom platform. The teachers found someone sitting close to them and started the conversation. After the groups had about 3 minutes to brainstorm, I asked them to find another pair sitting close to them and combine their ideas.

Giselle, Jack, Jessica and Sissy worked together on reflecting on the NGSS since they all taught Science. While Justine, Gwen, Sydney and Sylvia worked together on the CCSS for either math or ELA. When I asked each group to share out one large learning from

their discussion, this group indicated the focus on providing evidence when constructing an argument as a major theme in the standards for both ELA and math and that activities or teaching strategies that engaged students in real-world dilemmas would support this standard. The science group had a similar share-out that the new standards would require students have opportunity to know whey they are completing labs as well as teaching strategies that allow students to defend their conclusions. After approximately, 3 minutes of discussion in the larger group, I invited the groups to use this brainstorm to guide their work time.

During the work time, all of the teachers begin to design their lesson either using Google Classroom platform or a Google document. They worked collaboratively with many of the teachers discussing their ideas with the groups that they had ended the final discussion in.

Workshop 4: Collaborative Project Work Time

This session began with a demonstration of an application that can be added into the Google Classroom platform. This "add-on" is called Kaizena and allows teachers to leave verbal feedback in the text of Google document. I showed the teachers how to access this add-on by modeling and providing a step-by-step display, which the teachers followed on their own devices.

After this demonstration, I presented the teachers with their task over the next couple sessions, which had been described to them in the previous session. We discussed that the goal was that they would have identified a focus or a strand of focus standards to address through the use of technology, specifically Google Classroom. The teachers were encouraged to continue to work in pairs or groups. Two instructional coaches were also available to support teachers in thinking through and designing their lessons. Jack and one other teacher who was not part of the study but who was in attendance worked together to incorporate some the high school NGSS science standards. One of the instructional coaches worked closely with both Jessica and Justine to use a new assessment tool.

I supported Gwen by discussing a country case study project and brainstorm new aspects that would provide a more relevant experience for students. We discussed providing students with additional choices on which country they would research as well as provide them with a prompt that required them to find a current issue in the country and use evidence to address the dilemma. The other teachers worked in groups of three or pairs to work through their initial thoughts about the project.

I concluded the session by asking the teachers to find a partner to debrief on their progress and make a verbal agreement on what they would accomplish by the next session, which was ten days away. I encouraged them to get up and walk around the building as they debriefed. Jack and his partner stayed in the room while the rest of the

teachers got up and walked around. They were dismissed once they returned from their debrief.

Workshop 5: Project Completion and Technology Tool Playtime

The final workshop session began with a review the norms as we had done each of the sessions. Since this was a full day session and would last six hours, I encourage the participants to get settled and comfortable with whatever they needed to focus for our morning time together. I reminded them that there was coffee and snacks available at any time per our group norms. Once everyone was settled into his or her seats, I asked them to log-on to the Google Classroom and complete an opening activity by setting their intentions for the day together.

Seven of the eight participants completed this activity with the exception of Sydney. Three of the participants, Sissy, Justine and Sylvia had specified their intent to work within the Google Classroom platform for their projects. Two teachers, Jack and Gwen, had set their goal to incorporate the data assessment system called Educator's Assessment Data Management System (EADMS) into their design of their finals. Giselle was a little less specific about her goal for the day. She mentioned her experience with Macintosh computers; "I had to leave behind my Dell laptop for my sub today, so I brought my Mac that I'm completely unfamiliar with" (personal communication, 5/15/15). Jessica also was broader in what her goals were; she wrote that she would like to incorporate one of the technologies that she learned about during our sessions together. After I provided about 15 minutes of writing time, I asked the participants to share with the group what their goals for the day were. They all shared similar ideas to what they had written in their responses, both Gwen and Jack mentioned that they would also continue to build their project out in Google Classroom.

After everyone had shared their intentions for the day, I gave the group a few minutes to review the summary of responses to the student technology survey that the participants had designed in the first workshop session. There were a total of 863 responses to the survey (Appendix). Once they had a chance to review in pairs or individually, I conducted a brief open-ended conversation about the results. Many of the participants were particularly interested in the types of social media that students were using as well as the amount of technology that students were using in different classroom. Four of the teachers, Giselle, Gwen, Sydney, and Jack expressed skepticism to the fact that the majority of students (73.4%) responded that their smartphone does not distract them during class. The teachers also found it interesting that the majority of students were using technology for activities other than homework or classwork. The conversation was open-ended and I transitioned us into the next activity by mentioning that now we would look at some different examples of technology that they could work on incorporating into their practice during the course of our daylong session.

As we moved into the next activity, I emphasized that the group would have time to experiment with different technologies and I encouraged them to utilize the supported work time to try out new technology tools that they thought would be helpful in their own classrooms. I modeled this risk-taking or experimentation by demonstrating how to use an application called Screencastify. Which is a tool that allows for anyone to create a simple video with his or her computer screen. I walked through the steps to create their own screencastify by showing them how I had found a simple tutorial on YouTube.com and followed the directions. All of the participants got access to the application as well and were following along on their computers as I worked through the directions for the group. At this point, one of the teachers who was participating in our sessions, but not one of the research participants, also shared a Google add-on called Goobric and Doctopus. Both of these add-ons allowed for more advanced grading capabilities within the Google Classroom platform. As a way to model this for the group, he walked me through how to incorporate them into my Classroom platform for the workshop session. I was able to set-up the Doctopus and Goobric and then provided a rubric feedback to the participants through the Google Classroom platform. After a short demonstration of each of these different technology tools, I directed the team to the list of additional technology tools on the online agenda in the Google Classroom that they could play with. I then released them to start experimenting with whichever technology they were interested in and encouraged them to be open to trying out something that seemed interesting even if it may be difficult. I reminded them to use each other's support to learn how to utilize the different options.

Sylvia, Sissy, Jessica and Justine all begin to work with Screencastify during this work time. They were laughing at their first attempts with the application as they recorded their voice and walked through a variety of different attempts at creating a Screencastify video. Two other teachers, Jack and Gwen worked with EADMS to see how to incorporate it as a tool to administer their final exams. Sydney was trying out the Doctopus and Goobric applications and expressed excitement on the possibility for providing feedback to student's writing. Giselle was working to navigate her Macintosh computer and was working with Google Classroom to design an online assignment for her students. She had sent an electronic communication a couple weeks earlier that stated,

> By the way, it may appear that I've done nothing with my Google Classroom but I backed up completely and am starting from scratch. I realized I'd never used any of the different tools available in the Classroom, including Docs/Drive. I didn't realize just how much I didn't know when I started your class. I also was just given a new MacBook Pro and am learning how to use it too, so I'm making a lot of progress considering where I started. My goal is to be able to support and encourage other teachers on campus who are reluctant to delve into technology

Giselle worked with one of the instructional coaches to create an assignment in her Google Classroom. She also spent some of this work time to learn more about EADMS

as well. Seven of the eight teachers were working in pairs or groups to experiment with the technology for an additional thirty minutes.

After the teachers had time to work with a specific piece of technology, I reminded them of our group norms and encouraged them to take a break, stretch, walk around and debrief with someone new in the room. We took about a 15-minute break.

Once the teachers returned from the break, I reiterated the intent of the open-ended work time to provide teachers with the time to design projects that considered students' interest and incorporated technology. I encouraged teachers to continue working on their projects and introduced the next hour and a half as open-ended work time.

During this open-ended work time, I checked in with each of the teachers or groups of teachers to see how I could support their work time. Sydney was interested in finding an application in the Google suites that she had used before to create videos that was similar to Screencastify. We looked at a few different versions but concluded that Screencastify would work best for her purpose. She continued to work through different ways to incorporate this into her Google Drive and I moved onto to supporting Sylvia.

Sylvia wanted to provide students with different choices of technology to use during her final review project. She explained that it would be great to show an example of how the students could use Screencastify to describe how they worked through a problem in her Pre-Calculus class. We worked together to video as we drew on a blank piece of paper and describe the steps as we made the drawings. Sylvia exclaimed, "This is so easy to use!" (personal communication, May 5, 2015). Sylvia and I had completed an example Screencastify video together for her to use with her students.

I also checked in with Gwen and the project that we had discussed during the last session. She was interested in some of the suggestions and thoughts that we had come up with but did not think she had time to incorporate the ideas with the team of teachers that completed the country case study together. We also discussed her goals around using the Google Classroom in order to provide students with feedback on their first draft of an essay and then give another student access to the assignment so they could get another round of feedback from a classmate. We walked through the logistics together and realized that the students would have to "unsubmit" the assignment and then share with a classmate. Gwen stated, " I think this will work really well for the assignment" (personal communication, 5/15/15).

At this point, it was time for lunch. The group had agreed to a working lunch as a way to be released early. After the teachers had gotten their food and settled back in their seats, I introduced the next activity as a reflective time to consider how they would consider continuing with their professional learning on how to incorporate technology to support student learning. I provided them with several different links available through the online

agenda. I encouraged them to review different opportunities and discuss with other sitting around them to identify some that would benefit their continued professional growth. I had to leave the room for an unrelated meeting and did not capture the conversations. When I returned, a couple of the teachers, Justine and Jessica shared their interest in becoming a Google certified teacher. The rest of the group had considered a variety of different opportunities but did not share specific plans.

After the working lunch session, I initiated a more formal discussion on how to consider ways to incorporate student interest and personal experiences into their projects for this workshop series as well as their practice as a whole. I asked anyone to share how he or she considers student's interest into his or her classroom now. Sissy mentioned that she was going to provide the students with the chance to "discover and argue" what planet would be the best choice for the conclusion of her project. Sylvia offered that it was "difficult in math" to always engage student's personal experiences or background but since her project provided students with choice on how they would demonstrate their understanding, she thought the students would be "excited". The other participants listened closely and demonstrated agreement by shaking their heads in agreement.

As we moved into the last couple hours of the workshop series, I asked the teachers to share with a partner their elevator speech of the intended student outcomes for their project as a way to be clear with themselves and their students on what the goal for the project is and what the students could expect from it. I encouraged them to consider creative or unique ways to communicate this elevator speech. Each of the teachers shared their goals for the project in a straightforward manner.

As the session came to a close, I asked the teachers to complete two tasks before the time was up. This included taking the last research survey and a final open-ended questionnaire. The questionnaire asked the teachers the following questions:

1. *Describe the project or activity that you created through participation in this professional development experience*
2. *Reflect on how this professional experience impacted your teaching*
3. *How could this experience be improved for future sessions (with a new group of teachers)?*
4. *Describe one new technology tool that you are using because of this training? How has this impacted your practice?*

The teachers continued to finish up the last pieces of their project and completed these last two tasks. I received responses from every teacher in both the questionnaire and survey. We concluded our time together with one last brief discussion. I asked the teachers to share their goals for the upcoming school year. All of the participants mentioned Google Classroom and Drive as part of their goals for the next school year.

APPENDIX E: Rubric for Data Analysis

Level	***Student Choice (Element One)*** Descriptor
1	Teacher does not appear to provide for student choice in what or how they will learn. Teacher does not provide students with time to develop their own learning through the use of technology. Little Emphasis on classroom activities that allow for students to construct their own understanding and may focus on the process of communicating knowledge.
2	Teacher may provide for some student choice in how or what they learn. Teacher may provide students with time to demonstrate their learning through the use of technology. Some emphasis on classroom activities that provide students time to construct their own understanding of content.
3	Teacher provided students with choice on both how and what they will learn. Teacher encourages and facilitates opportunities for students to demonstrate their understanding through the use of technology. Strong emphasis on creating classroom activities that requires students to construct their own understanding of content.
Level	***Classroom Norms to Support Collaboration (Element Two)*** Descriptor
1	Teacher provides limited or superficial time for students to collaboration, there are not specific structures for student collaboration. There are not clear classroom norms for how students interact with each other or the teacher either online or in person. Demonstrates a weak understanding of how to provide for student-to-student interaction, indicates the infrequent use of classroom activities to allow for collaboration.
2	Teacher provides some time for student collaboration and demonstrates some instructional strategies for students to work in groups. There are some classroom norms on what is expected of students during particular group activities and there are some expectations on how students interact with each other, the teacher and online.

	Demonstrates an understanding of how to provide for student-to-student interactions, indicates the occasional use of classroom activities that require collaboration.
3	Teacher effectively promotes student collaboration and provides students with the necessary structure to learn how to work in groups in a productive and positive manner. Collaboration is meaningful and deliberate where students are given roles specific to topic and activity. There are clear classroom norms on how students interact with each other, the teacher, and online as well as clear, effective and appropriate expectations of students during the different classroom activities. Demonstrates a strong, daily emphasis on the importance of creating classroom activities that allow for student-to-student interaction.
Level	***Instructional Procedures and Organization (Element Three)*** Descriptor
1	Demonstrates some organization and evidence of routines and procedures to support and organize student learning; however they are inconsistently used or not clear to students. There is an objective but it may or may not be clear or written in student-friendly language, there is a not a clear hook or introduction into the day's activity. There not clear classroom norms on how the teacher will transition students from one task to another or how the teacher will get students' attention or these strategies may be ineffective.
2	Teacher demonstrates some organization, there is sufficient evidence of routines and procedures to support and organize student learning. There is an objective and a prompt or hook into the day's activity and there is an agenda for the tasks or activities for the day. Teacher demonstrates some ability to transition students from one task to another, redirect during a course of an activity and get students' attention.
3	Teacher demonstrates strong effective classroom organization. There is strong evidence of routines and procedures to consistently support and organize student learning. There is a clear objective for the class and there is a relevant and engaging prompt or hook into the day's activity. Teacher uses consistent and effective techniques to get students' attention, to transition students from one task to another and to redirect during the course of an activity.
Level	***Real Life Connection and Student Personal Experience (Element Four)*** Descriptor
1	Demonstrates limited understanding of how to create learning experiences that are relevant and based in real world context. Teacher may show limited effort at connecting classroom experiences to students' life experiences.

2	Demonstrates some understanding of how to create learning experiences that are relevant and based in real world context. Teacher may connect some of the classroom experiences to students' life experiences.
3	Demonstrates a strong understanding of how to create learning experiences that are relevant and based in real world context. Teacher explicitly and consistently connects the classroom experiences to students' life experiences.
Level	***Student Discourse, Inquiry and Problem Solving (Element Five)*** Descriptor
1	Teacher did the majority of talking during the class period with few opportunities for students to discuss or interact. Teacher asks mainly close-ended questions and students may or may not use technology to answer these questions. There is little evidence of students using critical thinking or problem-solving skills.
2	Teacher provides students with time to discuss and interact during the course of the class period. Teacher uses a mixture of close-ended and open-ended questions and students may have some opportunities to utilize technology to research and inquire into these questions. There is some evidence of students using critical thinking or problem solving skills
3	Teacher provides students with ample opportunity to discuss and interact during the class period. Teacher prompt students with primarily open-ended questions and students utilize technology frequently to research and inquire into these questions. There is strong evidence of students using critical thinking and problem solving skills.
Level	***Technology Use and Management (Element Six)*** Descriptor
1	The teacher does not have a system or it is inefficient in distributing and/or utilizing technology. Does not use a learning management system or website that provides a way for students to use technology to complete classroom assignments or interact with the class online. The teacher did not use technology during the course of the observation and did not indicate a system for technology management in the interview.
2	The teacher has a system and the technology is utilized quickly and efficiently within a few minutes of the need for the use of technology.

	Teacher utilizes some type of learning system or website to provide a way for students to use technology to complete classroom assignments or interact with the class online.
3	The teacher has an effective and efficient system for distributing technology and it requires little or no class time. The integration of technology is seamless Teacher has an effective system for students to interact online, submit assignments
Level	***Technology Integration, Innovation and Risk Taking (Element Seven)*** Descriptor
1	Teacher uses technology as a tool for themselves to deliver content to students or teacher may not use technology. Teacher may display concern about controlling students while online, may express uncertainty or nervousness about the use of technology. Teacher does not take risks in the use of technology, does not attempt to problem solve or use students to problem solve when problems arise. Teacher focuses on providing more procedural or close-ended tasks through technology.
2	Teacher views technology as tool provide students with learning experiences but may still view it as a vehicle for the delivering the content. Teacher may try to problem solve when using technology, may or may not ask students to help problem solve when problems arise. Teacher takes some risks in their use of technology but still expresses need to control and limit. Teacher creates activities online for students and demonstrates some skill in creating learning experiences that integrate technology to allow for student inquiry online.
3	Teacher problem solves when technology is not working properly or the way intended, teacher also relies on knowledgeable students to problem solve when issues arise. Teacher is confident in the use of technology and taking risks by trying new instructional approaches with technology and providing students with time to explore. Teacher demonstrates a strong understanding of the facilitative nature of integrating technology into their practice, skill in creating learning experiences that integrate technology that facilitate and encourage student inquiry online.