Designing for Transfer:

Instructional Design for Active Learning in Online Teacher Professional Development

by

Jeffrey Starr

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Education

Approved November 2021 by the
Graduate Supervisory Committee:

Terri Kurz, Chair
Leigh Wolf
Raja Ridgway

ARIZONA STATE UNIVERSITY

December 2021

ABSTRACT

Teacher professional development (PD) is widely pursued as a critical component of overall school improvement. However, it is frequently ineffective at changing teaching practice or impacting student outcomes. While online PD has the potential to greatly expand access to high-quality PD, questions remain about the extent to which online PD can be effective. This study examined the instructional design of an active learning asynchronous online PD short-course. The innovation sought to apply principles of a practice-based approach to teacher education that was delivered in a format and could be made widely available to teachers. A multistage mixed methods action research design was conducted to examine the effectiveness of the innovation. Participants (n = 8) included elementary and middle school teachers learning to implement a new district-adopted curriculum. Data were collected to specifically consider (a) what aspects of the active learning online PD influenced learner engagement, (b) the extent to which teachers' sense of self-efficacy changed, and (c) the effectiveness of the active learning online PD in supporting teachers' facilitation of the district-adopted curriculum. Primary results indicated the instructional design and facilitation contributed to high levels of sustained learner engagement throughout the PD. The innovation yielded statistically significant changes in teachers' sense of self-efficacy with implementing a district-adopted curriculum and all participants demonstrated an ability to transfer some knowledge and skills from the PD short-course into new classroom practices. Different levels of implementation of new skills were observed relative to participants degree of collective participation. Implications for practice suggest value in using Desimone's (2009) conceptual framework as guide for designing PD to include active learning,

collective participation, sustained duration, a content focus, and coherence with local context. Best practices for the design and facilitation of asynchronous online PD are discussed including learner agency, flexible pacing, frequent practice with authentic tasks, consistent feedback, and a present facilitator. More research is recommended to investigate the positive influence of a facilitator in asynchronous online PD. Additionally, research into the impact of collective participation in asynchronous online PD is recommended, with examination of ways to structure face-to-face collaboration outside of the online learning space.

DEDICATION

I dedicate this work to Siera and River. Your earnest curiosity and unlimited creativity fill me up and provide a constant source of inspiration. To Kaoru for your steady persistence, keeping us all grounded and centered. To my father for your encouragement and enthusiasm. To my mother, your memory forever guiding me to seek truth and justice.

ACKNOWLEDGMENTS

I want to express my deep appreciation to my committee chair, Dr. Terri Kurz for her endless support moving my abstract ideas toward more concrete details and for helping me to stay focused on what really matters. I am grateful to my committee members, Dr. Leigh Wolf, whose mentorship as a faculty member expanded my sense of what is possible in online learning, and to Dr. Raja Ridgway for constantly pushing my thinking outside of the box.

I want to acknowledge the deep partnership with Tim Carey and the collaborative journey from early ideation through the multiple cycles of iteration to bring this content to life. I am also deeply appreciative of my LSC members, who inspired me with their persistence and supported me with their encouragement.

Finally, I am grateful for so many professors who challenged me throughout the program and to my cohort mates and other MLFTC students who provided support in countless ways whenever it was needed and were the source of unexpected inspiration.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

There is little doubt that an effective teacher can have a dramatic and long-lasting impact on student learning (Adnot et al., 2017; Hattie, 2003; McCaffery et al., 2003). Although there is much debate about how to best measure teacher effectiveness, a growing body of research demonstrates the convincing link between quality teaching and student achievement (Araujo et al., 2016; Nye et al., 2004; McCaffery et al., 2003; Rivkin et al., 2005; Rockoff, 2004, Rockoff et al., 2011). The relationship between effective teaching and student outcomes underscores the importance of high-quality teacher preparation, in-service professional development (PD), and the value of systematic improvement (Darling-Hammond, 2016; Darling-Hammond et al., 2005; Powell & Bodur, 2019).

Access to high-quality teaching has significant implications for educational equity in the United States. It is among the numerous interdependent factors that contribute to *the opportunity gap,* which articulates the cumulative impact of systemic inequities experienced by historically underserved communities in this country (Carter & Welner, 2013). What Ladson-Billings (2013) refers to as the *education debt* resulting from, "the long-term failure to produce equitable conditions" (p. 13) is exacerbated by an overrepresentation of underdeveloped teachers in underserved communities who lack high-quality training, experience (Darling-Hammond, 2013; Berry, 2013), and the cultural competence of working with diverse students and communities (Carter, 2013).

Within the current era of reform marked by increasing accountability (Borko, 2004; Fusarelli & Fusarelli, 2015), PD for in-service teachers is widely pursued as a

critical component of overall school improvement. It is also viewed as a valuable lever for responding to the complex demands of learning in the 21st-century among an increasingly diverse student population (Darling-Hammond et al., 2017, Desimone et al., 2005; Hawley & Valli, 1999; Hill, 2007). Since the passage of No Child Left Behind (NCLB) in 2002 and extended by its 2015 successor, Every Student Succeeds Act (ESSA), the United States government has allocated billions of dollars annually to support teacher PD initiatives (Desimone, 2009; Spellings, 2005; Yoon et al., 2007). Jacob and McGovern (2015) found that districts spend, on average, approximately $18,000 per teacher on PD accounting for 6% to 9% of the annual budget. It is common for districts to set annual hourly targets of about 20 hours of PD, frequently tied to state requirements for recertification (Hill, 2007; Jacob & McGovern 2015).

This near-ubiquitous investment in teacher PD is largely premised on theories of change suggesting PD is effective when teachers develop new knowledge and skills that yield improved classroom practice and therefore improved student outcomes (Dede et al., 2009; Fischer et al., 2018; Yoon et al., 2007; Yoon et al., 2020). Yet, the assemblage of what constitutes teacher PD varies widely across different formats, content, learning experiences, and delivery methods (Desimone, 2009). Common formats include courses offered by outside providers, workshops conducted by outside experts or led by colleagues, participation with learning communities, individual coaching or mentoring, among others (Guskey, 2002; Hill, 2007). The content focus and learning experiences within each of these formats can also vary significantly reflecting vastly different instructional philosophies and learner engagement levels. For example, some experiences may be characterized by passively receiving instruction directed toward hundreds of

participants at the same time. In contrast, others may feature opportunities for active learning such as situated role-plays supported by individualized feedback, or collaborative inquiry within small grade-level communities of practice (Kennedy, 2016). Additionally, with the steady increase of online learning, delivery methods now expand into the virtual space, transcending distance and time (Bates et al., 2016; Dede et al., 2009; Fishman et al., 2013).

Despite the massive investment in teacher PD on a national scale, findings from empirical research studying the effectiveness of PD remain mixed (Borko, 2004; Hill et al., 2013). Widespread examples of failed efforts that drain district resources with little evidence of changed classroom practices or improved student outcomes persist (Jacob & McGovern, 2015; Loveless, 2014; Santagata et al., 2011). Yet, researchers who have synthesized empirical studies that can confidently connect PD to changes in teachers' practice and improvements in student learning support an emerging consensus on core features present when PD is effective (Desimone, 2009; Desimone & Garet, 2015). Generally, these core features include: (a) connections to content knowledge; (b) opportunities for active learning, practice, feedback, and reflection; (c) collective participation and collaboration among colleagues; (d) extended durations often spread across several months; and (e) coherence with local curricula and initiatives (Darling-Hammond et al., 2017; Desimone, 2009; Garet et al., 2001; Penuel et al., 2007). Together, these core features of effective PD stand in stark contrast to the one-off workshop model colloquially known as *sit-and-get* or *traditional PD*, characterized by passive participation and disconnected from participants' classroom context (Borko, 2004; Schwartz, 2019).

It is vital for PD providers to understand the evidence-based attributes that contribute to effective PD. It can be argued that these qualities should inform both the design and implementation of PD initiatives to reflect what is known to make PD effective. At the same time, a number of researchers note that these characteristics are highly complex and, in practice, heavily influenced by factors unique to each local context (Borko, 2004; Guskey, 2003; Kennedy, 2016). Guskey (2003), explains:

> Take, for example, professional development specifically designed to enhance teachers' content and pedagogical knowledge. Schools in economically depressed areas that have trouble attracting and keeping well qualified teachers and, as a result, have many teachers teaching subjects outside their area of certification, may benefit greatly from such programs. Schools in more affluent communities, on the other hand, that have sufficient resources to attract and retain well-qualified teachers with advanced training in the subject areas they teach may see little improvement from similar programs. (p. 4)

Guskey's hypothetical thought experiment illustrates that what is found to be effective in one context, may be ineffective in another context. This idea highlights an important methodological implication for measuring PD's effectiveness that suggests the potential value of using both quantitative methods for measuring changes on a large scale and qualitative methods for understanding context-specific nuances (Dede et al., 2009; Guskey, 2016).

From an equity perspective, the quote from Guskey (2003) above also exposes the harsh complexities of the opportunity gap that frame part of the problem of practice this action research examines. The reality is that current approaches to PD fall short of the intended goals for large populations of teachers, suggesting that access to high-quality PD is a persistent challenge. Additionally, ineffective approaches to PD disproportionately threaten communities grappling with systemic barriers to academic

success (Darling-Hammond, 2013). Two beliefs of mine, that all students deserve high-quality teaching and that all teachers deserve access to high-quality opportunities to continually develop, orient the larger problem of practice within a social justice perspective (Mertens, 2015). As such, this action research study explored how to design high-quality PD that is both effective and widely available to schools and teachers. In doing so, it strives to codify design principles for reimagining how PD can be responsive to participants as learners and professionals by incorporating research-informed practices into the design, implementation, and measurement of a flexible, active learning design of online PD that can be made more widely available to all teachers.

Situated Context

Over the past decade, the non-profit graduate school of education where I work as the Senior Director of Instructional Design expanded to 17 cities across the country, serving approximately 1,000 school leaders and 3,000 teachers who, in turn, educate more than 300,000 pre-kindergarten (PK) to 12th grade students. Our teacher education programs are tailored to employees in PK-12 schools so they can work full time while pursuing state certification, a Master of Arts in Teaching degree (MAT), or both. One program within the certification and MAT track is the Teaching Residency, which provides a gradual introduction to teaching through a year-long placement alongside an experienced mentor teacher. Although resident teachers spend their first year in the classroom deliberately developing in a co-teacher position, like all our graduate students pursuing a MAT, they are full-time employees.

Central to our mission is a commitment to challenging the *opportunity gap* where it exists by partnering with schools in traditionally underserved communities to fuel a

pipeline of high-quality teachers committed to their students' social and emotional growth, wellbeing, and academic achievement. Compared to only 18% of teachers nationwide, 60% of graduate students in our teaching education programs self-identify as a person of color, reflecting the racial diversity of many of our school partners. This demographic match between teachers and students is important because it can support cultural responsiveness (Carter, 2013) and positively contribute to student outcomes (Egalite et al., 2015).

My primary role as the Senior Director of Instructional Design is to oversee aspects of the design and continuous improvement of the centrally developed and maintained curriculum for our teacher education programs. An overarching goal is to design a coherent curriculum that is responsive to graduate students' needs recognizing that they are also full-time teachers. Part of this responsiveness is reflected in our pedagogical orientation toward a practice-based approach to teacher education.

Practice-based teacher education emphasizes preparation for the complex and practical demands of classroom teaching through deliberate modeling, analysis, practice, feedback, and supervised applications (Ball & Forzani, 2009; Zeichner, 2012). Ball and Forzani (2009) describe this as the *work of teaching* which includes:

> activities carried on both inside and beyond the classroom, such as leading a discussion of solutions to a mathematics problem, probing students' answers, reviewing material for a science test, listening to and assessing students' oral reading, explaining an interpretation of a poem, talking with parents, evaluating students' papers, planning, and creating and maintaining an orderly and supportive environment for learning. The work of teaching includes broad cultural competence and relational sensitivity, communication skills, and the combination of rigor and imagination fundamental to effective practice. (p. 497)

Internal surveys indicate that graduate students in our teacher education programs respond positively to the curriculum's practice-based aspects. In general, they find most coursework to be immediately relevant to their schools' demands and supportive of their ability to apply learning in their own classrooms.

The ability of graduate students to transfer the knowledge and skills practiced in coursework into their classroom practice is supported by the frequent use of authentic assessments which situate demonstration of learning in real-world tasks (Dick et al., 2015; Fink, 2013; McTighe & Wiggins, 2011; Wiggins, 1998). Most of our courses feature assessments that require graduate students to demonstrate their learning in the context of their own PK-12 classrooms by assembling portfolios of classroom artifacts to include lesson plans, videos of teaching events, evidence of student learning, written analysis, and reflection.

The use of authentic portfolio-based assessments that include classroom teaching videos emphasizes measuring what a teacher does and how those actions impact outcomes related to student learning (Crowe, 2010). The latter component is another defining characteristic of our approach to teacher education. As part of the program, graduate students track and demonstrate academic gains for their students. Among a recent cohort of graduates, 95% of the class met or exceeded their goals for their own students' growth and standards mastery. Experiencing this kind of success is important to teachers' sense of self-efficacy (Yost, 2006). Currently, 90% of alumni say their experience in the teacher education program increased their likelihood of remaining in the classroom.

Problem of Practice

As my institution continues to increase partnerships with schools and districts across multiple cities, we receive frequent requests to provide non-degree bearing PD for teachers. Many partners seek to replicate the successes of our graduate students through meaningful PD. We have experimented with meeting expressed needs by providing PD across a range of offerings from workshops to more intensive multi-session experiences. We also host a few high enrollment, open, online courses available to anyone. While participants tend to report high levels of satisfaction for each of these different approaches, like most PD providers, we face evaluation challenges in in measuring the extent to which these experiences influence changes in classroom practice, or ultimately impact student outcomes (Dede et al., 2009; Guskey & Yoon, 2009). This is one challenge to implementing PD to the same level of effectiveness as our graduate programs. Unlike participants in PD programs, our graduate students pursue professional certifications and advanced degrees, which factor into their motivation. They are surrounded by an entire infrastructure geared toward supporting their progress through a program of rigorous and coherent coursework oriented around deep engagement with educational theory and a close connection to practice. Faculty have the capacity and tools needed to support repeated cycles of authentic assessments requiring our graduate students to provide multiple artifacts from their classrooms, including video, as evidence of their progress toward mastery of standards-aligned teaching competencies.

As we expand non-degree bearing PD offerings for partner schools and districts while remaining aligned to our mission, several problems of practice emerge. Although there are aspects of our practice-based teacher education curriculum that can inform the

design and implementation of PD, doing so is a more complicated and nuanced task than repurposing content from existing coursework. The design of PD can be more explicitly informed by the evidence-based characteristics shown to change teacher's practice and influence student outcomes. It should consider the different incentives teachers have for participating in PD and reimagine flexible ways of motivating learner engagement. It needs to be responsive to the demanding schedules of full-time teachers who must balance engagement as a learner with their multifarious classroom responsibilities. Similarly, it must be responsive to participants' diverse and fluctuating needs as learners while grounding learning within the local context of participants' classrooms. Finally, PD needs to be available to a broad base of teachers, which carries design implications for both the format and delivery mechanism of the PD.

Innovation, Purpose of the Study and Research Questions

In my role, I have led and supported several PD pilots with partner schools and districts. These pilots presented opportunities to experiment with innovations in the format and delivery of PD. The purpose of this action research study was to integrate what we know from research about the qualities of effective PD with the practice-based principles of our pedagogical approach to design and examine the effectiveness of a self-paced active learning model of asynchronous online PD for teachers. Codifying an instructional design model for effective online PD was important because of the potential to make high-quality PD more widely available (Yoon et al., 2020) and to position the institution to broaden its support of schools and teachers in the geographically dispersed regions of operation.

Among the many intentional design features explored in the study, the innovation emphasized flexible pacing and an active learning design to provide participants with multiple opportunities to apply what they learned to authentic tasks that reflected their local context. The instructional design also optimized the technology of the online format to ensure learners received substantive and individualized feedback while engaging with the PD curriculum. A multistage mixed methods action research design (Ivankova, 2015) structured examining the aspects of the active learning model that influenced learner engagement, as well as the effects of the PD on participants' sense of self-efficacy and their ability to transfer skills into classroom practice. The research questions are as follows:

Research Question 1, Instructional Design: What aspects of the active learning online PD influenced learner engagement?

Research Question 2, Self-Efficacy: To what extent did teachers' sense of self-efficacy change when engaging with the active learning online PD?

Research Question 3, Transfer: How effective was the active learning online PD in supporting teachers' facilitation of the district-adopted curriculum?

This research study evolved across multiple recursive cycles of action research (Mertler, 2017). Cycle 0 was conducted in the Spring of 2019. The problem of practice was clarified through data collection and interviews to better understand the role of PD in my local context. Cycle 1 and cycle 2 were conducted in the Fall of 2019 and the Spring of 2020 respectively. Iterative prototypes of the self-paced, active-learning online PD course were developed in partnership with the developer of the district-adopted curriculum. The course content focused on preparing teachers to implement a specific

aspect of that curriculum which spans fourth to twelfth grade. Prototypes of the online PD course were piloted with small groups of participants. Results informed improvements in the design and facilitation of the experience as well as the evolution of the research agenda.

The redesigned course was facilitated in early 2021 over four weeks, examining the overarching concepts of flexibility and practice-based active learning in the context of asynchronous online teacher PD. A mixed methods approach was used to determine the effectiveness of the active learning online PD design by considering learner engagement, changes in participants' beliefs about their ability to implement the district-adopted curriculum, and the extent to which participants incorporated learning from the online PD course into their own classrooms.

CHAPTER 2

THEORETICAL PERSPECTIVES AND RESEARCH GUIDING THE PROJECT

"You can't teach people everything they need to know. The best you can do is position them where they can find what they need to know when they need to know it."
Seymour Papert

This study was guided by research examining what makes teacher PD effective, the processes that promote learning in professional settings, and the affordances and limitations of online teacher PD. Collectively these areas of research informed both the instructional design of the active learning online PD short-course that was the innovation for this action research study, as well as the methodology for evaluating its effectiveness. The first section explicates a conceptual model of effective PD. It explores a theory of change pertaining to teacher PD, addresses implications for evaluating PD, and describes an overview of the characteristics that make PD effective. The second section explores the theories of learning that undergird the core features of effective PD with a focus on learner engagement. The third section considers the benefits and limitations of online learning in the context of teacher PD. Attention is given to aspects of online PD that support the transfer of new knowledge and skills into classroom practice noting the instructional design implications for optimizing professional learning in an online space. The final section demonstrates how the theories from each of the guiding areas of research are represented in the design of the innovation.

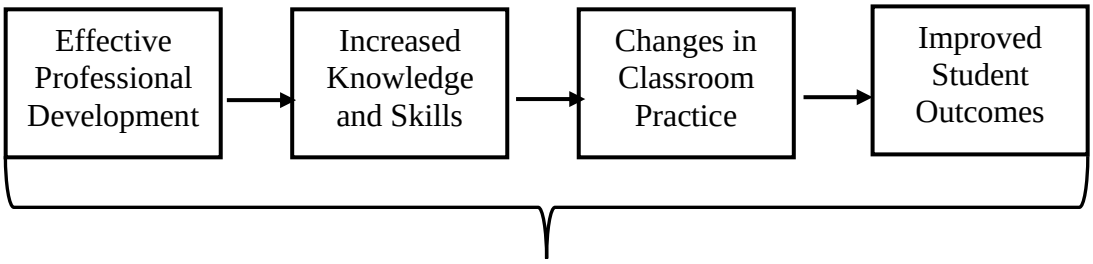
Conceptual Model of Effective Professional Development

Theory of Change. Teacher PD is widely viewed as a necessary component of school improvement plans (Ball & Cohen, 1999; Borko, 2004; Darling-Hammond et al.,

2017). Propelled by the standards-driven reform agendas of the past two decades, national investment in teacher PD exceeds $1 billion annually (Birman et al., 2007; Desimone, 2009; Jacob & McGovern, 2015). Implicit in teacher PD initiatives is a theory of change that begins with the PD experience and potential results that yield improved student outcomes. The diagram in Figure 1 is representative of teacher PD models of change frequently referenced in the literature that explain how effective PD should work (Desimone, 2009; Desimone et al., 2013; Guskey & Sparks, 2002; Yoon et al., 2007).

Figure 1.

Conceptual Change Model for Teacher Professional Development modified from Desimone (2009).



Although seemingly straightforward in its unidirectionality, several complex and interrelated factors are represented. To make the leap from the stimulus of an effective PD experience to improved student outcomes, the theory of change includes two intermediate results: (a) teachers develop new knowledge and skills, and (b) teachers transfer those into their own classroom practice in ways that impact student learning and development. Each of the sequential outcomes are strongly influenced by features of the PD's design and implementation that make it effective. Additionally, each of the outcomes are affected by a range of systemic and contextual factors that influence the

conditions in which both teachers and students learn (Borko, 2004; Desimone & Garet, 2015; Guskey, 2003; Kennedy, 2016).

The instructional design of PD encompasses the format, duration, delivery mechanisms, instructional methods, as well as the content which must hold value for the participating teachers and their students (Dede, 2006; Guskey, 2000). As such, the design of any PD reflects two different theories of learning and development. There is consideration for how adults learn as participants in PD, as well as consideration of the value of the PD's content, specifically the potential for positively impacting student learning (Desimone, 2009; Kennedy, 2016). On one hand, PD designers must select design features that influence how participants engage with and make meaning of the content, develop and retain new knowledge and skills, and devise strategies for applying those skills into their work with students. At the same time, designers must consider the instructional implications of the PD's content. They make assumptions about how the pedagogical aspects represented in the content will improve student learning. Hence, for PD to be effective at changing practice and improving student outcomes, both the instructional design of the PD experience and the content of that experience must be sound.

Beyond the content and instructional design that encompasses what and how participants learn respectively, teachers experience PD within a school context that is shaped by a myriad of factors like the professional culture, the size of the school, and the communities it serves. The context encompasses larger systemic elements influenced by district, state, and federal policies relating to standards, curriculum, and accountability. Additionally, the larger context comprises characteristics of students including their

varied academic, language, social, and emotional strengths and needs (Borko, 2004; Darling-Hammond, 2017; Guskey, 2003). Altogether, these systemic elements affect the conditions with which teachers experience PD and are supported in transferring learning into classroom practice. For example, some of the factors that influence teachers' ability to apply learning from PD to meet the variable needs of students include; the frequency and duration of engaging with PD, alignment between the content and school initiatives like new curricula, and access to structured opportunities outside of PD to collaborate or receive support (Desimone & Garet, 2015; Kennedy, 2016).

The theory of change represented by the conceptual model in Figure 1, therefore, suggests a certain degree of harmony between the PD's design and the local context. To produce the desired outcomes, the PD experience needs to be intentionally orchestrated with both a high-quality design and supportive conditions within the school, working in concert. The conceptual model suggests that the confluence of effective design and supportive conditions empowers teachers to make the pivotal leap from learning new knowledge and skills to applying both in their work with students (Guskey, 2003; Penuel et al., 2007).

Evaluation of PD. Citing numerous experimental studies from the previous two decades, Hill (2007) confidently declared; "professional development can, unequivocally, enhance teaching and learning" (p. 118). Nevertheless, it is a complex and challenging endeavor to determine the extent to which a PD experience is effective (Guskey, 2000; Guskey, 2003; Penuel et al., 2007). Copious measurement challenges arise when trying to link PD to each of the sequential outcomes represented in the conceptual model displayed in Figure 1. On one hand, there is the extremely wide range of formal and informal

learning experiences that constitute PD. The vast differences present particular challenges connecting the effects of the PD to changes in teacher knowledge and classroom practice (Desimone, 2009; Fishman et al., 2013; Hill, 2007; Kennedy, 2016). Additionally, there is the complexity linking student outcomes to teacher behaviors which is confounded by the contextual factors that influence student learning (Borko, 2004; Desimone et al., 2013; Guskey, 2000; McDonald, 2011). Related to the latter challenge, Yoon et al. (2007) noted a "paucity of rigorous studies that directly examine the effect of in-service teacher professional development on student achievement" (p. 6). In a synthesis of over 1,300 studies, the authors identified only nine that met the rigorous standards defined by the U.S. Department of Education's What Works Clearinghouse. This reality has compelled several scholars to advocate for more research that pushes beyond self-reported measures of teachers' satisfaction (Dede, 2006; Desimone, 2009; Desimone et al., 2013; Fishman et al., 2013; Guskey, 2016; Guskey & Yoon, 2009).

Guskey (2002, 2016) presented a model for evaluating PD's effectiveness that progresses across five levels of increasing complexity. He recognized the importance of understanding participants' perceptions as learners, including how they rate the meaningfulness of the content. However, he emphasized increasing value in understanding what participants learn, levels of organizational support, the ability of participants to apply what was learned to their own context, and ultimately how the new practices impact student learning outcomes in both intentional and unintentional ways. Table 1 displays a summary of the five levels of evaluation.

Table 1

Summary of Guskey's (2002, 2016) Five Levels of Professional Development Evaluation

Level	Intended Measures	Common Methods
1. Participants' Reactions	Satisfaction and perceptions of meaningfulness	End of PD survey
2. Participants' Learning	Knowledge and skills gained	Written and/or performance demonstrations of learning
3. Organization Support & Change	Level of organizational support for participation and follow through	District or school records, surveys, interviews with participants and/or administrators
4. Participants' Use of New Knowledge and Skills	Application of intended knowledge and skills to classroom practice	Observation, video, portfolio, surveys, and/or interviews after some amount of lapsed time
5. Student Learning Outcomes	Impact on student learning outcomes, both intended and unintended	Student records, assessments, surveys, and/or interviews

Guskey and Yoon (2009) argued that experimental studies using control groups remain the gold standard for measuring the effects of PD, though quasi-experimental studies without random sampling are still valuable for establishing links between the PD experience and various outcomes presented in the five levels. Guskey (2002) cautioned, however, against aiming to establish causality due to the variation in larger school contexts within which PD is experienced and teaching and learning occur. He explained:

> Even if we agree on the student learning outcomes that we want to achieve, what works best in one context with a particular community of educators and a particular group of students might not work as well in another context with different educators and different students (p. 11).

Guskey's (2002, 2016) framework for evaluating PD closely mirrors the conceptual model for effective PD presented in Figure 1. It urges PD designers to follow

a design process that first conceptualizes the desired student outcomes that should result from the PD experience. From there, it compels designers to plan backwards by identifying acceptable evidence for how participants might use new knowledge and skills in their classrooms as well as how participants might demonstrate the knowledge and skills gained in the PD experience. Finally, it includes ways for understanding the different contextual factors that might impact the effectiveness of PD by focusing on evidence relating to organizational support and change.

Characteristics of Effective PD. Guskey's (2002) evaluation framework provides a roadmap for linking specific outcomes to a PD learning experiences with attention to variation in context. However, Desimone (2009) noted the persistent measurement challenge posed by the vast variation of experiences that constitute PD. Rather than attempting to prove specific types of PD as effective, several researchers sought to identify a set of common characteristics present in high-quality PD that spanned the assorted approaches (Birman et al., 2000; Garet et al., 2001; Desimone et al., 2002; Yoon et al; 2007; Desimone et al; 2005). Desimone's (2009) synthesis of correlational, experimental, and case study research identified an emerging professional consensus of what makes PD effective. The findings named a set of core evidence-based features consistently present in the studies that confidently linked the effects of PD to the progression of changes represented in the conceptual model (Fig. 1) (Darling-Hammond et al., 2017; Desimone & Garet, 2013; Desimone et. al 2013; Powell & Bodur, 2019). A summary of the core characteristics common to effective PD appears in Table 2.

Table 2

Characteristics of Effective PD

Characteristics	Description
Active Learning	Cognitive engagement with the concepts and classroom-based skills (i.e., observation, interactive feedback, and analysis of classroom artifacts)
Collective Participation	Collaborative interactions among groups of teachers with a common relationship to the topics (i.e., school, grade level, or subject)
Sustained Duration	Ongoing and connected opportunities to learn across a school year including the total time and frequency
Content Focus	Explicit connections to subject matter content or how students learn related concepts
Coherence	Connected to school and district policies and initiatives such as standards, implementing curriculum as well as support, such that learning is continuous

As a collective set, the five core features of effective PD reflect a transition toward what some scholars have termed *reform-oriented PD* (Birman et al., 2000; Garet et al., 2001; Penuel et al., 2007). It stands in contrast to what Hill (2007) described as a "hodgepodge of providers, formats, philosophies and content" (p. 114) characterized by a mostly passive learning workshop model with few opportunities to extend learning that pervades much of the ineffective experiences (Fishman et al, 2013; Joyce & Showers, 2002). Integrating the five core characteristics, on the other hand, conjures an ongoing series of connected, content-rich PD experiences, often with job embedded components, that are supported by school leaders and aligned to local priorities.

It must be noted, however, that incorporating some, or all, of the core features, does not guarantee positive outcomes (Hill et al., 2013; Kennedy, 2016). In a review of

28 rigorously selected studies, Kennedy (2016) argued that program features alone are unreliable predictors of success. Contextual factors such as the qualities of collective participation in professional learning communities or the PD facilitators' depth of experiences working with teachers exert nuanced influences on results. Still, researchers in the past decade continue to affirm the consistent representation of the five core features among high-quality PD experiences. For example, Darling-Hammond et al. (2017) reviewed 35 studies that met a high standard for connecting PD to changes in teacher practice and impact on student learning. All the studies used either experimental or quasi-experimental comparison group designs or employed statistics to control for variables relating to context like student characteristics. Findings confirmed the presence of most or all of the five core features in all 35 studies. The researchers identified modeling, reflection, and feedback as additional features representative of high-quality PD.

In a longitudinal study examining data sets from over 7,000 teachers and 130,000 students, Fischer et al. (2018) sought to validate aspects of the conceptual model that connect effectiveness to changes in knowledge and skills, changes in classroom practice, and improvements in student outcomes. Findings revealed a strong connection between participation in PD and changes in teachers' knowledge and classroom practice. However, only tenuous connections were made to improvements in student outcomes. Researchers noted that contextual factors such as prior teaching experience or the affluence of the district may exert external influences on student learning. These findings demonstrate the persistent methodological challenges with linking the effects of PD to improved student results. They also highlight the complex reality that the effectiveness of PD hinges on both the quality of the teaching and learning experience for participants and

the value of the pedagogical implications of its content. Still, it can be argued that the theory of change represented by the conceptual model of effective PD in Figure 1 is strengthened by incorporating the core features consistently proven to be associated with PD when it is effective at changing teachers' practice and improving student outcomes (Desimone, 2009). By doing so, the conceptual model offers PD providers a flexible framework for approaching instructional design in a way that can be applied to a range of PD formats. Furthermore, it supports infusing best practices that can be applied to both the design and facilitation of PD experiences (Desimone & Garet, 2015).

Designing for Learning in Professional Development

PD designers must consider what makes a learning experience relevant and meaningful to participants, when and where learning will happen, the processes for how learning occurs, and ultimately how learning will be evaluated. Ingvarsen et al. (2005) noted that some aspects of a PD's design are influenced by structural elements whereas others represent opportunities to learn. Some of the core features of effective PD (Table 2) like sustained duration and aspects of collective participation reflect structural elements which are determined in part by school leaders who allot a total number of hours within a specified time span and who manage methods for assigning participation. Structural features also influence coherence, or the alignment to local initiatives which contribute to making learning relevant and meaningful to participants.

According to Ingvarsen et al.'s (2005) model, other design elements represent opportunities to learn. These include a content focus, which relates to what will be learned in the PD, as well as active learning and the collaborative aspects of collective participation which more directly describe how participants will learn. Some PD

designers may have opportunities to explicitly consider coherence to local initiatives or the extent to which participants will share common relationships, depending on their affiliation with the school or district where the PD occurs. However, all PD designers must consider how learning occurs, and therefore should ground design in sound learning theory. As this study focused on the levers that influence how participants learn in PD, this section explicates the underlying learning theories for active learning, its relationship to collective participation, and the ways learning might be influenced by the duration of teacher PD.

Active Learning Theory. The concept of active learning emerged in educational research from the need to concretize instructional techniques that reflected research from learning science and educational philosophy about the ways learners make meaning of new content (Bonwell & Eison, 1991; King, 1993). Reacting to the long-standing tradition of lecturing as the dominant method of instructional delivery in higher education, Bonwell and Eison (1991) described *active learning* instructional strategies as those that require students to do more than listen by cognitively engaging with activities that demand higher-order and metacognitive thinking. According to Bloom's (1956) taxonomy of cognitive development, these higher order thinking skills include analysis, synthesis, and evaluation. Advocates of active learning claim that when tasked with connecting abstract concepts to real-world applications, learners are more capable of transferring new knowledge beyond the classroom into novel situations (Allen & Tanner, 2005; National Research Council, 2012).

Active Learning, therefore, results from instructional techniques designed to stimulate and sustain high levels of cognitive engagement and development. As such, it is

a concept connected to the constructivist paradigm whose theorists posit that new knowledge and skills are developed through cognitive processes mediated by social interactions in which learners actively build on existing knowledge to construct new meaning (Ackerman, 2001; Jonassen, 1991; Schallert, 2003; Vygotsky, 1978). Principles of modern learning science affirm that learners actively organize knowledge into evolving conceptual frameworks when engaging with intentionally scaffolded instruction that balances direct teaching with learner-centered inquiry and problem solving (NRC, 2000).

Learning is effective when the tasks with which learners engage are just beyond the edge of what they can accomplish on their own without being too challenging to frustrate effort. This is the premise of the zone of proximal development (ZPD) defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). The interactions learners negotiate with others in the learning environment are a critical aspect of cognition and therefore amplify the effects of socio-cultural factors. In this regard, designing for active learning techniques requires consideration of more than just the cognitive demand of learning tasks. Designers must also plan for collaboration among learners that takes into account the reality that "learning emerges from the social, cultural and political spaces in which it takes place, and through the interactions and relationships that occur among learners and teachers" (Nieto, 1999, p. 2).

Active Learning and Collective Participation. Designing active learning methods into teacher PD is vital for moving beyond the traditional workshop model

where an expert presents new information to a largely passive crowd of participants. Elements of active learning in PD can include responding to questions that check for understanding, performing tasks that prompt applications such as evaluating student work, or engaging in metacognitive tasks like reflection or self-assessment (Archibald et al., 2011; Ingvarsen et al., 2005). Another constructive way to engage participants in active learning is to incorporate opportunities to practice applying new skills. Participants can engage in deliberate practice through simulations as well as with job-embedded tasks (Deans for Impact, 2016; Kavanaugh et al., 2020). Clear modeling of new skills, feedback from experts, and opportunities for personal reflection can all strengthen the effectiveness of deliberate practice as an active learning technique in PD (Bambrick-Santoyo, 2018; Darling-Hammond et al., 2017).

Because learning involves active cognitive engagement and is mediated through rich social interactions, the core features of active learning and the collaboration aspect of collective participation are often conceived as working in tandem in teacher PD. Indeed, some designers accomplish active learning through intentionally designed collaboration among participants (Greenleaf, 2011). Darling-Hammond et al. (2017) found that among the 34 studies in their review that featured active learning, 32 included some form of collaboration among participants. Collaborative structures in PD span a range of approaches from one-to-one mentoring with a coach, to more structured group discussions or simulated group practice protocols (Bambrick-Santoyo, 2018; Darling-Hammond et al., 2017). Collective participation might also be accomplished in professional learning communities, where teams of colleagues engage in protracted

collaborative learning oriented around common goals and shared practices for measured improvement (Hord & Sommers, 2008).

Sustained Duration. In addition to actively and collaboratively engaging in the learning experience, teachers need enough time to sufficiently develop the knowledge and skills to the point where changes in classroom practice can occur. No clear consensus on a minimum number of contact hours has emerged in the literature. However, as estimates vary from about 15 hours to 50 hours, significantly more time than a one-off workshop is needed (Desimone et al., 2013; Guskey & Yoon, 2009; Parsons et al., 2019). Different examples of effective PD have ranged from intensive experiences spanning a few weeks to extended learning that stretches across multiple school years (Darling-Hammond et al., 2017). The implication for PD designers necessitates the need to not only plan for the significant amount of time needed for transferable changes to occur, but to also consider how to sustain cognitively engaging active and collaborative learning throughout. As Guskey & Yoon (2009) attest, "effective professional development requires considerable time, and that time must be well organized, carefully structured, purposefully directed, and focused on content or pedagogy or both" (p.497). Therefore, PD designers must consider how to sequence a variety of experiences capable of sustaining learner engagement in ways that continually reinforce and extend learning across time (Sample McMeeking et al., 2012).

Online Professional Development

The National Education Technology Plan released by the United States Education Department in 2010 accented a decades-long trend to wire the nation's schools with information and communication technologies (U.S. Department of Education, 2010;

Cuban, 2001). Among the advancements touted in its 2017 updated report were the dramatic gains toward equipping all schools with high-speed connectivity (U.S. Department of Education, 2017). In the current technological landscape of American schools where teaching and learning have become increasingly intertwined with digital tools, the global educational technology marketplace has ballooned to a multibillion-dollar industry (Shulman, 2018). The rapid expansion of educational technology includes tools marketed to adult learners for whom the need to continually develop professional skills is paramount (Curran et al., 2019; Lench et al.,2015). As such, online modes for teacher PD have proliferated over the past decade (Bates et al., 2016; Dede, 2019; Fishman et al., 2013; Reeves & Pedulla, 2013). While there are numerous benefits to online learning that PD providers can leverage to incorporate evidence-based features that contribute to making PD effective, there remain calls for further research into understanding the effectiveness of online PD (Dede, 2006; O'Dwyer et al., 2010; Parsons et al., 2019). This section provides an overview of online PD with a focus on studies examining effectiveness in relation to the conceptual model in Figure 1 discussed above. It explores some of the benefits and limitations to online teacher PD and closes with design considerations.

Learning Settings for Online Teacher PD. Adults turn to online learning for a vast range of professional learning needs. Unstructured activities include searching informational websites, browsing instructional videos, or engaging in wikis to name a few (Little & Housand, 2011). There are also myriad options for participating in more formal learning experiences like massive open online courses (MOOCs), or for engaging

in formal and informal learning communities mediated through applications or social media platforms (Parsons et al., 2019).

Given the plethora of formal and informal teacher PD experiences, it is not surprising to find a similarly wide range of experiences where teachers engage with PD in an online format (Fishman et al., 2013; Elliot, 2017; Powell & Bodur, 2019). Online PD is delivered in three primary ways: synchronously, asynchronously, or in a blended setting. Synchronous online learning occurs at a set time and is typically an experience that is facilitated by an instructor who manages real time interactions and controls the pace. Asynchronous experiences, on the other hand, are designed to provide learners with more autonomy to choose when and at what pace to engage with the activities. However, there is wide variety in asynchronous learning based on the presence or absence of a facilitator, whether the experience is on-demand or accessed at set start and stop dates, and the degree to which learning is collaborative versus independent. Blended learning experiences, also known as hybrid learning, combine synchronous and asynchronous activities with both modalities occurring at different times (Elliot, 2017; Kleiman, 2004). Traditionally, blended learning models leverage in-person physical spaces for synchronous activities and use online instructional technologies for asynchronous learning (Horn & Staker, 2014). However, there has been a recent increase in blending online synchronous instruction with online asynchronous learning (Arnett, 2020).

Different modes of online instructional delivery lend themselves to synchronous or asynchronous experiences. Little and Housan (2011) described a framework consisting of five common modes of online PD that span synchronous and asynchronous learning settings (see Table 3). Increasingly, multiple modes have been integrated into entirely

synchronous or asynchronous settings, as well as with blended learning approaches to teacher PD (Elliot, 2017).

Table 3

Common Modes of Online Teacher PD

Mode	Learning Setting	Example
Accessible websites / online resources	Asynchronous	Text / Video
Presentations to an audience in real time	Synchronous	Webinar
Discussion Forum	Asynchronous	Threaded text or video based
Video conferencing in real time	Synchronous	Video platform
Ongoing community	Asynchronous	Wikis

Integrating Modes for Online PD. Fishman et al. (2013) urged online PD designers to avoid merely attempting to replicate in-person PD experiences into online environments. Integrating multiple modes helps designers to engineer experiences that can take advantage of multiple modalities to produce unique learning experiences. For example, synchronous online instruction can combine real time video conferencing with shared electronic documents, quizzes, polls, and embedded websites or videos for independent or small group exploration (Francescucci & Rohani, 2019). The combination of these different digital tools increases the variety of real time interactions and provides multiple means for engaging with content, receiving feedback, and collaborating with peers (Martin et al., 2012). Similarly, online learning designers can engineer sophisticated asynchronous learning experiences not easily achieved in the traditional,

face-to-face in-person modality. This can be accomplished using multimedia to present content and by leveraging the technology to foster multidimensional interactions among learners, instructors, and the content (Crisan, 2018; Dede et al., 2018; Riggs & Linder, 2016).

Effectiveness of Online PD. Like the trends among teacher PD broadly, researchers have noted the general paucity of rigorous studies measuring the impact of online PD. (Dash et al., 2012; Dede et al., 2009; Reeves & Pedulla, 2013; Shaha & Ellsworth, 2013). As online PD continues to grow in popularity, however, more researchers have used rigorous methods for measuring the effects of online PD on changes in knowledge and skills, changes in classroom practice, and the impact on student learning outcomes (Shaha et al., 2015; Yoon et al., 2020). Themes among the literature that are most relevant to this study include: (a) the impact of online PD (Dash et al., 2012; Reeves & Pedulla, 2013; Shaha et al., 2016), (b) comparison of effects between online PD and traditional face-to-face delivery methods (Fishman et al., 2013; Russell et al., 2009a; Yoon et al., 2020), and (c) teachers' perceptions of online PD (Parsons et al., 2019; Powell & Bodur, 2019). An additional consideration within each of these themes is understanding the design features of effective online PD and the extent to which they align with the core features that contribute to making PD effective on a broader level.

Trends among the results from empirical studies indicate the promising potential of fully online PD to positively impact development of teachers' knowledge and skills and changes in classroom practice (Dash et al., 2012; Dede, 2006; Dede et al., 2016; O'Dwyer et al., 2010; Shaha et al., 2015; Yoon et al., 2020). In one representative study, Dash et al. (2012) examined the effects of 79 middle school mathematics teachers who

participated in approximately 70 hours of asynchronous online PD over the span of three semesters. In addition to the content focus and sustained duration of the PD experience, the design featured a learning community model which prompted active learning through collaborative participation with discussion threads and resource sharing. Findings revealed significant improvements among participants in the experimental group in both pedagogical knowledge and pedagogical classroom practices.

Notable among online PD research, however, has been the persistent measurement challenge of connecting the effects of the PD experience to improvements in student outcomes (Dash et al., 2012; Dede et al., 2009). While Dash et al. (2012) noted only tenuous connections to student learning, other studies have been able to demonstrate significant improvements in student achievement relative to teachers' participation with online PD. In their quasi-experimental research, Shaha et al., (2015) examined an asynchronous online PD model that focused less on collective participation in favor of active learning within the context of a self-paced on-demand approach. The model provided teachers with anytime, anywhere access to the PD resources allowing teachers to engage with just-in-time learning based on perceived need and relevance. In a related study, Shaha & Ellsworth (2013) found that teachers' levels of engagement with on-demand online PD positively correlated with student achievement outcomes. The positive relationship between a teachers' engagement with PD and student outcomes suggests the value of incorporating active learning in the design of online PD to encourage high levels of learner engagement.

A number of randomized controlled studies have shown that not only can online PD be effective, but that it can produce results that are consistent with comparable face-

to-face PD. (Fishman et al., 2013; Kissau & Algozzine, 2015; Russell, Carey, et al., 2009; Yoon et al., 2020). Responding to concerns that teachers might lose opportunities for rich collaboration and meaning making when engaging with fully online, asynchronous PD, Fishman et al. (2013) compared the effects between the two formats of comparable PD focused on training teachers to adopt a new curriculum. In one group, 24 teachers participated in a face-to-face workshop totaling 48 instructional hours spread across 6 days before the start of the school year. In the other group, 25 teachers participated in self-paced asynchronous short courses after the school year had begun. In both cases, growth in teacher self-efficacy, classroom practice, and student outcomes were observed with no significant differences between the two delivery methods. Researchers hypothesized that the affordances of the online format, which included greater flexibility in pacing and closer proximity to implementation, balanced some of the limitations such as fewer opportunities for collegiality and discussion among peers. In the self-paced online PD short course, the duration of time varied by individual. The researchers viewed this flexibility in the duration as valuable because it reflected agency among participants who adjusted the pace according to their own learning needs (Fishman et al.,2013).

Benefits and Limitations of Online Professional Development.

The research on online teacher PD demonstrates that some models can effectively develop teachers' knowledge and skills, drive changes in classroom practice, and influence student learning outcomes. Research also reinforces the value of incorporating the core features that contribute to making PD effective into the design of online PD (Elliot, 2017). While some studies have shown that online PD can be just as effective as in-person PD, there are distinct benefits and limitations to the online format that are

informed by both teacher perceptions and the broader impact of the PD experience. This section will look specifically at the benefits and limitations of asynchronous online PD settings which relates directly to the innovation under study in this action research. Design implications are considered.

Benefits of Online PD. One of the primary benefits of asynchronous online PD is that it can offer teachers greater flexibility with deciding when, where, and at what pace they engage with professional learning (Dash et al; 2012; Dede, 2006; Reeves & Pedulla, 2013; Yoon et al., 2020). The heightened degree of learner agency is valuable to teachers as they negotiate a myriad of personal and professional responsibilities. More than just a matter of convenience, however, the increased learner agency afforded to participants of online PD can positively influence the learning process (Luo et al., 2019; Reeve & Tseng, 2011).

Quality asynchronous design fosters self-directed learning which is a central component of Knowles' (1984) theory of adult learning, andragogy. Self-directed learning implies a degree of learner autonomy with diagnosing individual needs, determining individual goals, and pursuing the resources and strategies to meet those goals (Knowles, 1975). Online learning platforms support flexible pathways and access to frequent individualized feedback, often in real time, that can empower learners to make strategic decisions over the pace and direction of learning (Horn & Staker, 2014; Dede et al., 2018). Indeed, in a survey of over 300 teachers across 27 states, Parsons et al. (2019) found that being able to work at their own pace was perceived as the most beneficial aspect of online PD. Additionally, the autonomy afforded by quality asynchronous learning design is linked to increases in learner's intrinsic motivation (Hsu

et al., 2019), which can increase learner engagement and improve learning outcomes (Deci & Ryan, 2008).

Closely related to the flexibility of path, place and pace is the on-demand aspect of some asynchronous online PD which can provide access to resources and learning experiences when teachers perceive them as being most useful to their own professional trajectory (Duffy et al., 2006; Parsons et al., 2019; Russell, Carey, et al., 2009). As Fishman et al. (2013) observed, compared to a weeklong workshop held over the summer, the online PD version of comparable training narrowed the proximity between learning and practice. This gave teachers an opportunity to immediately apply what they were learning to their work in the classroom. Additionally, the value of just-in-time-learning was reinforced by the on-demand aspect of the online PD that Shaha et al. (2015) found to be effective. In that study, teachers were able to curate their own PD experiences by choosing the content perceived to be most useful at a specific time relative to identified areas of personal growth.

A different way that the flexibility afforded by quality asynchronous design can support learning is by increasing responsiveness to individual needs. One approach is to apply principles of Universal Design for Learning (UDL) to online spaces which are intended to remove barriers to learner engagement and can improve retention (Tobin, 2014). Designers can foster multiple means of content representation and learning engagement by leveraging a variety of multimedia resources and other tools like screen readers to increase accessibility (Rogers-Shaw et al., 2018). Additionally, online learning can offer flexibility in how learning is assessed and how learners access feedback, often in real time. Consistent and timely feedback is a key lever for sustaining learner

engagement (Chakraborty & Muyia, 2014). A high degree of interactivity coupled with frequent feedback can simulate practice of transferable skills and support decision making.

Finally, perhaps the most significant benefit of online PD is the potential to address issues of equity related to teaching quality by broadening access to effective PD among schools or districts that experience geographical, logistical, or fiscal constraints for attaining high-quality in-person PD (Dede et al., 2009; Powell & Bodur, 2019; Reeves & Pedulla, 2013; Yoon et al., 2020). More affordable PD offerings that can offer access to high-quality resources and facilitation are needed in resource constrained schools and districts. Asynchronous online PD, in particular, offers ways to standardize the quality of the learning experiences across different settings, thereby supporting a more scalable and cost-effective model (Powell & Bodur, 2019; Shaha & Ellsworth, 2013).

Limitations of Online PD. Despite the potential benefits afforded by quality asynchronous design, research reveals several limitations that can present barriers to learner engagement for which PD providers should be mindful of in their design. One important consideration is that an individual's technical skills and proficiency in navigating virtual learning spaces can impact outcomes (Reeves & Pedulla, 2013; Tallent-Runnels et al., 2006). Online PD designers, therefore, should pay close attention to the user experience by: (a) creating a consistent and predictable structure to learning that is easy to navigate, (b) clearly communicating learning goals as well as expectations for how to successfully meet those goals, (c) providing learners with access to prompt and supportive feedback, and (d) directing learners to tools that provide immediate technical support when needed.

Another potential barrier to learning is the ability of participants to sustain learner engagement for the entirety of the course. Some factors contributing to high attrition rates with MOOCs, for example, are a lack of interactivity in the course, learners feeling disconnected from others, and a general loss of motivation (Khalil & Ebner, 2014). Some of these factors might be attributed to an insufficient reward for participation. Others suggest flaws in learning design such as an inability to effectively communicate feedback to participants about how they are developing relative to course goals, or ineffective means for activating social elements of learning.

Design Considerations. The Community of Inquiry (CoI) model for online learning provides online PD designers a conceptual model grounded in constructivist learning theory to guide design decisions for addressing interactivity and social aspects of learning (Swan, Garrison, & Richards, 2009). The CoI model posits that online learning is optimized at the intersection of three interrelated spheres: (a) the cognitive presence which relates to learning tasks, (b) the social presence which relates to interactions among learners, and (c) the teaching presence which relates to interactions between learners and the instructors (Garrison & Arbaugh, 2007). In the context of asynchronous online PD, balance among the three presences can be accomplished in numerous ways. For example, facilitators can consistently communicate how to engage with learning tasks in addition to providing individual and group feedback at consistent intervals (Anderson et al., 2001). Also, learning experiences should be designed to provide an appropriate degree of challenge and coherence relative to course learning goals while encouraging rich collaborative interactions among cohorts of participants (Powell & Bodur, 2019; Russell et al., 2009).

Some asynchronous learning experiences that aim to maximize flexibility in favor of self-paced learning experiences tend to reduce emphasis on the teaching and social presences (Duffy et al., 2006; Russell, Kleiman, et al., 2009). While much research has shown the potential of online PD to support asynchronous collaboration and professional learning communities (Dede, 2006; Sun & Chen, 2016) others have indicated there may be less of a need. Among the teachers surveyed by Parsons et al. (2019), collaboration with other teachers was cited as the least popular reason for participating in online PD. Similarly, Russell, Kleiman, et al. (2009) explored the effects of a strong facilitator presence in self-paced online PD short courses. In a side-by-side comparison of near identical courses ranging from a high amount of support and facilitated by an instructor to entirely self-paced by learners, the researchers were surprised to find no significant difference in outcomes among participants. Although more research is needed, there is some indication that a well-designed, self-paced asynchronous learning experience that emphasizes the cognitive presence may be able to achieve sufficient interactivity (Curran et al., 2019; Russel, Kleiman, et al., 2009)

One way to mitigate some of the potential barriers to fully asynchronous online PD is to integrate it with some in-person or synchronous sessions. A blended approach, which combines both asynchronous and synchronous learning can offer a more intentional way for activating the teaching and social presences while maintaining the benefits of increased flexibility (Belland et al., 2015). In the most comprehensive meta-analysis of the effects of blended learning approaches, the U.S. Department of Education found that high quality blended experiences are more successful than either fully online or fully in-person experiences on their own (Means, et. al, 2009). Yurtseven Avci et al.

(2020), presented a compelling argument for applying a blended model for developing teachers' skills with integrating technology indicating how a blended approach can effectively maximize the benefits of both modalities to ensure consistent application of the five core features of effective PD.

Implications for the Study based on the Literature

Three primary themes of literature were explored in this chapter: a conceptual model for effective teacher PD, theories informing learning design for PD, and the benefits and limitations of online PD. Each informs different aspects of this action research study. These aspects include the instructional design of the innovation, the instructional methods used in its facilitation, and the methodology employed to examine its effectiveness.

The innovation for this action research study was a facilitated, self-paced, asynchronous online PD short-course that intentionally incorporated the five core features of effective PD (Desimone, 2009; Garet & Desimone, 2015) into its learning design and facilitation. The innovation rejected the traditional PD model characterized by passive, one-off workshops. Instead, it was situated as one part of a larger suite of PD experiences offered to teachers learning to implement a district adopted curriculum. In this regard, the innovation accomplished coherence with local initiatives, maintained a content focus, and supported the sustained duration of time needed for teachers to sufficiently develop transferable skills (Darling-Hammond et al., 2017; Yoon et al., 2007).

Moreover, the innovation emphasized an active learning design that included the collaborative learning aspects of collective participation. The instructional design of the innovation was grounded in a constructivist paradigm premised on a learning process that

involved active intrapersonal cognition as well as interactive interpersonal communication (Schallert, 2003). It prompted learners to negotiate meaning through interacting with objects of learning and through social interactions (Koro-Ljungberg et al., 2009). By doing so, the active learning design sought to sustain learner engagement for the duration of the PD experience. The meaning-making process was recognized as deeply personal; reflecting an individual's understanding of self in relation to their environment and mediated through both cognitive and cultural influences (Ackerman, 2001; Costantino, 2012).

The innovation leveraged the benefits of online learning to structure an active learning experience that is flexible and responsive. Instructional technologies were used to create a dynamic environment to empower learners with increased agency and autonomy (Luo et al., 2019). The digital environment was engineered to present learners with multiple means of accessing and interacting with the content in flexible ways to appeal to the range of learning needs and preferences (Meyer, Rose, & Gordon, 2014). Additionally, the ability of computer software to efficiently collect and organize large data sets was optimized to improve the speed and accuracy with which learners receive substantive individualized feedback, thereby increasing the overall flexibility and responsiveness to learning needs (Chakraborty & Muyia, 2014; Spector, 2014).

At the same time, the design of the innovation considered the varied limitations of online learning. It remains weary of what Papert (1987) referred to as *technocentric* thinking, a mindset that is overly preoccupied with what the technology can do rather than how it fits into and influences the larger culture of teaching and learning. Papert explains:

> The context for human development is always a culture, never an isolated technology. In the presence of computers, cultures might change and with them people's ways of learning and thinking. But if you want to understand (or influence) the change, you have to center your attention on the culture not the computer. (p. 23)

From this perspective, the innovation drew from the CoI model for online learning to strive for balance among the cognitive presence, teaching presence, and social presence (Garrison & Arbaugh, 2007). While self-paced, the innovation was not intended to be on-demand. This means the innovation had a start and end time within which learners exercised agency over the path and pace of learning. Doing so supported collective participation because learners who shared a context could engage with the innovation during the same time interval. It also helped to establish a social presence which supported meaning-making among learners (Swan et al., 2009). Furthermore, the innovation was designed to be facilitated to maintain a teaching presence by supporting learners as they navigate the digital space by providing expert individualized feedback throughout (Reeves & Chiang, 2019). Finally, cognitive presence was emphasized by posing questions for inquiry that guided participants to make connections between the content and their local context.

CHAPTER 3

METHODOLOGY

The purpose of this action research study was to examine the effectiveness of an active learning design for an online professional development (PD) short-course. The research questions specifically investigated (1) how aspects of the instructional design influenced learner engagement, (2) to what extent changes in self-efficacy occurred, and (3) how participants were able to transfer what they learned in support of implementing the district-adopted curriculum. This chapter describes the overarching research design and introduces the setting and the context in which participants engaged with the PD. The various aspects of the instructional design under inspection are explained including the methodology for data collection and analysis used to address the research questions.

Mixed-Methods Action Research

My positionality in this action research study encompassed three different roles: the instructional designer, the primary instructor and facilitator of the online PD short-course, and the researcher responsible for data collection and analysis. Each of these roles was influenced by my epistemological stance about education broadly, and about teaching and learning specifically.

As a practitioner-researcher acutely concerned with understanding what works, I am closely oriented to a pragmatic paradigm (Creswell & Creswell, 2017). Pragmatism "offers a practical and outcome-oriented method of inquiry that is based on action and leads, iteratively, to further action and the elimination of doubt" (Johnson & Onwuegbuzie 2004, p. 17). A pragmatic orientation provided a rationale for employing an action research methodology to this study. Action research is an applied approach to

problem-solving that spans different disciplines, is used for different purposes, and can reflect a range of different philosophies (Herr & Anderson, 2005). Commonalities among action research designs are grounded in the active role of the researcher and the iterative cycles of learning, experimentation, data collection/analysis, and reflection (Dick, 2014; Ivankova, 2015; Mertler, 2017).

My epistemological orientation toward constructivism aligns with the qualitative methods employed in this study (Costantino, 2012). Understanding learners' perceptions of the PD experience is vital for making sense of how the design influences learner engagement (Mandernach, 2015). Furthermore, the transfer of skills learned in PD to classroom practice is highly contextualized (Guskey, 2000; Kennedy, 2016). Measuring transfer involves gaining insights into the broader socio-cultural learning environment where learning occurs as a function of teacher-student, student-teacher, and student-student interactions (Guskey, 2002). Therefore, qualitative data collection and analysis is an essential methodology for extrapolating the nuance of a teachers' sense of their own development of knowledge and skills, as well as the context within which specific practices are, or are not, executed (Denzin & Lincoln, 2018).

I also believe that PD designed for teachers should aspire to change instructional practices with the purpose of improving student outcomes (Guskey, 2000). Therefore, quantitative methods are relevant for efficiently measuring the extent to which change occurs (Gelo et al. 2008) in relation to the PD experience. Consequently, a mixed methods approach, which includes both quantitative and qualitative methods, reflects the pragmatism of action research (Ivankova, 2015) and best supported unraveling the research questions of this study. In the context of examining the effectiveness of online

PD, qualitative methods revealed insights into the phenomena of learning from the participants' perspective and quantitative methods identified the significance of change resulting from participation. Triangulation was used to combine the results from both data sources to reach more nuanced and thorough insights into each research question and of their interdependencies (Creswell & Creswell, 2017; Mertler, 2017).

Setting and Context

The setting of this action research study spanned both physical and virtual spaces. The physical setting comprised a medium-sized public school district located in the Southwestern United States where participants taught elementary or middle school. They were part of schools or grade-level teams that adopted the Summit Learning program, a project-based learning curriculum with an integrated social-emotional learning component and a multifaceted student- and teacher-facing online platform (Daro, Diekmann, Martin, Renner, Schultz, & Wei, 2015). The virtual setting consisted of the online space where the active learning online PD short-course was facilitated. This was where participants engaged in learning experiences supportive of implementing Summit Learning.

The vision of the Summit Learning program is to shift schooling from a traditional one-size-fits-all approach toward a more student-centered and personalized model for teaching and learning (Jacobs, 2017). The Summit Learning model aims to holistically foster the development of content knowledge as well as a complex set of transferable cognitive skills, mindsets, and behaviors related to 21st-century skills like communication, collaboration, and problem-solving (Wilka & Cohen, 2014). Specifically, implementing the Summit Learning curriculum requires educators to

develop skills in four broad areas: (a) empowering students with more agency over the direction of their learning; (b) explicitly mentoring students in the development of social and emotional habits that contribute to lifelong learning; (c) facilitating creative and collaborative project-based learning; and (d) ensuring mastery of standards-aligned content knowledge.

Educators who are new adopters of the model face a number of implementation challenges. Not only do they need to become proficient with the technical aspects of the learning platform, but they must also internalize the content of the new curriculum. The pedagogical approaches related to project-based learning, social-emotional development, self-directed learning, and integrating technology can also be challenging to new adopters because they may prioritize student outcomes that often differ from their previous classroom experiences (Bingham et al., 2018).

Because of the challenges, careful consideration must be taken to support the development of the knowledge, skills, and mindsets needed to effectively implement the Summit Learning model. The developers of the Summit Learning program offer a multifaceted approach to professional learning that includes in-person workshops, classroom-based coaching, and access to a range of online resources. Altogether, the content aims to address the challenges new adopters face by offering a comprehensive PD program to assure the successful implementation of the curriculum. To broaden the breadth of their online resources and overall effectiveness of their multifaceted approach, the professional learning team partnered with my institution to experiment with ways of applying practice-based teacher PD to asynchronous online learning. The result was the

design of the active learning online PD short-course, which is the innovation for this study.

The typical challenges that participants face in learning to implement the Summit Learning program were exacerbated by the widespread calamitous effects of the global pandemic that presented a significant backdrop against which this study occurred. Across the country, the normal processes for teaching and learning were upended. In many cities, schools shifted entirely to ad hoc distance learning models while others negotiated mixed offerings where some students attended in-person classes while others engaged remotely. The added complexity of incorporating distance learning along with the emotional stress caused by the grim effects of the pandemic's social, political, and economic upheaval created unprecedented conditions for teaching and learning experienced by both teachers and students. These unusual and extreme circumstances underscored the context within which this research was conducted and accelerated the need to develop online PD models that could effectively prepare teachers with transferable classroom skills.

Participants

A non-probability convenience sampling approach (McHugh, 2013) was used to recruit eight upper-elementary and middle school teachers who participated in the study. The self-paced online PD short-course was offered to approximately 300 teachers implementing the Summit Learning program in the Spring semester of the 2020-2021 academic year as part of the district's suite of PD offerings. PD coordinators communicated that five PD credit hours would be recognized for successful completion of the online PD short-course. Thirteen teachers registered to take the short-course.

Among those, eight teachers completed the course, all of whom consented to participate in the research project.

All teachers who participated in the study were learning to implement Summit Learning. However, their individual contexts varied in terms of grade levels taught, years of total teaching experience, years of experience implementing Summit Learning, and the amount of local support they received. Six participants taught elementary grades and two taught in middle school. There was a broad range of teaching experience among the participants. Three teachers were relatively new to teaching with one to three years of experience, one had six to nine years of experience, and the other four teachers were veterans with more than 10 years of classroom teaching. Six of the teachers were in their first year implementing the Summit program, while two had more than three years of experience with the curriculum.

All eight teachers received some form of support with implementing Summit Learning. Six teachers attended the synchronous summer training facilitated by Summit's professional learning team online before the 2020-2021 school year began. Six teachers met with an administrator or instructional coach for support implementing Summit once per week, while two teachers had monthly touchpoints for support. The varying experience levels of the participants mirrored a typical cohort of teachers partaking in Summit Learning PD.

Instructional Design of the Innovation

The Summit Learning professional learning team partnered with my institution to broaden the scope of their online resources and to support the effectiveness of their PD offerings for new adopters. As the primary instructional designer of the innovation, I

intentionally incorporated the research-based features of effective PD throughout the design process (see Table 2 in Chapter 2) in addition to applying research-informed decisions about active-learning and the affordances of online PD to optimize a flexible, practice- and feedback-rich learning experience.

Coherence and Sustained Duration. The innovation for this study was the first of a proposed series of four asynchronous online PD short-courses, each constituting approximately five hours of learner engagement. Altogether, the content of the four short-courses would center on the development of high leverage classroom practices needed to effectively implement the three primary components of the Summit Learning model: Projects, Self-Direction, and Mentoring. The short-course under examination in this research study focused on implementing the Self-Direction component of the curriculum.

The online PD short-course was designed to maintain coherence with the local school districts' initiative to implement the Summit Learning model. As such, it connected conceptually to the content of the in-person workshops facilitated by Summit's professional learning team during three days over the summer and two days each in the fall and spring semesters for teachers who are new adopters of the program. The conceptual continuity between the online PD short-courses and the synchronous workshops was intended to differentiate for new adopters and more experienced teachers by providing opportunities to review, reinforce and extend their understanding of how to implement the model.

An additional benefit of the online modality of the innovation is its ability to offer greater flexibility over when, where, and at what pace teachers engage with PD. The asynchronous online nature of the design intended to allow administrators to align the

online PD to their own professional learning calendars while expanding options for sustaining the duration of their PD programs by increasing the total number of contact hours available to teachers. Furthermore, the self-paced nature of the online PD short-course was intended to afford teachers with greater agency in choosing when, where, and at what pace they engage with the learning experiences.

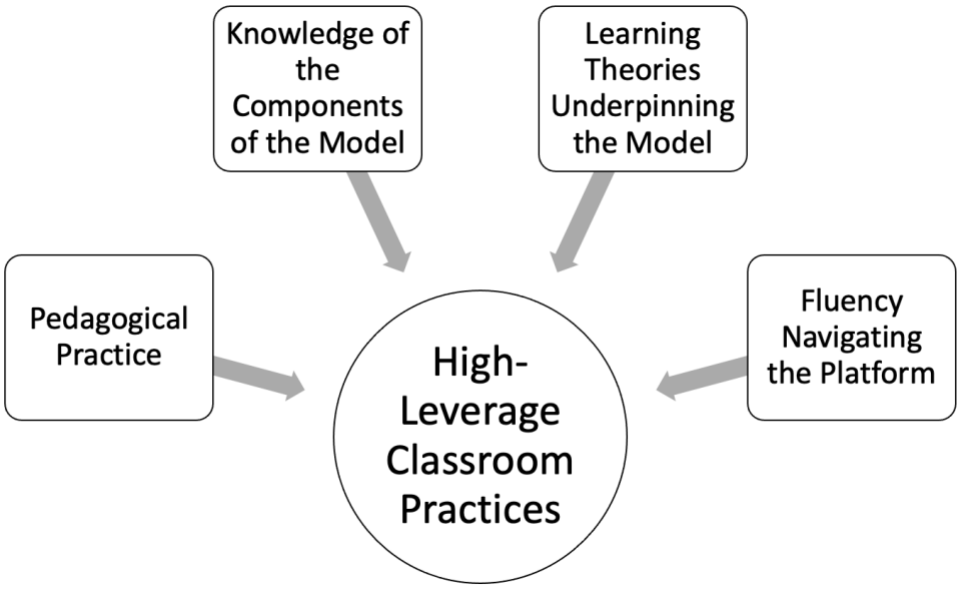
Content. The desired learning outcomes of the innovation were organized into a framework targeting four broad categories:

1. Knowledge of the primary components of the Summit Learning model
2. Understanding of the underlying theories and learning science that explain how the different components foster student outcomes
3. Fluency with navigating the learning Platform to locate teacher- and student-facing curricular resources and to use data to provide individual student support
4. Development of pedagogical practices used to implement the primary components

Overall, there was a greater emphasis devoted to modeling and practicing the pedagogical practices throughout the short-course. Figure 2 depicts the relationships among the categories of content for the online PD course with the convergence centered on high-leverage classroom practices.

Figure 2

Model of Learning Outcomes



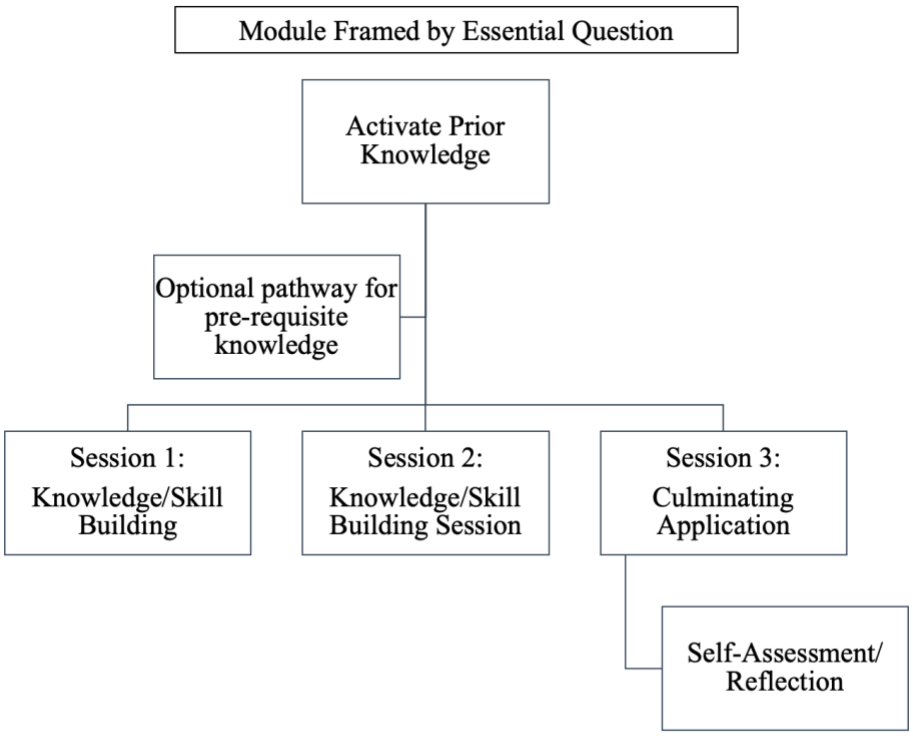
Architecture. Structurally, the innovation was composed of three modules. Each module began with a task to activate prior knowledge that prompted learners to reflect on their own strengths and individual needs by making connections between the course content and their own context. Short readings, video clips, and other classroom-based resources intended to build knowledge and provide explicit modeling as learners worked through a range of practice-based activities where they could apply skills, receive feedback, self-assess, and reflect on progress. At key points within the modules, learners were prompted with choices to pursue individualized pathways to reinforce skills or to collaborate with peers before advancing.

Figure 3 displays a model representing the architecture of each of the modules. The problem-centered approach reflects Merrill's (2002) First Principles of Instruction intended to deepen learning and aid in transfer from the online PD experience and into

the real world (Collis & Margaryan, 2005.) Each module culminated with a multifaceted performance task that situated the demonstration of knowledge and skills within a job-embedded context.

Figure 3

Module Map



In the innovation, participants role-played how to explain self-direction to different stakeholders, analyzed sample student work and data from case studies to design individualized innovations, designed and role-played teaching classroom routines supportive of self-directed learning, and used the learning platform to facilitate individualized goal setting for students. These activities were the most heavily weighted

of each module because they were more closely related to the skills that participants would transfer into their classroom practice.

Active Learning Design. An active learning design was used to propel high levels of learner engagement throughout the innovation. The goal was that participants would have frequent opportunities to engage in learning activities that prompted meaning making, application, and reflection through a wide range of learner interactions that included a combination of closed- and open-ended inputs as well as discussion prompts (Snow-Renner & Lauer, 2005; Trotter, 2006).

The ICAP framework (Chi & Wylie, 2014) guided the design and sequence of the instructional activities within the modules to prompt high levels of cognitive engagement. The ICAP framework categorizes four modes of behavior learners exhibit when engaging with different learning activities as Interactive, Constructive, Active, and Passive. Chi and Wylie (2014) hypothesize that learning is maximized by activities that demand the highest levels of cognitive engagement, "such that the Interactive mode of engagement achieves the greatest level of learning, greater than the Constructive mode, which is greater than the Active mode, which in turn is greater than the Passive mode (I > C > A > P)" (p. 220).

Modules for the innovation were composed of individual pages within the learning management system (LMS) that hosted the online PD short-course. Each of these pages was categorized according to the four modes of engagement in the ICAP framework. Passive pages presented content in the form of text, images, and videos. Active pages checked for conceptual understanding and prompted analysis of classroom case studies. Constructive pages prompted learners to develop classroom plans and lesson

artifacts. Interactive pages engaged learners in collaborative analysis of videos and shared reflection.

This study characterized the use of the three non-passive modes (Active, Constructive, and Interactive) as part of an overarching active learning design because they all required some form of learner input that resulted in individualized feedback. Table 4 shows the percentage of the different modes in the ICAP Framework used per module for the innovation.

Table 4

Percentage of Total Pages per Model Categorized according to the ICAP Framework

Module	Total Pages	Percent of Interactive, Constructive, or Active Pages	Percent of Passive Pages
1	18	67%	33%
2	14	87%	13%
3	23	78%	22%
All Modules	55	77%	23%

Altogether, the innovation consisted of 55 learner-facing content pages. 77% of those pages prompted some form of input from learners. These prompts leveraged a wide range of problem types including open-ended and selected response items to support learners with connecting content to their own context and to actively construct new knowledge and skills. Figure 4 shows an example of simulating an observation by embedding questions along with watching a video. The example in Figure 5 shows an opportunity for interactions among learners as they bring different perspectives from prior experiences into the discussion.

Figure 4

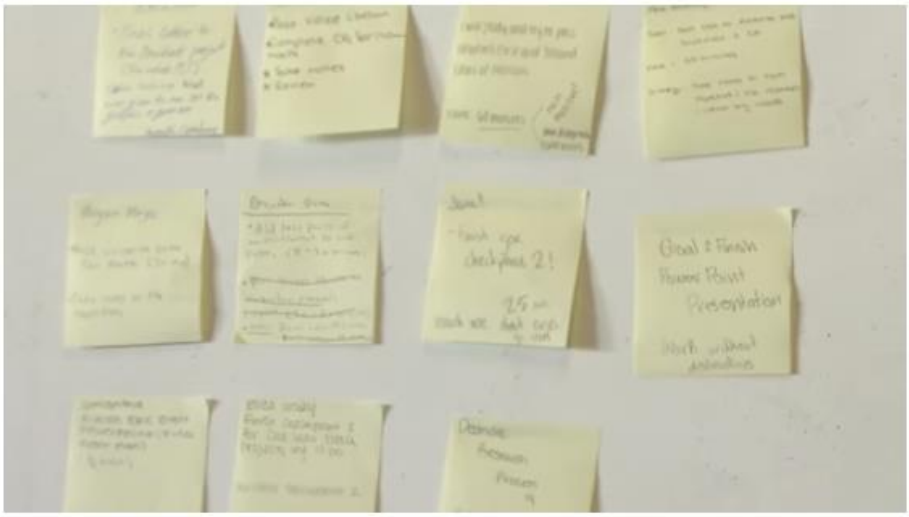
Truncated Example of an Active Page

To kick-off Module 3 Session 1, you'll observe self-directed learning in action again. This time, though, you'll focus your observations on the teacher by describing what you can see and hear Mr. Howell doing and saying in the classroom.

As you watch, consider these guiding questions:

- What actions does the teacher take?
- Why does the teacher take these actions?

TIP: *Browse the answer choice options below before re-watching the video to preview the prompts.*



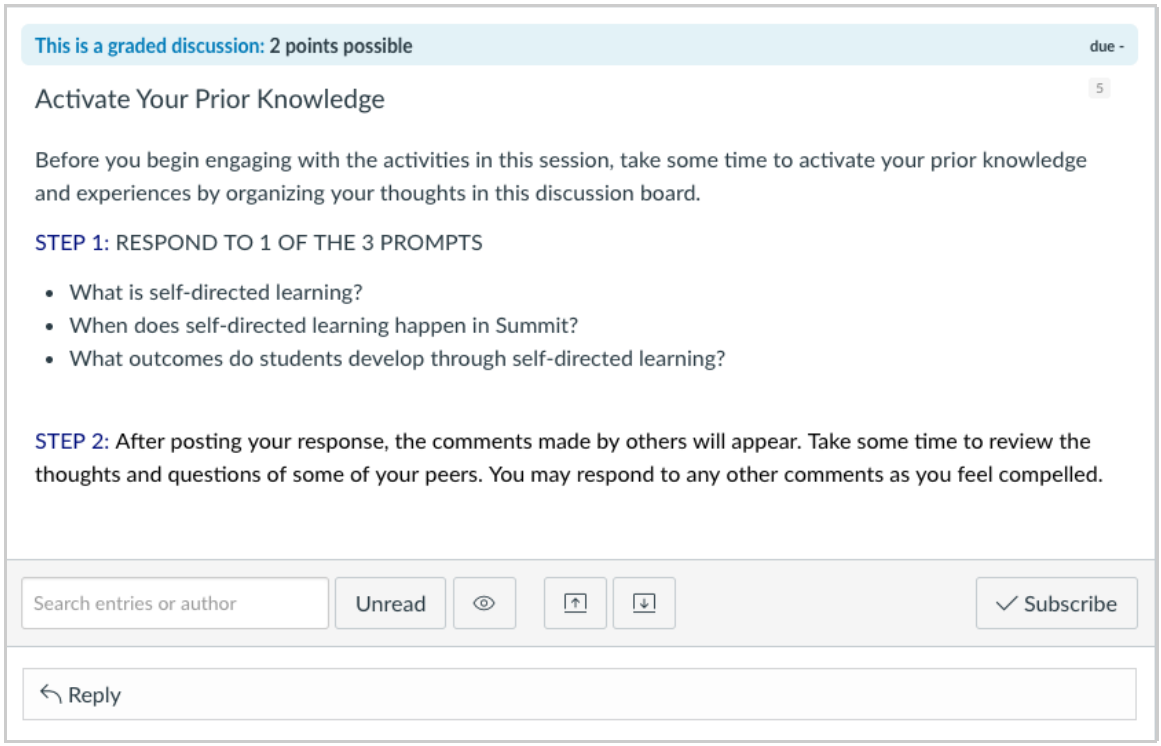
Question 1 5 pts

Select all of the actions you saw Mr. Howell perform or describe in the video.

- ☐ Greets students at the door.
- ☐ Assigns seats.

Figure 5

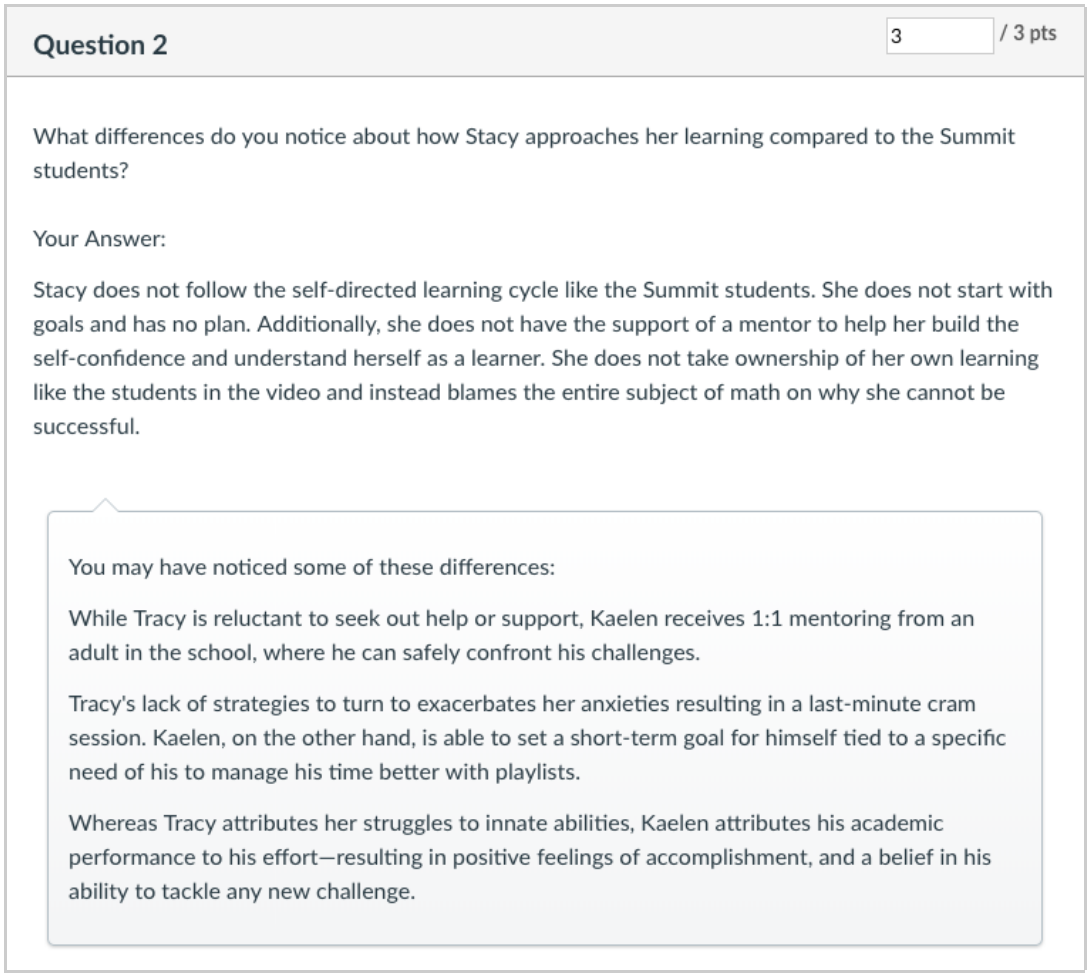
Interactive Page Using a Discussion Prompt to Activate Prior Knowledge.



The practice-based and feedback rich design created frequent opportunities for learners to receive prompt and substantive individualized feedback. Selected response items were automatically scored and provided immediate feedback, whereas participants received expert feedback for all open-ended submissions from the PD short-course facilitator within 24 hours. While expert feedback was returned quickly, participants were immediately able to compare their own work to exemplar responses that were revealed upon submission. For example, Figure 6 shows automated feedback from an *active* page. After submitting an open-ended response, participants can immediately compare their response with an exemplar.

Figure 6

Example of automated feedback for an open-ended prompt.

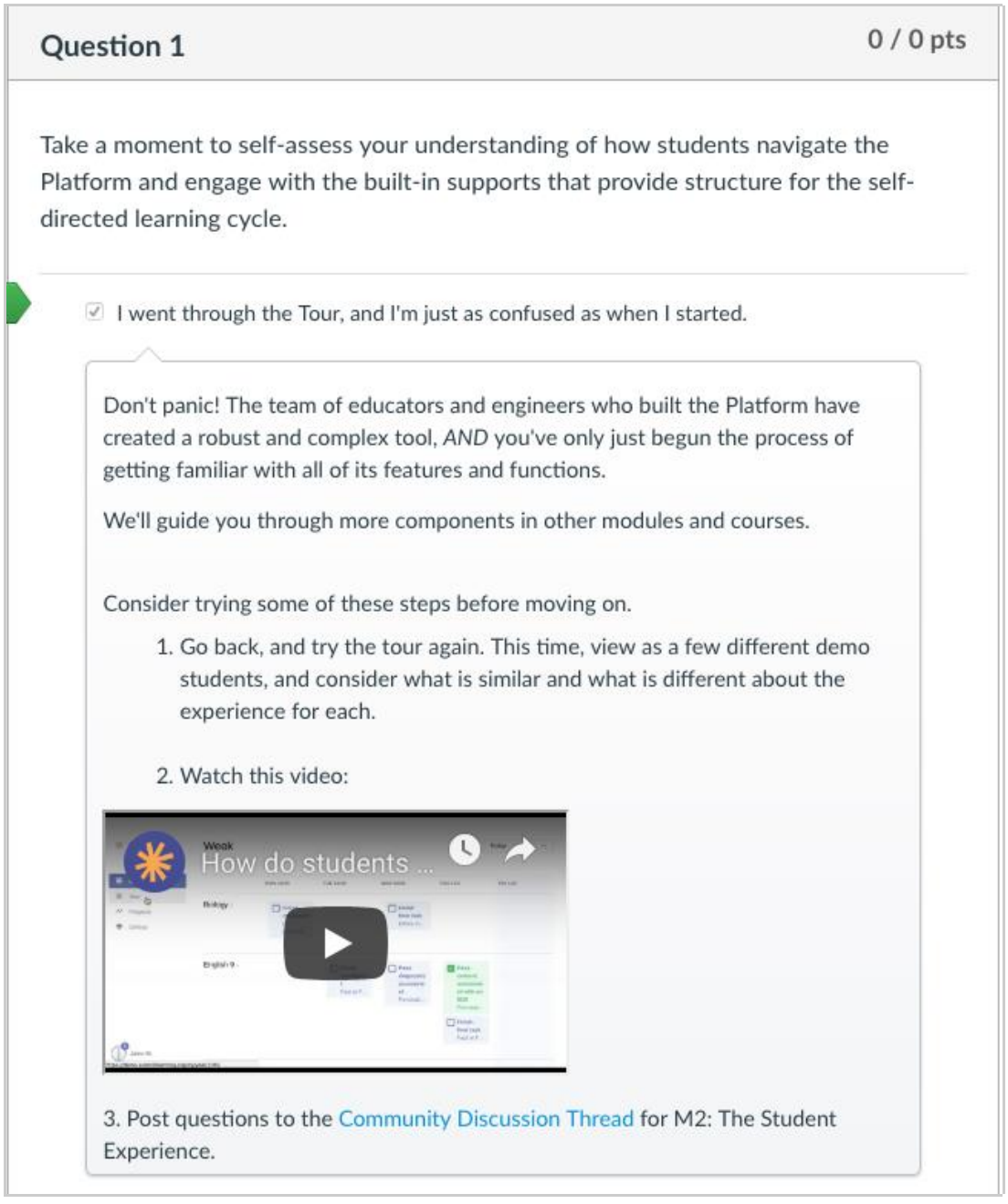


All pages that prompted an input from participants were treated as formative assessments, meaning that participants were able to use the feedback to make decisions about the path and pace of their learning. Some feedback was intended to direct learners to explore specific resources (Figure 7) whereas other feedback aimed to help learners gauge their own depth of understanding or skill development. Each active learning prompt allowed up to two submissions. As such, learners were encouraged to apply any feedback

received to a second attempt as often as was needed to feel confident about the content and skills being developed.

Figure 7

Individualized Automated Feedback Directs Learners To New Pathways



The frequency of individualized feedback is an affordance of the online PD modality that supports learner-instructor and learner-content interactions (Tallent-Runnels et al., 2006; Moore, 1989). It is a critical component for adult learners (Trotter, 2006) and empowers participants to make autonomous choices regarding moving forward or seeking more practice for building knowledge and skill. Ultimately, the course was intentionally designed to empower learners with the agency and the individual data needed to make informed choices like when to attempt practice exercises more than once, and when to go back to re-examine resources more closely. Both their autonomy as learners and the affirmation of progress through consistent and supportive feedback aimed to meet learner needs and increase motivation to sustain engagement (Hsu, Wang, & Levesque-Bristol, 2019; Ryan & Deci, 2000).

Collective Participation and Facilitation. While the innovation was designed to be self-paced, it was not an on-demand experience. Therefore, it was not intended to be completed independently, but rather collectively among a cohort of colleagues. Participation was grounded in several defined structures that provided support to learners while also maintaining some degree of learner flexibility. Most importantly, there were fixed starting and ending dates along with a recommended pace for completing each module within the short-course. Similarly, while there was a logic to the progression of modules, participants were not forced into a linear sequence of learning. These guidelines were intended to allow participants to exercise some agency over pacing while ensuring there were enough active peers for collaboration.

Additionally, the course was designed to be facilitated by an instructor versed in best practices of online teaching. The role of an engaged facilitator in online learning is

valuable for providing learners feedback and has been shown to be a significant factor in supporting completion rates (Hone & El Said, 2016; Reeves & Chiang, 2019). The course instructor was responsible for establishing a teaching presence to reinforce an engaging climate for learning and to drive teacher-student, student-teacher, and student-student interactions (Garrison, Anderson, & Archer, 2000; Richardson & Alsup, 2015). Examples of actions the PD short-course facilitator during the innovation included orienting participants to the LMS, the course architecture, and expectations for participation. The facilitator also shared whole class announcements to encourage appropriate pacing and to synthesize observations for group feedback. Perhaps most importantly, the facilitator paid close attention to collaborative discussions and open-ended submissions to provide prompt and substantive expert feedback to individuals for encouragement and to connect big ideas to each learner's pathway of development (Chen et al., 2009).

Methods of Data Collection and Analysis

The purpose of this action research study was to examine the effectiveness of the active learning design for an asynchronous online PD short-course. Specifically, data collection and analysis examined participants' levels of engagement and how that was influenced by aspects of the PD's instructional design. The methods also explored the extent to which participants' perceptions of their own ability to implement the curriculum changed after engaging with the PD. Finally, the data collection and analysis examined participants' ability to transfer skills from the innovation into their classroom practice along with some of the contextual factors that influenced transfer.

Broadly, data collection and analysis drew from the domains represented in Guskey's (2002, 2016) model for evaluation of training and development which

considers: (a) participants' reactions, (b) participants' learning, (c) organization support, (d) participants' use of new knowledge and skills, and (d) the impact on student outcomes. Table 5 outlines how the research questions align with the different levels of evaluation from Gusky's (2002, 2016) model along with the methods that will be used to collect data.

Table 5

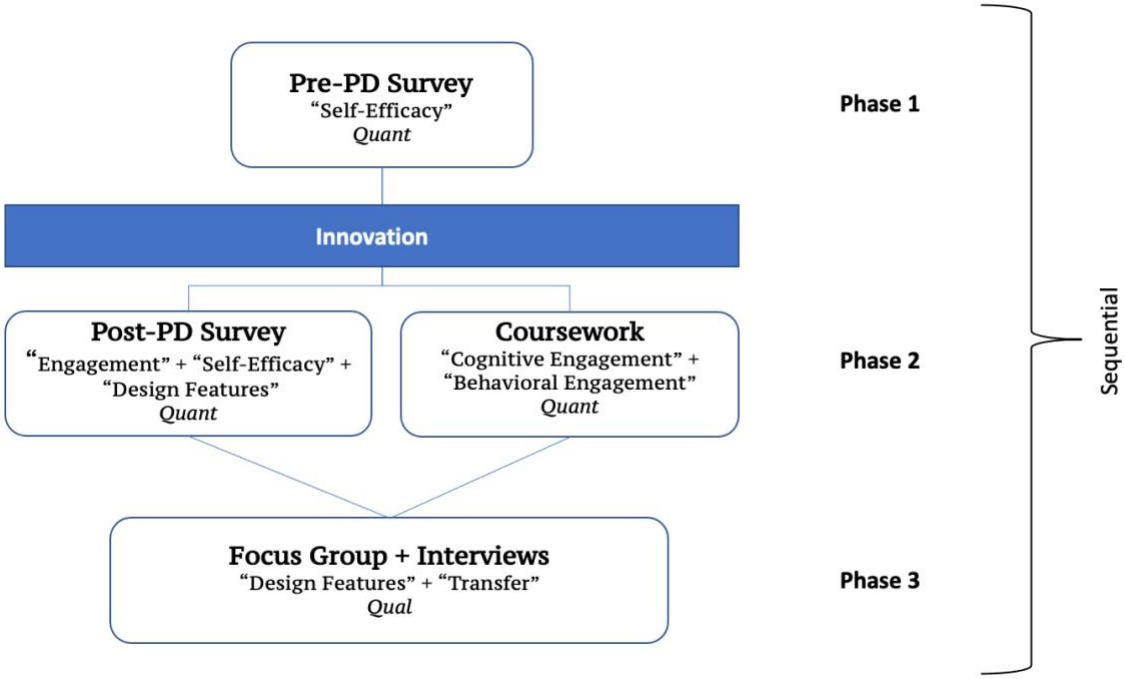
Research Questions and Levels of Evaluation

Research Question	Level of Evaluation	Construct	Data Collection
Q1. Instructional Design: What aspects of the active-learning, online PD influenced learner engagement?	Reactions to Learning Experience	Instructional Design	Quantitative: Post-PD survey Qualitative: Focus group and 1:1 Interviews 4 weeks after PD
		Learner Engagement	Quantitative: Post-PD survey and Coursework analysis
Q2. Self-Efficacy: To what extent did teachers' sense of self-efficacy change when engaging with the active learning online PD?	Learning new Knowledge and Skills	Self-efficacy	Quantitative: Pre- and Post-PD survey
Q3. Transfer: How effective was the active learning online PD in supporting teachers' facilitation of the district-adopted curriculum?	Use of new knowledge and skill	Implementation	Qualitative: Focus group and 1:1 Interviews 4 weeks after PD

A multistrand mixed methods action research design was used to collect data across multiple points during the innovation (Ivankova, 2015). Figure 8 outlines the three phases for this study. The first two phases addressed research questions 1 and 2; quantitative and qualitative data were collected concurrently for triangulation (Creswell & Creswell, 2017). Analysis from the first two phases informed qualitative data collection in phase 3 from a smaller subset of participants approximately four weeks after completion of the PD short-course.

Figure 8

Multistrand Mixed Methods Design



Research Question 1: Instruments, Data Collection, & Analysis

The first research question considered which instructional design aspects of the active learning online PD influenced learner engagement. Quantitative data was collected to determine learners' level of engagement. Then, a mix of quantitative and qualitative

data was collected to reveal participants' reactions to the PD and their perceptions of how the specific aspects of the design influenced their engagement.

Learner Engagement. Learner engagement is a multifaceted construct measured by levels of interest, participation and learning outcomes with the learning experience (Chakraborty and Nafukho, 2014). According to Fredricks et al. (2004) learner engagement encompasses interrelated categories for emotional, behavioral, and cognitive engagements. Quantitative data were collected from multiple sources to analyze levels of engagement for each of the three constructs to provide an overall measure of learner engagement.

Measuring Emotional Engagement. Quantitative data from the Post-PD survey measured emotional engagement using items borrowed from the Online Student Engagement Scale (OSE) (Dixson, 2015). The OSE is a validated survey that measures participants' perceptions of their own level of engagement in online courses (Dixson, 2010; Dixson, 2015). Individual items measure four sub-constructs; *skills, emotion, participation,* and *performance*. Participants were prompted to reflect on their effort, interest, interactions, and ability to apply course material to their own classroom during the learning experience using a five-point Likert scale that ranged from *Not at all characteristic of me* to *Very characteristic of me*. Five of the ten items used on the Post-PD survey were specifically aligned to emotional engagement (Appendix A, Section 3, Items 2, 4-7). Two of those five items were slightly modified to align to the context of the PD short-course by changing "my life" to "my classroom" (Appendix A, Section 3, Items 4-5).

Measuring Behavioral Engagement. Behavioral engagement was measured by participants' overall activity in the short-course. This included how much of the content they viewed and how many times they responded to prompts for various interactions. Quantitative data reflecting indicators for behavioral engagement were collected from the LMS showing the total number of *page views*, and the total number of *participations.*

Page views are used to indicate how much content within the course participants viewed. The data actually represent the number of server requests made when loading a page in the LMS which can vary significantly based on the amount of curricular assets on any given page. Whereas visiting one content page in the short-course may produce 5 *page views*, another may yield upwards of 15 *page views* or more.

Participations data represents learner interactions in the course and is generated by the number of contributions to a discussion board, by opening quizzes or assignments, and/or by submitting responses to quizzes and assignments. This can also vary by learner due to the flexibility of the design that allowed up to two submissions for graded interactions.

Measuring Cognitive Engagement. Quantitative data indicating achievement of learning outcomes was used to examine cognitive engagement (Fredricks et al, 2004). This was measured by generating each participant's percentage of total points earned from graded interactions and culminating applications. The percentage of total points earned was a reasonable indicator of cognitive engagement because participants were provided feedback on all scored activities and encouraged to resubmit all graded activities as needed to feel confident in one's understanding.

Analysis of Learner Engagement. The data representative of each sub-construct (emotional engagement, behavioral engagement, and cognitive engagement) were analyzed using descriptive statistical procedures. Mean and standard deviations are reported. For emotional engagement, each choice on the five-point Likert scale was coded using the following values; 1 = *not at all characteristic of me,* 2 = *not really characteristic of me,* 3 = *moderately characteristic of me,* 4 = *characteristic of me,* 5 = *very characteristic of me*. For behavioral engagement, a baseline number of *page views* and *participations* was established by visiting every page in the course and by responding once to every prompt for an interaction. It was possible for participants to visit a single page multiple times because they could navigate the PD short-course at their own pace and relative to their own needs, which would generate a wide variety of *page views* and *participations* among the teachers taking the PD short-course. Therefore, a baseline number of *page views* and *participations* is reported to compare against the measures of central tendency among the participants. Similarly, for cognitive engagement, a baseline percentage of total points is reported. This represents the minimum percentage of points needed to demonstrate proficiency with course learning outcomes and is used to compare against the reported descriptive statistics. Altogether, the results for emotional engagement, behavioral engagement, and cognitive engagement are considered to evaluate the overall levels of engagement in PD short-course among all participants.

Influence of Instructional Design. The instructional design of the active learning online PD short-course featured a number of decisions intended to inspire learner engagement and support development of transferable knowledge and skills. It sought to incorporate structural aspects of effective PD such as alignment to local initiatives and

adding to the sustained duration of time for learning. Additionally, it aimed to incorporate intentional opportunities to learn. These included meaningful content, frequent interactions for active learning and job-embedded practice, an appropriate degree of challenge, and supportive feedback. Additionally, it sought to foster a flexible environment to promote learner agency for determining when, where, and at what pace to engage with the learning experiences.

Participants' reactions to the different aspects of the instructional design were measured with both quantitative and qualitative methods. Quantitative data were collected from eight Likert-scale items on the Post-PD survey that prompted participants to evaluate the impact different aspects of the instructional design had on their learning experience (Appendix A, Section 4). Qualitative data were also collected from one semi-structured focus group interview of three teachers, and two one-on-one semi-structured interviews with teachers after completion of the PD-short course. The first segment of interview questions encouraged participants to reflect on their experience as learners including different choices they made, and how those decisions might have influenced their engagement (Appendix B). A focus group was valuable because it included three teachers who also worked together in the same school. The interactive format fostered opportunities to hear how each other responded to questions and to react by adding additional context or differing perspectives (Creswell & Creswell, 2014).

Analysis of Instructional Design. Quantitative and qualitative data analysis was used to gain insight into participants' perceptions of how the different instructional design aspects influenced their engagement with the PD content. Participants' responses

on the five-point Likert scale for Section 4 of the Post-PD survey were coded from 1 = strongly disagree to 5 = strongly agree and descriptive statistics were calculated.

Next, the one-to-one and focus group interviews conducted approximately one month after completion of the PD were transcribed and imported into Dedoose, an online research software that supports organization and analysis of qualitative data. The qualitative analysis process involved first cycle coding, code mapping, and second cycle coding (Saldaña, 2016). First cycle coding began by generating structural codes which, according to Saldaña (2016), apply "a conceptual phrase representing a topic of inquiry" (p. 97). 14 structural codes applied to each data set to reflect the instructional design features of the innovation and to align with the features measured by Section 4 of the Post-PD survey to support triangulation of data for research question #1 (Ivankova, 2015). This was followed by line-by-line process coding to gain clearer insights into the actions participants described within the larger structure provided by the initial structural codes (Charmaz, 2002; Gibbs, 2007; Saldana, 2016). 81 sub-codes within the structural codes were generated. A code-mapping process followed the first cycle coding. This transitional step between first and second cycle coding aimed to bring organizational structure to the codes and support preliminary analysis, thereby aiding in the trustworthiness (Saldaña, 2016). Analytic memos revealed new patterns in the data which contributed to a new organizational structure and allowed themes to begin to emerge (Charmaz, 2014; Gibbs, 2007). In a second cycle of coding, focused coding was used to generate more salient categories within the organizational structure resulting from the first cycle (Charmaz, 2014; Saldaña, 2016). Focused coding was applied to all data sets.

The resultant set of second-cycle focused codes led to specific themes and theme-related topics. These are presented along with quotes from interviews as supporting evidence.

Research Question 2: Instruments, Data Collection, and Analysis

Data Collection. The second research question explored the extent to which participants' sense of self-efficacy changed by participating in the innovation. Bandura (1997) defined self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). The goal of the innovation was to prepare teachers with the knowledge and skills to implement the Summit Learning program confidently. Improvements in teacher self-efficacy as a result of participating in the PD would suggest a greater likelihood of implementing the high leverage classroom practices covered in the PD short-course. Participants completed a Pre- and Post-PD survey to measure changes in their perceptions of their ability to implement the Self-Direction component of the Summit Learning program with their students.

Tschannen-Moran & Hoy (2001) developed the Teacher Sense of Efficacy Scale (TSE) as a way to measure teachers' perceptions of their own ability to perform tasks specific to the context of classroom teaching. The instrument was designed to gain insight into which practices teachers perceive as being most difficult. Rather than assessing more general traits of teachers, the TSE measures perceptions of actions relating to three specific constructs: (a) student engagement, (b) instructional strategies, and (c) classroom management (Heneman, et al., 2006).

The overall survey design and item construction of the TSE was used as a model for the development of twelve new items used in this study's Pre- and Post-PD survey

(Appendix A, Section 2). These items more specifically measure participants' sense of efficacy implementing the Self-Direction component of the Summit Learning curriculum, which was the focus of the innovation. Facilitating the Self-Direction block of instructional time requires a complex set of knowledge and skills. As such, the sub-constructs of the instrument map to three categories of intended learning outcomes: (a) Content Knowledge, knowledge of the Summit Learning model; (b) Technical Knowledge, ability to navigate the Summit Learning platform; and (c) Pedagogical Knowledge, ability to implement the high leverage classroom-based practices used to facilitate the Self-Direction component of the model. Participants indicated their confidence in their own ability for each item using a five-point Likert scale ranging from *None at all* to *A great deal.*

The survey items were piloted in the Spring of 2020 to test the internal reliability, or the consistency, of related items (Fraenkel & Walllen, 2005). For each sub-construct and for the survey instrument as a whole, Cronbach's alpha was calculated. This analysis produced a coefficient alpha (α) as an estimate of reliability for each sub-construct and for the instrument as a whole. Results are presented in Table 6.

Table 6

Internal Reliability

Sub-construct	Aligned Items	Coefficient Alpha Estimate of Reliability
Knowledge of the SL Model	1, 2, 3, 9	.898
Skill using the Platform	6, 7, 8	.899
Pedagogical Skills for SDL	4, 5, 10, 11, 12	.885
Overall Alpha	1-12	.953

All three of the sub-constructs measured alphas between 0.8 and 0.9 indicating a good degree of internal consistency among the related items ($0.9 > \alpha \geq 0.8$). Analysis of the instrument as a whole produced a high alpha ($\alpha = .95$) suggesting an excellent overall degree of internal reliability (Cortina, 1993).

Research Question 2 Analysis. Quantitative data from the Section 2 of the pre- and Post-PD survey were analyzed using both descriptive and inferential statistical procedures. A Likert-scale with five responses were coded so that 0 represented *None at all* and 4 represented *A great deal.* Measures of central tendency and the frequency of responses along the Likert-scale were examined for numerical changes. Next, a paired-samples t-test (Field, 2013; Ivankova, 2015) was conducted comparing the means of each sub-construct for the Pre- and Post-PD survey results. This method was used to determine if participants experienced a statistical change in their sense of self-efficacy implementing the Self-Direction component of the Summit Learning model. Finally, Cohen's d was calculated to estimate the effect size, or the magnitude of the results contributed to the innovation (Kelley & Preacher, 2012).

Research Question 3: Instruments, Data Collection, and Analysis

Data Collection. The third research question sought to gain insight into the ways participants were able to transfer the skills practiced in the innovation into implementation of the district-adopted curriculum. Because of the restrictions on travel, school visits, and face-to-face learning imposed to limit the spread of the novel coronavirus disease of 2019 (COVID-19), it was not possible to perform observations of classroom practices. Instead, one-to-one and focus group interviews were used to engage

participations in conversations about transfer (Guskey, 2000). Questions aimed at eliciting concrete ways participants had incorporated learning from the PD into their classroom, as well as the contextual factors that influenced transfer. Convenience sampling was used for this portion of data collection, as six of the eight research participants were available to partake in the interviews (Teddlie & Yu, 2007). This method aimed to understand how participants approached implementing new skills learned in the PD as they negotiated the factors unique to their teaching context (Guskey, 2002; 2016).

The second portion of the semi-structured interviews was devoted to questions pertaining to the transfer of knowledge and skills learned. Interview questions (Appendix B, Part 2) prompted participants to reflect on their facilitation of Self-Direction in the one month since completing the PD. Some questions asked participants to describe changes to instructional practices they had made or planned to make in the future. This approach to data collection provided participants with the opportunity to articulate the context of their classroom, to communicate specific strengths and needs of their students, and to describe nuances in the successes and barriers they faced when facilitating the self-direction block of time (Kennedy, 2016).

Research Question 3 Analysis. Qualitative data sets were transcribed and entered into Dedoose. Two structural codes, *context* and *transfer,* were used for first cycle coding to examine individuals' classroom context and to identify all of the places where teachers named concrete examples of applying new knowledge and skills (Guest et al., 2012; Saldaña, 2016). Next, line-by-line process coding was applied to all text coded as *transfer* to narrow in on the specific actions that teachers described taking in their

classrooms by creating sub-codes (Charmaz, 2002; Gibbs, 2007; Saldaña, 2016). A code-mapping process, along with analytic memos was used to examine relationships between the desired learning outcomes of the innovation and the teachers' application of those skills (Saldaña, 2016). Competencies related to implementing the Self-Direction component (Appendix C) provided conceptual frames for categorizing all the sub-codes. These categories guided second-cycle focused coding. Focused codes helped to clarify evidence of applied knowledge and skills from the interviews (Charmaz, 2014). Patterns in the frequency of evidence revealed the extent to which specific outcomes were transferred into classroom practices.

Various strategies were used to ensure the trustworthiness of the qualitative data and analysis. First, I sought to increase dependability by adhering to a systematic process that included triangulating qualitative data with quantitative data to identify areas of convergence or divergence (Creswell & Creswell, 2017; Mertler, 2017). To minimize bias, I engaged in reflexivity. This included recording a journal while facilitating the innovation to reflect on how I was balancing the simultaneous roles of facilitator and researcher (Ivankova, 2015). Additionally, I included detailed descriptions throughout the study of the participants, the innovation, their context for engaging in learning, and the various role I played throughout (Ivankova, 2015).

CHAPTER 4

RESULTS

Results from the study are organized into sections that correspond to each of the three research questions. Quantitative and qualitative data are reported in relation to the first research question, Instructional Design: What aspects of the active-learning, online PD influenced learner engagement? Next, quantitative data are presented for the second research question, Self-Efficacy: To what extent did teacher's sense of self-efficacy change when engaging with the active learning online PD? Finally, qualitative data are reported for the third research question, Transfer: How effective was the active learning online PD in supporting teachers' facilitation of the district-adopted curriculum?

Research Question 1, Instructional Design: What aspects of the active learning online PD influenced learner engagement?

Learner Engagement: A wide range of data sources were used to examine the aspects of instructional design that influenced learner engagement. First, quantitative data from the Post-PD survey along with participants' activity during the course were used to measure levels of learner engagement. These data were representative of how participants' felt engaging with the course (*emotional engagement*), their activity in the course (*behavioral engagement)* and the extent to which they met course learning outcomes (*cognitive engagement*). Next, quantitative data from the Post-PD survey revealed participants' perceptions of how different features in the course influenced their learning experience.

*Emotional Engagement***.** The mean and standard deviation for five items on Post-PD survey measuring *emotional engagement* are reported in Table 7. The overall mean

for all five items was 4.50 indicating that participants perceived their own levels of emotional engagement to be *characteristic* or *very characteristic* of the descriptors. The mean for four of the five descriptors fell between *characteristic* or *very characteristic of me.*

Table 7

Emotional Engagement (Post-PD Survey)

Participants (n = 8)	Emotional Engagement	
	M	*SD*
Putting forth effort	4.75	.707
Finding ways to make the course material relevant to my classroom	4.75	.463
Applying course material to my classroom	4.50	.535
Finding ways to make the course interesting to me	3.88	1.126
Really desiring to learn the material	4.63	.518
Overall	4.5	.507

One of the descriptors, *finding ways to make the course interesting to me*, averaged between *moderately characteristic* and *characteristic of me,* though it skewed to the latter and had the highest standard deviation of all the constructs.

Behavioral Engagement. Coursework data showing participants' activity throughout the course were used to examine *behavioral engagement.* Specifically, descriptive statistics for the total number of *page views* and *participations* are reported. Table 8 shows the range, mean, median, and standard deviation for all participants in the course. These data are presented next to baseline numbers of *page views* and

participations which represent the minimum number of *page views* and *participations* for the complete course.

Table 8

Activity in the Course: Page Views and Participations

n = 8	Baseline	Minimum	Maximum	Mean	Median	SD
Page Views	274	490	880	692.4	680.0	151.387
Participations	68	84	108	95.6	94.0	8.847

Results show that the mean and median for *page views* (*M* = 692.4 and *Mdn* = 680.0) and for *participations* (*M* = 95.6, *Mdn* = 94.0) exceeded the baseline for both data sets. Furthermore, the fewest number of *page views* by any participant (*minimum = 490)* exceeded the baseline by 216 *page views*. Likewise, the minimum number of *participations* (*minimum* = 84) exceeded the baseline by 16 *participations* and the maximum number (*maximum* = 108) exceeded the baseline by 40 *participations*. Thus, activity in the PD short-course suggests high behavioral engagement among all participants.

Cognitive Engagement. Descriptive statistics are reported for the overall percentage of points earned in the PD, which can be representative of cognitive engagement (Fredricks et al, 2004). Table 9 displays the minimum, maximum, mean, median, and standard deviation for all participants. These data are presented alongside the baseline requirement of 85% of the total possible points needed to demonstrate overall proficiency with the learning outcomes of the PD. Both the mean percentage (*M* =

96.8%) and median percentage (*Mdn* = 96.5%) of total points earned for all participants (*n* = 8) exceeded the baseline requirement by more than 10%. Additionally, the lowest percentage of points earned (*minimum* = 92%) exceeded the baseline requirement by 7%. These data indicated that the participants demonstrated interactions with the course content above and beyond the baseline requirement for proficiency to achieve course learning outcomes. There were high levels of consistent participation throughout the short-course.

Table 9

Course Learning Outcomes: Percent of Total Points Earned

n = 8	Baseline	Minimum	Maximum	Mean	Median	SD
Percentage of Points	85%	92%	99%	96.8%	96.5%	2.328

Summary of Learner Engagement. All participants (*n* = 8), perceived their own levels of emotional engagement as *characteristic* or *very characteristic* of their behavior in the PD. Additionally, all participants exceeded the baseline expectations for activity in the course, which was representative of behavioral engagement. Finally, all participants exceeded the baseline number of points needed to demonstrate proficiency with course learning outcomes, representative of cognitive engagement.

Influence of Instructional Design on Learner Engagement. The next set of quantitative data examined what aspects of the instructional design influenced learner engagement. Descriptive statistics were generated for responses to the Post-PD survey

(Appendix A, Section 4). Results are displayed in Table 10 in rank order based on the means of each construct measured.

Table 10

Influence of Instructional Design Features (Post-PD Survey)

Features (n = 8)	Mean	SD	% Agree/ Strongly Agree
Meaningfulness of the content	5.00	.000	100%
Helpfulness of the feedback (including automated and facilitator feedback)	4.88	.354	100%
Supportiveness of interactions with course facilitator	4.75	.463	100%
Flexibility relative to in-person workshops	4.75	.463	100%
Active learning tasks	4.63	.518	100%
Appropriateness of challenge	4.50	.535	100%
Agency with pacing	4.38	.744	88%
Agency with when to engage	4.38	.744	88%

Results indicated 100% of participants *strongly agreed* or *agreed* on six of the eight design features measured. The top four aspects of the instructional design included the *meaningfulness of the content* (M= 5.0), *helpfulness of the feedback* (M = 4.88), the *flexibility of the asynchronous design relative to typical in-person workshops* (M = 4.75), and the *supportiveness of the facilitator* (M = 4.75). Although to a slightly lesser extent, participants also indicated value in the appropriateness of the challenge of tasks (M =

4.38), as well as the autonomy they exercised when they engaged and how quickly they moved through the course (M = 4.38).

To better understand how participants perceived the influence of different aspects of the instructional design on their engagement as learners, qualitative data were also collected. A total of five teachers participated in the semi-structured interviews that occurred approximately four weeks after completing the PD short-course. One group of three teachers completed a focus group interview, while the other two teachers partook in a one-to-one interview. The questions and duration were the same for focus group as they were for the one-to-one interviews. Table 11 summarizes the qualitative data sources and their length. Word count refers to the total words spoken by the participants throughout the interview. Individual participants spoke a little less than the three participants in the focus group interview combined.

Table 11

Description of Qualitative Sources

Data Source	Participants	Word Count
1:1 Interview	T2	4,278
1:1 Interview	T1	5,039
Focus Group	T3, T4, T5	5, 692
Total	5	15,009

First cycle coding generated 81 sub-codes within 14 larger structural codes that aligned closely to the various design features measured on the Post-PD survey. Following first cycle structural coding, code mapping resulted in six overarching categories leading to second cycle focused coding. From there, themes and theme-related topics were

generated (Table 12). Each theme along with the theme-related topics and supporting quotes (Charmaz, 2014) are discussed within the text.

Table 12

Themes and Theme Related Topics

Theme	Theme-Related Topics
Content and Context; Need for this PD Topic Amidst Challenging Year	1. Named challenges faced with implementing a new program amidst the circumstances of the pandemic. 2. Recognized needs in their students for improving facilitation of the self-direction block of time. 3. Recognized a need to deepen their own knowledge and skills for facilitating the self-direction block of time.
Architecture; Navigating the Online Learning Space	1. The active-learning design meant there was a lot going on in the course, which required getting used to. 2. The consistency of the module structure, module overviews, and time estimates supported self-pacing. 3. The navigation bar helped teachers to keep track of progress.
Flexibility; When, Where, and at What Pace to Engage	1. Teachers worked on the short-course on their own schedules, when they could find the time to concentrate. 2. Teachers individualized pace based on their own needs and preferences. 3. Teachers mostly paced sequentially, but used the navigation features to return to pages as often as needed.
Active Learning; meaningful tasks, challenge, and feedback	1. The frequent prompts coupled with fast feedback helped teachers to check their own understanding. 2. The feedback helped teachers to identify areas to improve understanding. 3. The use of videos to model concrete practices supported personal reflection. 4. The graded responses, point structure, and opportunity to re-try provided accountability and was motivating. 5. The application tasks felt authentic and connected to actual classroom practices.
Facilitation; Teaching Presence and feedback	1. Teachers noted that the facilitator's feedback was fast, consistent, and positive. 2. The feedback from the facilitator communicated that their ideas, experiences and success with the PD was valued. 3. The feedback relieved stress and encouraged motivation.

Content and Context; Need for This PD Topic Amidst the Challenging Year. One theme to emerge in the data reflected the context of the school year within which the PD occurred as well as the reasons for choosing to engage with this particular PD offering. Teachers described compounding challenges they faced during the school year which indicated a need for engaging with this topic of PD. They named the general challenge of implementing the new Summit Learning model amidst the realities of the pandemic which forced remote teaching at the start of the school year. Teacher 2 (T2) stated, "It was really hard to try to get them familiar with [Summit Learning] and not being able to have them face to face…so I picked this course first because I need help." (Interview, April 2).

Teachers identified needs they observed among their students as well as identified their own need to develop knowledge and skills necessary for facilitating the Self-Direction block of time. T1 explained, "I have students that are truly struggling with this Self-Direction...and once I read a little bit [about the PD short-course] it gave me interest..." (Interview, April 13). T3 added, "We've been working on the Platform since the beginning of the year, when our students were still virtual, and then having kids come back, it really helped us understand about the Self-Direction Cycle." (Focus Group, April 12).

Architecture; Navigating the Online Learning Space. The active learning design of the PD short-course resulted in numerous opportunities for teachers to interact with the content and with each other. Two teachers commented that it took some time to get familiar with the structure of the course and how to navigate the learning environment.

“There’s a lot going on in that course, and I was a little bit confused… mainly at the beginning.” (T2, Interview, April 2).

Others noted that both the consistency with which the course was structured along with navigation features activated in the learning management system helped with self-pacing and tracking progress:

- “... once you click on each module it is broken down with what to do and how to do it, so that was helpful” (T2, Focus Group, April 12).
- “I really liked it because you can see everything that you need to get done” (T4, Focus Group, April 12).
- “...it was easy to know and we were able to plan out just how long it's going to take” (T3, Focus Group, April 12).
- “you can really track how much you've done and how much you have left” (T5, Focus Group, April 12).

Flexibility: When, Where, and at What Pace to Engage. Another theme related to flexibility and the asynchronous aspect of the online PD short-course. All teachers commented on the flexibility by describing their behaviors for when, where, and at what pace they engaged. Teachers described the different times and locations they chose to engage based on their individual preferences and circumstances. Some chose to work on the short-course in school after students had left, “I chose to do it here...after they leave I can really have time to concentrate.” (T1, Interview, April 13). Another preferred working in the evening on work nights, “I worked on it at night because I can concentrate better at that time.” (T2, Interview, April, 2). And still others found themselves engaging with the PD during the weekends.

Similarly, all teachers described the agency they experienced with self-pacing as being positive. Teachers most often elected to move through the course sequentially, though all teachers described using the flexible navigation to change the pace or return to previous pages based on individual learning needs:

- "I was replaying how things go in my classes and comparing them to [the video models]. So, the self-pacing is what I really appreciate" (T2, Interview, April 2).
- "I liked it because I like being able to move at my own pace...if you're in a room full of teachers I just feel like it would take so much longer, but I learn better this way" (T3, Focus Group, April 12).
- "Sometimes I didn't need a lot of time to think, but other times I kept thinking deeper about what was being asked, I was able to walk away and even just go for a walk" (T2, Interview, April 13).
- "Being able to work at my own pace [was most appealing] and there were some things that I had to go back to several times" (T1, Interview, April 2).

Active Learning; meaningfulness of tasks, challenge, and feedback. The elements of the PD's design that incorporated active learning also surfaced in the data as a theme. Teachers' comments focused on the meaningfulness of the tasks, the level of challenge, and the role of feedback. Several teachers claimed the frequent prompts for interactions coupled with the fast feedback helped them to check their own understanding of the content and skills. T2 commented, "They [the quizzes] helped make sure that I understood what was going on" (Interview, April 2). T1 stated, "I like the quizzes because actually I don't think I passed, maybe a few of them, and I had to go back" (Interview, April 13). And T5 added, "... and with the feedback that the quiz gave I just

sort of looked to see if I had any notes on that… and maybe I missed it and then I would go back help myself fill whatever gap" (Focus Group, April 12).

Teachers also discussed the usefulness of some of the content and resources. Videos showing classroom examples were specifically mentioned a number of times as being meaningful for modeling and prompting reflection. T2 explained, "[being able to] see it in action I feel like that's it's easier to compare how well things are going in my room and what can I do to improve or keep on doing" (Interview, April 2). T2 also stated, "there was a video that I watched several times, just because I was replaying how things go in my classes and comparing them" (Interview, April 2).

Several teachers commented on the point structure of the course. They mentioned the opportunities to earn points through participation or by demonstrating knowledge and skills was motivating and directed them toward specific content to focus on development. T5 claimed, "I'm really glad that there were grades… helps me continue to work and strive for the best that I can do" (Focus Group, April 12). T4 added, "I also like to make the best score that I can, so if I missed one, of course, I wanted to take it again, even if it's just one question" (Focus Group, April 13).

Finally, teachers commented on the meaningfulness of the tasks. One teacher described the authenticity of the applications and that they reflected actual classroom practices encountered with their students. T1 explained, "...it felt authentic, like something that I could use, and I could see that's why I took the time into going into the case study and going to the data" (Interview, April 13). This aspect of authenticity was also reflected in the concrete changes that teachers described having made since completing the PD which is discussed in detail in relation to the third research question.

Facilitation; Teaching Presence and Feedback. A final theme to emerge was related to the teaching presence experienced in the course and the role of the facilitator. Participants expressed that the feedback was fast, consistent, and positive. T4 highlighted the promptitude of the feedback, "It [the feedback] was really quick, even when I was doing them at odd times, and you would still reply really fast" (Focus Group, April 12). T1 focused on the positivity of the feedback, "At the beginning. I was anxious about your responses. But, as we moved along, I knew you were going to have a comment, I knew it was going to be always positive, so the anxiety went away" (Interview, April 13).

Several teachers expressed appreciation for the encouragement of the facilitator's feedback and presence. They felt that their experiences and successes with the PD short-course were valued and encouraged by the facilitator:

- "There was also the personal feedback, which made me feel like wow someone really cares if I do well, it's not just a certificate" (T5, Focus Group, April 13).
- "He didn't just leave us, you know high and dry, so you were actually looking to see what we had to say" (T3, Focus Group, April 13).
- "I like receiving the feedback from you, just because I knew that this was your course, so I thought it made me feel good to know that you were engaging with us in the course that." (T4, Focus Group, April 13).

The prompt, positive and substantive feedback contributed to the motivation of some participants. T4 and T3 succinctly commented about the facilitator's feedback. T4 stated, "It kept my motivation going, I'm like oh wow, he sees this" (Focus Group, April 13). T3 commented, "This is a real person, we were being heard" (Focus Group, April 13).

Research Question 2, Self-Efficacy: To what extent did teachers' sense of self-efficacy change when engaging with the active learning online PD?

Quantitative data from the pre- and post-intervention survey were examined to determine if participants' sense of their own ability to implement the Summit Learning curriculum changed as a result of engaging with the PD. Descriptive statistics were analyzed for each of the three constructs: Content Knowledge, Technical Knowledge, Pedagogical Knowledge. Inferential statistics were generated using a paired samples t-test comparing the means of each sub-construct for the pre-intervention and post-intervention survey results. The p-value was analyzed to determine if a statistically significant difference among the means for pre- and post-test results occurred for each sub-construct.

Numerical Changes in Self-Efficacy. Table 13 displays the mean and standard deviation from the pre- and post-interventions survey results for each of the three constructs. On average, participants' confidence in implementing these components of the Summit Learning curriculum were between *a moderate amount* and *a little* on the pre-test. This rose on the post-test with average confidence being between *a moderate amount* and *a lot.*

Table 13

Pre- and Post-PD Survey Scores on the Three Subscales of the Teacher Beliefs Survey

	Pre-Test		Post-Test	
Construct	*M*	*SD*	*M*	*SD*
Pedagogical Knowledge	2.38	0.518	3.55	0.487
Technical Knowledge	2.17	0.309	3.29	0.677

Content Knowledge	1.97	0.619	3.28	0.565

The pre-test mean for the 5 item subscale, *Pedagogical Knowledge* was 2.38 which skewed toward *A moderate amount*. It rose to 3.55 on the post test, skewing slightly toward *A great deal* and indicating a 49.2% increase. On the three-item subscale for *Technical Knowledge,* the mean increased from 2.17, closer to *A moderate amount*, to 3.29 closer to *A lot*. This represented a 51.6% increase. Similarly, the means increased on the four items that assessed *Content Knowledge* from 1.97, skewing toward *A moderate amount* to 3.28 which was closer to *A lot.* Although *Content Knowledge* had the lowest overall mean among the three sub-scales for both the pre- and the post-test, it was the subscale with the greatest percentage increase of 66.5%.

Statistical Changes in Teacher Efficacy. The descriptive statistics in the tables above show that there was a numerical increase in the mean for each of the three constructs measuring participants' beliefs in their own ability to implement the curriculum. A paired sample t-test was conducted to determine if the identified numerical increases among the means of each subscale were statistically significant and could therefore be explained by the innovation. Results from the t-test shown in Table 14 indicate that there was a statistically significant difference between the measure of participants' sense of self-efficacy on the pre- and post-intervention surveys for Content Knowledge ($t = 6.34$, $p < 0.001$), Technical Knowledge ($t = 4.10$, $p = 0.005$) and Pedagogical Knowledge ($t = 7.67$, $p < 0.001$).

Table 14

Paired sample t-test for computed means of survey constructs

		Paired Differences							
					95% Confidence Interval				
		Mean	SD	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1: Content Knowledge	Post-test - Pre-test	1.306	0.583	0.206	0.819	1.793	6.340	7	<.001
Pair 2: Technical Knowledge	Post-test - Pre-test	1.125	0.775	0.274	0.477	1.773	4.104	7	.005
Pair 3: Pedagogical Knowledge	Post-test - Pre-test	1.175	0.433	0.153	0.813	1.537	7.668	7	<.001

With the t-test indicating that the changes in mean could be attributed to the innovation, the magnitude of the difference between the means for each subscale was calculated to determine the effect size, or the practical significance, of the changes in participants' sense self-efficacy. Table 15 displays the value of Cohen's d for each of the constructs. The results show an effect size greater than one standard deviation for Technical Knowledge (d = 1.37) and greater than two standard deviations for Content Knowledge (d = 2.24) and Pedagogical Knowledge (d = 2.71).

Table 15

Effect Size

			95% Confidence Interval	
		Cohen's d	Lower	Upper
Pair 1: Content Knowledge	Post-test - Pre-test	2.42	0.883	3.564
Pair 2: Technical Knowledge	Post-test - Pre-test	1.451	0.412	2.446
Pair 3: Pedagogical Knowledge	Post-test - Pre-test	2.711	1.145	4.247

RQ3: Transfer: How effective was the active learning online PD in supporting teachers' facilitation of the district-adopted curriculum?

Qualitative data from the one-to-one and focus group interviews were collected to examine the ways in which teachers incorporated learning from the PD into new classroom practices supportive of implementing the self-direction block of Summit Learning. See Table 12 for a description of the data sources. To answer this research question, first cycle process coding generated 24 sub-codes under the structural code of *Transfer*. Code mapping resulted in eight categories into which each of the sub-codes was sorted. Second-cycle coding used the emerging categories as focused codes leading to larger themes and theme-related topics (see Table 16). Quotes that support the themes are provided within the explanation of themes.

Table 16

Themes and Theme Related Topics

Theme	Theme-Related Topics
Goal Orientation: Essential Knowledge, and Goal Cycles	1. Knowledge about the Self-Directed Learning cycle and its connection to the Model 2. Mindsets and skills about goal setting and its importance to success with Self-Direction 3. Knowledge and skills using the Platform
Student Centered: Systems and Supports for Facilitating Self-Direction	1. Strategies for facilitating SD 2. Strategies planning / implementing workshops 3. Strategies for administering assessments
Connection to Habits of Success	1. Strategies for developing habits during SD 2. Connecting SD to mentoring

Goal Orientation: Essential Knowledge, and Goal Cycles. One theme related to the transfer of knowledge and skills from the PD experience into classroom practice reflected an orientation to goal cycles. This included statements about the importance of goal cycles for Self-Direction within the model, strategies for structuring goal-setting with students as well as ways to leverage the Platform to support goal cycles.

In several instances, teachers expressed having developed a new commitment to goal setting and communicated its importance for the success of the Self-Direction block of time. T1 explained, “The goal setting part, I really fully understood why it's so important” (T1, Interview, April 13). Similarly, T1 connected the relevance of goal setting to Self-Direction and the Platform, “...now, I completely understand why the goals are so important. And how to keep them on track on the Platform” (Interview, April 13).

Teachers also named several concrete strategies related to goal setting and the Self-Directed Learning Cycle that they had already started implementing since engaging

with the PD short-course, or that they intended to implement at the start of the next school year. Two teachers looked to establish routines early at the start of next year,

- "[I learned] how to manage the goal setting, because that's one thing I want to change next year" (T2, Interview, April 13).
- "I really do want to invest the time in goal setting and the beginning, so that is going to make a difference in the long run" (T1, Interview, April 13).

Others reflected on changes made since completing the PD including supporting students to set more specific and attainable goals,

- "I don't think we were focusing heavily on goal setting, but now we really do that" (T5, Focus Group, April 12).
- "After the course we all were really changing the way that we approach the goal setting... when we started it was a little bit more like 'pass content assessment', and now they're very specific" (T3, Focus Group, April 12).

Teachers who made changes to classroom practice since completing the PD commented on the effects these changes had on their students. They said,

- "Kids are actually now accomplishing their goals, because they're attainable during the time that we're giving them" (T4, Focus Group, April 12).
- "When they accomplished their goal, they're like, 'you have to add another goal?' [I say] 'You accomplished your goal, what are you going to do next?' And then they're like, 'yeah give me the next challenge'" (T5, Focus Group, April 12).

There were also two examples of how teachers used the Platform differently to support students with goal setting. T1 alluded to using the Platform to make goal setting more efficient, "[I'm] slowly moving them to the tools on the Platform to make it easier"

(Interview, April 13). T2 described how to use Learning Strategies in the Platform to support students with specific needs, “Two to three of my kiddos still are struggling with their goals, like quickly putting in a goal, and so I have that learning resource for these smart goals” (Interview, April 13).

Student Driven: Systems and Supports for Facilitating Self-Direction. Another theme that surfaced in the data reflected the ways teachers described making the self-direction block of time more student-driven. These reflected practices for the physical layout of the classroom as well as supportive classroom norms and procedures. Two teachers expressed changes they would make early in the next school year. T2 stated, “I know for the beginning of next year, like I need to have some type of assessment norms, I'm hoping to make the expectations clear” (Interview, April 13). Later in the interview, the same teacher elaborated, “Having norms for when the teacher is with the workshop and different things like that, I think that the beginning of the year is important.”

Others described how to establish a more productive environment for students, including changes to make to the classroom layout. T1 said, “there were some examples of the seating arrangements, like this is where you go sit for the assessments. And also, trying to space out the desk a little bit more” (Interview, April 13). Another series of comments described changes that had already been implemented including changing seating, setting time limits for different parts of the self-direction block of time, and adding stations. Some examples of these examples included:

- “We've actually been applying those strategies like having a collaboration table, assessment table, changing our seating, because it actually helped us a lot” (T4, Focus Group, April 12).

- "It's just important to structure our time a certain way. To where students have independent time and then they've got some talking time" (T2, Interview, April 3).
- "We've changed our seating and we have added a collaboration table. And we're moving away from the playlist a little bit, we're adding stations" (T5, Focus Group, April 12).

Connection to Habits of Success. The third theme reflects the ways teachers expressed connections between Self-Direction and the social emotional learning framework in the Summit Learning model known as the *Habits of Success*. T2 noted how the *Habits of Success* can be explicitly taught within the context of the Self-Direction block of time, "I was pulling a small group, it was honestly for content. And then, like well it's more for habits. Like you're teaching or helping them with their skills and the habits, not always the content" (Interview, April 3).

Several other comments mentioned, or alluded to, the ways specific *Habits of Success* supportive of self-directed learning like *growth mindset, resilience,* and *academic tenacity* are present among the students in their classrooms;

- "I'm hitting that growth mindset [with my students] more times throughout the year, it is something that I want to keep focusing on" (T1, Interview, April 13).
- "going over resilience… you're not always going to get it the first time, you might try and take a test, you might not master it your first time, but just understanding that you have to keep working at it and persevere" (T5, Focus Group, April 12).

Teachers also made connections between Self-Direction and another important part of the Summit Learning model which involves mentoring students to explicitly foster

development of the *Habits of Success*. T2 noted the opportunity to infuse development of *Habits of Success* into her mentoring more frequently, “As for me, though, I do need to bring in the *Habits of Success*, more into my mentoring” (Interview, April 3). T1 more specifically connected the opportunity to infuse goal-setting with mentoring, “So next year when I do these meetings, I'll try to start setting the goals right there when I'm mentoring so it's already done, they don't have to worry about it” (Interview, April 13).

In summary, this chapter presented results from both quantitative and qualitative data sources as they pertained to each of the three research questions. For research question 1, quantitative data were used to demonstrate levels of learner engagement, while a mix of both qualitative and quantitative data results reflected participants perceptions of how the instructional design aspects of the active learning online PD influenced engagement. Results from quantitative data sources and from statistical methods were displayed for research question 2 as a measure of the extent to which teachers’ sense of self-efficacy changed. Finally, qualitative results from one-to-one and focus group interviews were presented as evidence for different ways teachers were able transfer learning from the active learning online PD into their implementation of the district-adopted curriculum.

CHAPTER 5

DISCUSSION

The problem of practice at the core of this mixed methods action research study was the challenge of reimagining the design of teacher PD to expand access and increase flexibility while adhering to principles of practice-based teacher development. The innovation was the design and facilitation of an asynchronous active learning online PD short-course. It incorporated instructional design features informed by the intersection of what research has shown to be effective of teacher PD broadly and asynchronous online teacher PD more specifically. The study examined the overall effectiveness of the innovation through the lens of a conceptual model of change (see Figure 1 in Chapter 2) that suggests PD is successful when ensuing knowledge and skills are transferred into classroom practices yielding improved student outcomes. To examine the effectiveness of the innovation, this study explored how the various instructional design aspects influenced learner engagement, how teachers' confidence in their own ability to implement the district adopted curriculum changed, and how teachers were able to transfer knowledge and skills from the active learning online PD into implementing the district-adopted curriculum.

This discussion explicates the study's results by first considering the complementarity and integration of quantitative and qualitative results. Results are also discussed in relation to the guiding theoretical frameworks for teacher PD. Limitations of the study are addressed, as well as implications for practice and future research.

Explanation of Results

Instructional Design and Learner Engagement. The overall findings showed that all eight participants in this research study demonstrated consistently high levels of learner engagement across all three sub-constructs: *emotional engagement, behavioral engagement,* and *cognitive engagement*. Convergence among the quantitative and qualitative data suggests the broad collection of instructional design decisions appealed to learner differences and influenced the high levels of sustained learner engagement. The findings specifically pointed to a collection of instructional design aspects that included: (a) the meaningfulness of the content, (b) the easy-to-navigate learning space, (c) the predicable architecture of learning experiences, (d) the emphasis on active learning coupled with supportive feedback, (e) the flexibility afforded by the asynchronous modality, (d) and the positive interactions with the online PD facilitator. Contextual factors, like the unique challenges presented by the COVID-19 pandemic, also played a role in motivating engagement.

Meaningfulness of the Content. One important driver of learner engagement was participants' perception that the content was meaningful to their own development and their students' success with the Summit Learning model. This finding is consistent with the literature that recognizes the importance of participants finding the content of PD relevant (Guskey, 2000, Powell & Bodur, 2019). It also underscores the significance of PD being aligned to local initiatives (Darling-Hammond, 2017; Desimone, 2009).

The interest in the content for this particular active learning online PD was amplified by the unique context of the school year. The teachers participating in this study negotiated the start of the year remotely and then needed to adjust mid-year as they

transitioned back to in-person learning. The stuttered rhythm of the year made establishing the systems that set students up for success during the Self-Direction block of time especially challenging. Because this online PD was offered shortly after students transitioned back to in-person learning, it was perceived as providing just-in-time support for an identified need. The notion that the perceived relevance of the innovation was not only a function of the content on its own, but also related to when that content is most valuable to the participant is pertinent for two reasons. First, it resonates with the calls of those who advocate for *teacher-centered PD*, or an approach to professional learning that empowers teachers with more autonomy in choosing PD (Cavendish et al., 2020; Díaz-Maggioli, 2004). Second, it reinforces the benefit of increased flexibility that comes with asynchronous online PD by more closely connecting learning experience to the job-embedded application of learning (Fishman et al., 2013; Shaha et al., 2015a; Shaha et al., 2015b).

Active Learning Design. Beyond the meaningfulness of the content, there was also convergence in quantitative and qualitative results suggesting the active learning design played an important role in influencing and helping to sustain engagement throughout the course. The findings showed that participants were motivated by the tasks because of their ability to regularly check their understanding of the content, see useful models of facilitation in action, and engage with case studies and application tasks that reflected familiar classroom-based situations. These findings were especially relevant because authenticity of practice is a critical component of practice-based teacher education (Grossman, et al., 2018; Hauser & Kavanaugh, 2019; Lampert et al., 2013) and increases the likelihood of transfer when the content is practical and concrete (Guskey,

2002; Reeves & Pedulla, 2013). The results highlighted the notion that it is not merely the frequency of interactions in the active learning design that add value to learning in online PD, but rather the relevance of those tasks in relation to actual classroom practices (Kennedy, 2009).

Related to this idea was the degree of challenge among the application tasks. Again, there was convergence in the quantitative and qualitative data suggesting there was an appropriate degree of challenge in the active learning online PD relative to participants' needs. This finding reflects the learning principles of the zone of proximal development and the significance of designing learning tasks that are not too easy to make learners bored while also not too difficult to disrupt effort (Vygotsky, 1978). It is important to mention that the most rigorous tasks in the course, those that best approximated authentic classroom practice, also demanded the most effort from the facilitator to evaluate. While these authentic tasks yielded meaningful feedback, they also added to the complexity of the role of the facilitator.

High-Quality Feedback. Directly tied to the active learning aspect of the innovation was the presence of prompt and substantive feedback, both automated and expert. Results showed that feedback aided reflection, motivated effort, and nurtured the tenacity participants needed to retry and improve on quizzes and application tasks. These findings are consistent with Chakraborty and Muyia's (2014) extensive literature review of empirical studies examining the role of feedback in online learning. The authors concluded that best practices include sustaining the consistency of feedback for the duration of the learning experience, providing positive, constructive feedback that prompts how to improve, and delivering feedback that praises effort, all contribute to a

positive learning experience. The findings also underscore the potential of the technology in online learning to deliver more bespoke learning experiences, by automating individualized real time feedback and presenting learners with more choices about how to use that feedback for making learning decisions (Horn & Staker, 2014).

Of particular interest was how participants received the automated feedback differently from the facilitator's feedback. The former was largely instructive and helped teachers to make informed adjustments to their pacing of the learning experiences. The decisions teachers made in response to feedback often meant going back to review notes, or to review prior pages in a module to strengthen confidence with specific content. The facilitator's feedback, on the other hand, was more motivational and individualized. It tended to praise effort, encourage progress, and make connections to the individuals' context and expressed goals for the course. Participants appreciated this kind of encouragement and noted its effect on their motivation to keep pace and to persevere with completing the course (Chakraborty & Muyia, 2014).

The results that highlighted the influence of the teaching presence are supported by studies examining the Community of Inquiry (CoI) model. That research emphasizes the value of a teaching presence in relation to the cognitive presence and social presence in online learning (Garrison & Arbaugh, 2007; Nagel & Kotzé, 2010). In an asynchronous course, the use of video, instructional text, and automated feedback can simulate some aspects of the teaching presence (Curran et al., 2019; Russel, Kleiman, et al., 2009). Because the innovation minimized collaboration to support greater flexibility with individualized pacing, the overall social presence in the active learning online PD experience was reduced (Duffy et al., 2006; Russell, Kleiman, et al., 2009). Therefore,

from the perspective of the CoI model, it proved particularly valuable to ensure the teaching presence was more strongly represented. Ultimately, the facilitator's interactions with teachers communicated care in their success as learners, and that helped to add a responsiveness to the experience that aided in motivation and engagement (Miltiadou & Savenye, 2003).

Flexibility. It was anticipated that the flexibility of the asynchronous modality would benefit learners by providing more autonomy in choosing when, where, and at what pace to engage with the learning experiences (Dash et al; 2012; Dede, 2006; Reeves & Pedulla, 2013; Yoon et al., 2020). As such, it was not surprising to find complementarity among the quantitative and qualitative results regarding the benefits of the flexible design. Findings revealed that all five teachers who participated in the interviews described entirely unique approaches to when, where, and at what pace, they learned. That each participant pursued a unique approach to learning aligned to their individual preferences highlights the responsiveness of asynchronous online PD and underscores self-pacing as an important affordance identified in the literature (Hsu et al., 2019; Lim, 2016; Parsons et al., 2019; Russell, Kleiman, et al., 2009). At the same time, all interviewees indicated a decision to engage with the online PD course outside of the regular workday. Although teachers valued the ability to work at their own pace and named that aspect of the design as a contributing factor to their positive outcomes, it raises larger questions about the feasibility of asynchronous online PD. Teachers often face competing workplace demands that bleed into personal time, including but not limited to student work analysis, lesson planning, and preparation. Therefore, uses of

online PD that foster self-pacing need to be cautious to avoid adding too much to teachers' already full schedules.

Architecture. Another important aspect of the instructional design was the architecture of the learning experiences. The complexity demanded by the active learning design along with the ability to pursue flexible learning pathways ran the risk of creating a frustrating user experience with the technology, particularly for anyone who may have lacked proficiency with the LMS (Reeves & Pedulla, 2013; Tallent-Runnels et al., 2006). It was relevant, therefore, to see convergence among quantitative and qualitative data suggesting that the ease of navigation contributed to a positive learning experience and supported the agency learners exercised as they worked through the course at their own pace. Findings showed that the overarching structure of each module provided consistency and predictability for learners. Additionally, numerous features built into Canvas, the LMS used in the intervention were were optimized to support tracking individual progress and flexible pathways. One of these features included the "complete all" function which allowed learners to see a check-box for completed pages in each modules. The gradebook was also utilized, through which the facilitator's individualized feedback was provided. Within the context of the active learning design, this made it easy for learners to see feedback, and return to activity to make sense of that feedback or to try again if necessary.

Changes in Self-Efficacy and Transfer. As a result of the high levels of sustained learner engagement, participants' self-efficacy at the conclusion of the online PD increased for all areas of implementing the Self-Direction block of time. Results showed increases in confidence with knowledge about Self-Direction and its role in the Summit

Learning model (content knowledge), increases in how to use the Summit Learning Platform to support students with Self-Direction (technical knowledge), and increases in how to implement high-leverage classroom practices during the Self-Direction block of time (pedagogical knowledge). Research has shown that self-efficacy positively affects teachers' implementation of new teaching strategies (Tschannen-Moran & McMaster, 2009; Zee & Koomen, 2016). It was not surprising, given the increases in self-efficacy, that one month after the conclusion of the PD, participants consistently described concrete examples of transferring knowledge and skills from the PD into their classroom practice. What was most surprising, however, was that the teachers who participated in the PD at the same time as other teachers with whom they regularly collaborated on grade level teams reported higher levels of use with the teaching strategies.

The greatest change in self-efficacy was in the sub-construct of content knowledge. The growth in this area suggested that teachers came into the PD lacking some theoretical understanding of self-directed learning and how it fit within the larger framework of the Summit Learning model. Convergence with the qualitative data suggested growth in teacher mindsets oriented toward goal-setting and student-centered learning during the Self-Direction block. It also showed teachers making connections between the skills students use during Self-Direction and the Habits of Success component of the Summit Learning model, though to a lesser extent.

Patterns in the use of these strategies reflected conceptual themes that spanned content for all three of the self-efficacy constructs that were measured. The multifaceted ways teachers connected goal-setting, student-centered learning, and the Habits of Success to implementation of the Self-Direction block of time reflect critical aspects of

the model that are essential to implementation of Summit Learning (Wilka & Cohen, 2014). These findings were not surprising because they are consistent with research that shows changes in self-efficacy often lead to changes in instructional practice (Fackler & Malmberg, 2016; Klassen & Chiu, 2010; Rimm-Kaufman & Sawyer, 2004)

What was most surprising in the patterns of transfer, however, was the variation in the levels of use among the skills teachers described implementing in the month since the PD had concluded. Hall and Hord (1987) described a progression of uses leveled by their degree of consistency and depth of implementation. Preparing to use a new skill counted as *nonuse*, whereas evaluating the quality of new strategies and making modifications represented the highest level of use. While all participants in this study described uses of new skills across the range of levels, there was a concentration of higher level uses among those teachers who participated in the PD alongside others on their immediate grade level team. These higher-level uses included making variations on strategies practiced in the course to match context, coordinating with colleagues to achieve stronger collective impact, and making modifications to existing practices to align with new insights gleaned from the short-course (Hall & Hord, 1987). Conversely, there were more examples of lower-level uses, like planning for implementing new skills learned in the PD, among the teachers who completed the PD without another colleague from their grade level team or school. These patterns reflect the value of collective participation and collaboration demonstrated in other studies about teacher PD (Desimone et al., 2003; Kennedy, 2016; Yoon, 2007). They raise questions about the potential elevated role of collective participation in supporting transfer of new skills into new classroom practices in the context of asynchronous online PD and seem to suggest rich opportunities for

blended approaches that integrate some online learning with some in-person learning (Means, et. al, 2009; Yurtseven Avci et al., 2020).

Results Relative to Guiding Theoretical Frameworks

The guiding theoretical frameworks for this action research study consisted of the conceptual model for teacher PD displayed in Figure 1 (see Chapter 2), the core characteristics research has shown to be present when PD results in positive student outcomes (see Table 2 in Chapter 2), and the instructional-design principles gleaned from research on effective online teacher PD. The directionally positive results from this study largely affirm the application of the research-based best practices that undergird the literature review. This was true, also, of the inherent evaluation challenges researchers face in connecting the impact of teacher PD to changes in classroom practice that positively impact student outcomes (Dede et al., 2009; Desimone et al., 2013; Guskey & Yoon, 2009).

Characteristics of Effective PD. The results from this study were largely consistent with what research has affirmed about the presence of the five core characteristics commonly found in effective teacher PD: content focus, active learning, collective participation, sustained duration, and coherence. In Ingvarsen's (2005) model, sustained duration, coherence, and some aspects of collective participation can be characterized as structural elements, largely influenced by school leaders and district policies. The other characteristics, representative of opportunities to learn, were more directly influenced by instructional design and facilitation decisions (Ingvarsen, 2005). Intentional inclusion of some aspects of each of the five characteristics contributed to the

largely positive outcomes demonstrated among all participants (Darling-Hammond et al., 2017; Desimone & Garet, 2013; Desimone et al., 2013; Powell & Bodur, 2019).

Coherence. A crucial part of the success of this innovation was its relationship to the district's initiative to implement Summit Learning. This commitment from the district situated the innovation within an existing system of tiered support which added to its coherence with teachers' priorities at the local level (Garet et al., 2001; Ingvarsen, 2005; Reeves & Pedulla, 2013). Furthermore, the innovation was one option among several in a suite of experiences offered by the Summit Learning Professional Learning team. This context supports the study's findings about the participants' perceived meaningfulness and relevance of the PD. Unlike a one-off workshop (Guskey & Yoon, 2009; Hill, 2007), the innovation established a high degree of coherence with other professional learning support and focused on learning classroom strategies that could be immediately applied.

Sustained Duration. Overall, the innovation added approximately five hours of professional learning directly related to implementing Summit Learning. This was in addition to the synchronous summer training and follow-up convenings offered by the Summit Learning Professional Learning team and the regular weekly or monthly coaching offered to participants by the district. While there may have been other professional learning opportunities organized by the district and school that were not identified in this study, it is clear the addition of the innovation contributed to the recommendation of 15-50 contact hours with a topic estimated by research (Desimone et al., 2013; Guskey & Yoon, 2009; Parsons et al., 2019).

However, among the total hours of PD focused on implementing Summit Learning, it is less clear how much of that time was focused specifically on the Self-

Direction component. The findings from this study show that Self-Direction was identified as a particular need for the participants, especially due to the changing modalities necessitated by mitigating the spread of COVID-19. The ability to choose more specific content aligned to one's identified needs was shown to drive learner engagement. This finding implies that the self-paced asynchronous learning solution helped to increase the total number of contact hours of PD relative to individuals' perceived needs for development, and likely brought with it the added benefit of shortening the distance between learning, practice, and application (Fishman, et al., 2013; Russell et al., 2009).

Active Learning. As Darling-Hammond et al. (2017) explained, "PD experiences must address *how* teachers learn, as well as *what* teachers learn" (p. 7). Careful attention was given to creating an active learning environment in the asynchronous online learning space that was responsive to adult learning needs such as building on the wealth of prior experiences, fostering learner agency, and prompting reflection and inquiry (Knowles, 1975; Trotter, 2006). Findings showed how participants valued the frequent sense-making activities that included, among others, modeling of high-leverage practices, and analysis of student-work (Penuel et al., 2007). Although the teachers commented on the authenticity of the practice-based elements in the innovation, those mostly consisted of case study-like simulations. There is an opportunity in the future to make the learning activities even more relevant by situating practice directly in teachers' classrooms with their students, as has been shown to be effective in other studies (Darling-Hammond et al., 2017; Greenleaf et al., 2011). For example, participants might analyze their own

students' data instead of sample data, or they might submit short videos as evidence of having applied new strategies with their students.

Collective Participation. As a characteristic of teacher PD, collective participation, can be accomplished in several ways. On the structural side, research points to value for participating in PD with teachers for whom an affinity is shared, like a grade level team in the same school (Desimone, 2009; Desimone & Garet, 2013; Fischer et al., 2018). Within the realm of opportunities to learn, collective participation speaks more to collaborative learning that occurs in the context of the PD (Borko, 2004; Greenleaf, 2011). The innovation in this study achieved some degree of collective participation by focusing on teachers who were implementing Summit Learning, and who shared a common district. However, to optimize flexibility with self-pacing, it intentionally reduced the emphasis for collaboration in the PD without entirely eliminating opportunities for some social presence (Russel, Carey, et al., 2009). While the findings were consistent with prior research showing that teachers value the autonomy and flexibility to self-pace (Parsons et al., 2020), an unexpected result was how the skills teachers transferred into classroom practice differed in the levels of use. As explained above, the participants who shared students and collaborated closely in grade level teams more consistently described employing higher level uses of new strategies. This elevates the potential relevance of collective participation and demands further attention in future cycles of research to better optimize the benefits of self-pacing with the transferability of collective participation.

Content Focus. The content focus characteristic of effective PD in the literature tends to include alignment with traditional subject-matter content, such as mathematics or

English language arts, as well as the pedagogical strategies for teaching those subjects (Darling-Hammond et al., 2017). However, as some studies have shown, it can also include testing out a new curriculum or narrowing in on a particular pedagogical area, which is similar to this study (Penuel et al., 2011). The content focus of the innovation centered on the theories of self-directed learning and how to foster the development of noncognitive skills among students, which is a critical element of implementing the Summit Learning model (Wilka & Cohen, 2014). The results that pointed to participants development of a mindset oriented to goal setting and the pedagogical strategies for activating more structure and support around goal setting were directly related to the content focus of this PD. Ultimately, the content knowledge goals need to be connected to pedagogical practices which increases the likelihood of transfer (Guskey, 2002; Reeves & Pedulla, 2013).

Limitations

In consideration of these interpretations, it is prudent to identify the limitations of this study's results. One limitation is the small number of participants, all of whom opted into taking the PD short-course and therefore came into the course already motivated to learn. The participants of the study represent only a small percentage of the sample population. The statistical models used to determine the significance of the numerical changes in self-efficacy and the effect size of the innovation are typically used in experimental or quasi-experimental studies with substantially larger samples of the population under study (Marshall & Jonker, 2011; Greenland et al., 2016). Therefore, the results from this study are not generalizable to the larger population of teachers implementing Summit Learning (Smith & Glass, 1987). While this is typically not a goal

of action research studies (Mertler, 2017), it is important to note that the statistical procedures used for measuring change demonstrate a proof of concept which can be replicated for use in future studies of this innovation.

Another limitation of this study, which sought to evaluate the effectiveness of the innovation, is the fact the no data were collected measuring the impact on student outcomes. Recall from Guskey's framework (see Table 1 in Chapter 2) regarding the evaluation of teacher PD; there is an emphasis on evidence from student outcomes that aligns with the conceptual model of change for PD (see Figure 1, Chapter 2). The next level in Guskey's framework, however, focuses evidence on uses of new knowledge and skills in the classroom. Due to restrictions imposed to limit the spread of COVID-19, interviews were used instead of in-class observations to get a sense of how teachers transferred their knowledge and skills into new classroom practices. Although self-reporting raises some validity concerns, interviewing is a common method for evaluating transfer in teacher PD (Guskey, 2000). Furthermore, there is compelling evidence from research that more efficacious teachers can yield positive impacts on student learning outcomes (Fackler & Malmberg, 2016; Holzberger, Philipp, & Kunter, 2014). This fact increases the validity of self-reporting in this study because all teachers who participated in interviews also demonstrated increases in their sense of self-efficacy with implementing the Self-Direction aspect of the Summit Learning model.

A third limitation was the potential for the Hawthorne Effect. The Hawthorne Effect is when measured improvements are caused more by participants feeling as if they received special treatment than by the intervention itself (Smith & Glass, 1987). The potential for the Hawthorne effect was likely amplified by the fact that I was the primary

designer, the facilitator, and the researcher. For example, during interviews, one teacher commented, “we knew this was your course…”. That said, seven out of the eight participants agreed to participate in the study after having completed all coursework and relevant surveys used to measure change, whereas only one consented at the start of the course. Therefore, the Hawthorne effect might have been most relevant to the data collection during interviews. Future studies can mitigate this by increasing the overall sample size, and by separating the role of the researcher from the role of the facilitator (Smith & Glass, 1987).

Implications

Implications for Practice. The findings from this action research study yield several implications for the design of PD in my context. First and foremost, the five core characteristics of effective PD (Desimone, 2009) present a critical guiding framework that should be used for designing effective PD. Examining the core features in relation to the content and the context of the learners will ensure appropriate consideration is given to both structural features and instructional design decisions. Doing so will help PD designers to evaluate the inevitable tradeoffs that must be made when pursuing a project.

Next, the online modality for delivering PD should be used to ensure that effective PD is widely available to teachers across distance and time. Synchronous, asynchronous, and blended options hold tremendous potential for expanding equitable access to high-quality PD (Dede et al., 2019; Yoon, 2020). Because the context of learners varies for each project, having first evaluated the balance among the five core features will help to inform which online approach is best suited to the particular learning needs. For example, the asynchronous design of this study’s innovation worked

particularly well given its coherence with the suite of synchronous offerings made available by the Summit Learning team.

The findings from this study also suggest that in the case of asynchronous online PD, an active learning design should be pursued to maintain the principles of practice-based teacher preparation and to optimize the benefits of the technology. The ICAP Framework (Chi & Wylie, 2014) (See Chapter 2) is especially useful for informing the balance among learner experiences to create a rigorous practice- and feedback-rich experience. However, it must be considered in relation to the authenticity of tasks. The innovation in this study incorporated open-ended tasks that simulated relevant classroom-based applications.

Altogether, the active learning model coupled with authentic tasks and supportive feedback can positively influence learner engagement and sustain motivation for the duration of the PD. However, the more complex open-ended tasks also created more a demanding role for the facilitator to evaluate and give individualized feedback, which becomes challenging at scale. A design challenge for future uses of more on-demand active learning asynchronous PD is to find creative ways of using peer evaluation or self-evaluation to provide opportunities for individualizing feedback without relying as heavily on an expert facilitator.

Another significant implication for practice is the tremendous potential in empowering teachers with more agency over their professional learning. Results from this study show that being able to choose PD that is perceived as meaningful and exercising autonomy over the pace and path of learning can all motivate learner engagement. Furthermore, there is an indication that teachers might also benefit from

being able to choose a modality, like asynchronous online PD, that is appealing from a learning perspective.

Ultimately, flexibility lies at the crux of designing responsive professional learning experiences for teachers. While the technology inherent in online learning offers solutions for optimizing flexibility, tradeoffs must be made when designing PD for any modality. A primary challenge asynchronous PD designers face is in considering the balance between learning experiences that are available on demand versus others that are structured by a facilitator. Whereas the former maximizes autonomy and self-pacing, it reduces the influence of teaching presence and can impact opportunities for collaboration. The CoI model (Garrison & Arbaugh, 2007) should be used for evaluating the tradeoffs between greater flexibility and autonomy with more structure and teaching presence.

Finally, there are implications for the role of collective participation and the quality of collaboration among participants in PD. This study found that collaboration, as a sense-making strategy within the PD, can be minimized to optimize the benefits of self-pacing. But, from the perspective of increasing the likelihood of transfer, there is potentially significant value in going through the PD with others from the grade level team. Future designs that build from the model of this innovation will need to look for opportunities to inspire greater in-person collaboration among grade-alike colleagues in the same school. Communicating and coordinating follow-through activities to school leaders and coaches might increase the potential benefits of those additional learning experiences.

Implications for Future Research. A few implications for future research emerge in consideration of the limitations of this study along with the gaps in the existing

body of research related to online PD. As mentioned in the literature review, there remains a paucity of research connecting the efficacy of face-to-face and online PD to improved student outcomes. (Dash et al., 2012; Dede et al., 2009; Yoon et al., 2020). There also remains a need to better understand the impact of a facilitator in asynchronous online PD. Related to this is the extent to which adaptive learning environments powered by artificial intelligence can automate feedback and provide sufficient cognitive tutoring to compensate for a lack of teaching presence. Finally, there is a need explore the effects of collective participation, along with the ways to support constructive collaboration among participants outside of the online space.

Although evaluating the impact of student outcomes remained outside of the scope of this action research study, there is an opportunity to extend examination of its impact on student actions during the Self-Direction block of time. To evaluate the impact of this innovation of student outcomes, a mixed methods approach could be employed. Quantitative methods could be used to evaluate changes that occur in the quality of goals students set, changes in the frequency with which students use the Platform to assign learning strategies to goals, and changes in completion rates of self-paced units of study. Qualitative methods could look for ways students exhibited Habits of Success supportive of self-direction during one-on-one mentoring sessions or in collaborative work with peers.

To broaden confidence in how the innovation might impact teachers in other contexts, an experimental or quasi-experimental study drawing on a larger sample of teachers implementing the Summit Learning curriculum is recommended. This type of study would treat participants engaged in the innovation as an experimental group,

comparing results against a broader sample of teachers who did not receive the innovation. Quantitative methods for measuring changes in teachers' sense of self-efficacy as well as changes in students' uses of the Platform in relation to goal-setting during Self-Direction for both groups would yield more generalizable results about the efficacy of the innovation.

Another direction for future research is to reveal more insights into the effect of the facilitator in asynchronous online PD. Russel, Kleiman, et al.'s (2009) comparison study examining the effects of four similar online PD courses with varying degrees of support produced unexpected findings. Results showed positive effects from all four conditions, with no discernable differences between the autonomous self-paced version and the highly facilitated version. Additionally, modern advances in information technology have given rise to adaptive learning environments that use real time data to individualize learning pathways (Fontaine et al., 2019). Advances in artificial intelligence have demonstrated the promising potential of fully autonomous asynchronous adaptive learning in various domains (Hillmayr et al., 2020; Steenbergen-Hu & Cooper, 2014). From the perspective of instructional design and socio-cultural learning, future research is recommended for determining how effective automated feedback and adaptive pathways are at sustaining learner engagement and driving outcomes among the complex and interdisciplinary skills of teaching.

Finally, among the participants in Parsons et al. (2019) study, collaboration within the online PD was identified as among the least important features. This notion influenced some of the instructional design of the innovation in this study by minimizing in-course collaboration in favor of more autonomy over pacing. However, the unexpected

findings about the role of collective participation and the differing levels of use point to the potential value of face-to-face collaboration outside of the online space among participants who share a local context. Future studies should examine flexible ways to structure local collaboration among participants with consideration of how to integrate such activities with local support from instructional coaches and school leaders. Bridging the asynchronous online learning space with local collaboration would, in effect, add a blended learning like element to the experience and could increase coherence with local initiatives and context.

Lessons Learned as an Action Researcher. I developed as an educator during an era of public schooling that was shaped by the rise of high-stakes testing and accountability tied to student achievement. This forced an emphasis on quantitative measures of learning and a culture of data driven decision making often connected to standardized tests composed of selected response items.

While I see tremendous value in data informed practices that support differentiating instruction along with great efficiency in quantitative analysis, there is a risk of relying too heavily on quantitative methods for measuring learning.

The mixed methods approach used in this study affirmed for me, the essential need for qualitative data to be taken into consideration when dealing with the complex processes of learning. The science of learning suggests that it is an individual process subject to inherent variability. Individuals' emotions as well as social connections can influence learning in different and often unexpected ways (Charlot et al., 2018).

These principles of learning were more clearly surfaced in the qualitative data collected during interviews as participants shared thoughts that highlighted their unique

context. Individual preferences, emotional aspects of the experience, and the unexpected outcomes resulting from spontaneous social collaboration outside of the PD were all revealed through interviews in ways that would have been a struggle using interviews. As I consider infusing action research into future cycles supportive of continuous research, I recognize the value of continuing to employ mixed methods approaches for data collection and analysis.

Conclusion:

This action research study was premised on the broadest notion that great teaching matters. I hold the belief that great teaching is the manifestation of an interplay among complex and evolving sets of knowledge, skills, and dispositions that ultimately influence the learner's experience, impacting social-emotional development and academic achievement. The act of teaching is shaped by the socio-cultural environment in which learning occurs and by the multifaceted teacher-student, student-teacher, and student-student interactions (John-Steiner & Holbrook, 1996). Just as the teacher does, learners too, exert an influence on the act of teaching, and that act is perceived differently among learners. From this epistemological stance stems a deep fascination with the learning process, in all its elaborate complexity and creative splendor.

I also believe in the potential of technology to provide novel solutions to seemingly intractable learning problems. However, I approach integrating technology into learning situations with a healthy skepticism. I remain particularly wary of what Papert (1987) warned about *technocentric* thinking. Focusing narrowly on what the technology can do instead of what learners might be able to do differently risks of replicating ineffective practices in digital form.

Precisely because learning is a confounding process, teachers value PD that can help them to meet the continuously evolving and variable needs of their students. However, as research has shown, much of the available PD is ineffective at changing practice or improving student outcomes (Hill, et al., 2013; Jacob & McGovern, 2015; Loveless, 2014; Santagata et al., 2011). This reality threatens to exacerbate patterns of educational inequities that have contributed to an *opportunity gap* facing students from historically underserved communities (Carter & Welner, 2013; Ladson-Billings, 2013). Therefore, as an act of social justice, I believe the design and facilitation of PD should not only be effective at changing classroom practices and improving student outcomes, but also widely available to teachers across both distance and time.

To accomplish both aims, this action research study sought to integrate research-based principles about what makes PD effective broadly with instructional design decisions informed by the research on online PD specifically. The resulting innovation was an active learning online PD short-course steeped in learning science principles that spanned theories pertaining to adult learning, professional learning, online learning, and teacher education. While this study points to opportunities to better understand the factors that contribute to effective PD in different contexts, the overall positive results affirm that much can be gleaned from the existing body of research about designing and facilitating effective PD in multiple modalities. At its core, this study highlights the promising potential of leveraging technology to reimagine PD by empowering teachers with more

REFERENCES

Ackermann, E. (2001). Piaget's constructivism, Papert's constructionism: What's the difference. *Future of learning group publication, 5*(3), 438.

Adnot, M., Dee, T., Katz, V., & Wyckoff, J. (2017). Teacher turnover, teacher quality, and student achievement in DCPS. *Educational Evaluation and Policy Analysis, 39*(1), 54–76.

Alexander, P. A., Schallert, D. L., & Reynolds, R. E. (2009). What is learning anyway? A topographical perspective considered. *Educational Psychologist, 44*(3), 176–192.

Allen, D., & Tanner, K. (2005). Infusing Active Learning into the Large-enrollment Biology Class: Seven Strategies, from the Simple to Complex. *Cell Biology Education, 4*(4), 262–268.

Allua, S., & Thompson, C. B. (2009). Inferential statistics. *Air Medical Journal, 28*(4), 168-171.

Altman, N., & Krzywinski, M. (2015). Simple linear regression. *Nature Methods, 12*(11), 999-1000.

Anderson, T., Rourke, L., Garrison, D. R., & Archer, W. (2001). Assessing teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks, 5*(2).

Araujo, M., Carneiro, P., Cruz-Aguayo, Y., & Schady, N. (2016). Teacher quality and learning outcomes in kindergarten. *The Quarterly Journal of Economics, 131*(3), 1415–1453.

Archibald, S., Coggshall, J. G., Croft, A., & Goe, L. (2011). High-quality professional development for all teachers: Effectively allocating resources. Research & Policy Brief. *National Comprehensive Center for Teacher Quality*.

Arnett, T. (2020). *The online edtech that helps educators make distance learning less distant*. Clayton Christensen Institute. https://www.christenseninstitute.org/blog/the-online-edtech-that-helps-educators-make-distance-learning-less-distant/?_sft_topics=personalized-blended-learning

Ball, D. L., & Cohen, D. K. (1999). Developing practices, developing practitioners: Toward a practice-based theory of professional development. In G. Sykes & L. Darling-Hammond (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 30–32). Jossey-Bass.

Ball, D., & Forzani, F. M. (2009). The work of teaching and the challenge for teacher education. *Journal of Teacher Education*, *60*(5), 497–511.

Bambrick-Santoyo, P. (2018). *Leverage leadership 2.0: A practical guide to building exceptional schools*. Jossey-Bass.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* Freeman.

Bates, M. S., Phalen, L., & Moran, C. (2016). Online professional development: A primer. *Phi Delta Kappan, 97*(5), 70-73.

Belland, B. R., Burdo, R., & Gu, J. (2015). A blended professional development program to help a teacher learn to provide one-to-one scaffolding. *Journal of Science Teacher Education, 26*(3), 263-289.

Berry, B. (2013). Good schools and teachers for all students: Dispelling myths, facing evidence, and pursuing the right strategies. In P. L. Carter & K. G. Welner (Eds.), *Closing the Opportunity Gap* (pp. 181–192). Oxford University Press.

Bingham, A. J., Pane, J. F., Steiner, E. D., & Hamilton, L. S. (2018). Ahead of the curve: Implementation challenges in personalized learning school models. *Educational Policy, 32*(3), 454-489.

Birman, B. F., Desimone, L., Porter, A. C., & Garet, M. S. (2000). Designing professional development that works. *Educational leadership, 57*(8), 28-33.

Birman, B., LeFloch, K. C., Klekotka, A., Ludwig, M., Taylor, J., Walters, K., Wayne, A., & Yoon, K. S. (2007). *State and local implementation of the No Child Left Behind Act, volume II—Teacher quality under NCLB: Interim report*. U.S. Department of Education, Office of Planning, Evaluation and Policy Development, Policy and Program Studies Service.

Bloom, B. S. (1956). *Taxonomy of educational objectives. Vol. 1: Cognitive domain*. David McKay Co Inc.

Bonwell, C. C., & Eison, J. A. (1991). *Active Learning: Creating Excitement in the Classroom. 1991 ASHE-ERIC Higher Education Reports*. ERIC Clearinghouse on Higher Education.

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher, 33*(8), 3–15.

Carter, P. L. (2013). Student and school cultures and the opportunity gap: Paying attention and to academic engagement and achievement. In P. L. Carter & K. G. Welner (Eds.), *Closing the opportunity gap* (pp. 143–155).

Carter, P. L., & Welner, K. G. (2013). *Closing the Opportunity Gap: What America Must Do to Give Every Child an Even Chance*. Oxford University Press.

Cavendish, W., Barrenechea, I., Young, A. F., Díaz, E., & Avalos, M. (2021). Urban teachers' perspectives of strengths and needs: The promise of teacher responsive professional development. *The Urban Review*, *53*(2), 318-333.

Chakraborty, M., & Muyia Nafukho, F. (2014). Strengthening student engagement: What do students want in online courses? *European Journal of Training and Development*, *38*(9), 782–802.

Charmaz, K. (2014). *Constructing grounded theory* (2nd ed.). Sage.

Charmaz, K. (2002) Qualitative interviewing and grounded theory analysis. In J. F. Gubrium & J. A. Holstein (Eds.), *Handbook of interview research: Context & method* (pp. 675–94). Thousand Oaks, CA: Sage.

Charlot, J., Leck, C., & Saxberg, B. (2020). *Designing for learning primer: A synthesis of key insights from the science of learning and development.* Transcend. https://static1.squarespace.com/static/55ca46dee4b0fc536f717de8/t/5e34735882e01937d768e9ee/1580495727222/Designing+for+Learning+Primer_Transcend_Web+Version_Feb_2020.pdf

Chen, Y., Chen, N. S., & Tsai, C. C. (2009). The use of online synchronous discussion for web-based professional development for teachers. *Computers & Education*, *53*(4), 1155–1166.

Chi, M. T. H., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational Psychologist*, *49*(4), 219–243.

Christensen, C. (2008). *Disrupting class: How disruptive innovation will change the way the world learns*. McGraw-Hill Education.

Chung Wei, R., Darling-Hammond, L., & Adamson, F. (2010). *Professional learning in the United States: Trends and challenges* (Technical report). https://edpolicy.stanford.edu/sites/default/files/publications/professional-development-united-states-trends-and-challenges.pdf

Cohen, D. K., & Hill, H. C. (2000). Instructional policy and classroom performance: The mathematics reform in California. *Teachers College Record*, *102*(2), 294–343.

Collis, B., & Margaryan, A. (2005). Design criteria for work-based learning: Merrill's First Principles of Instruction expanded. *British Journal of Educational*

Technology, *36*(5), 725–738.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of applied psychology*, *78*(1), 98.

Costantino, T. (2012). Constructivism. In L. M. Given, *The SAGE encyclopedia of qualitative research methods* (pp. 116-120). SAGE Publications.

Creswell, J. (2015). Educational research: *Planning, conducting, and evaluating quantitative and qualitative research* (5th ed.). Pearson Education.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage Publications.

Creswell, J. W., & Miller, D. L. (2000). Determining Validity in Qualitative Inquiry. *Theory Into Practice*, *39*(3), 124–130. JSTOR.

Crisan, C. (2018). The pedagogy of an asynchronous online course: supporting students' engagement. British Congress of Mathematics Education (BCME).

Crowe, E. (2010). Measuring what matters: A stronger accountability model for teacher Education. *Online Submission*. https://files.eric.ed.gov/fulltext/ED518518.pdf

Cuban, Larry. (2001). *Oversold and underused: computers in the classroom*. Harvard University Press.

Curran, V., Gustafson, D. L., Simmons, K., Lannon, H., Wang, C., Garmsiri, M., ... & Wetsch, L. (2019). Adult learners' perceptions of self-directed learning and digital technology usage in continuing professional education: An update for the digital age. *Journal of Adult and Continuing Education*, *25*(1), 74-93.

Darling-Hammond, L. (2016). Research on teaching and teacher education and its influences on policy and practice. *Educational Researcher*, *45*(2), 83-91.

Darling-Hammond, L. (2013). Inequality and school resources: What it will take to close the opportunity gap. In P. L. Carter & K. G. Welner (Eds.), *Closing the opportunity gap* (pp. 77–97).

Darling-Hammond, L., Holtzman, D. J., Gatlin, S. J., & Heilig, J. V. (2005). Does teacher preparation matter? Evidence about teacher certification, Teach for America, and teachereffectiveness. *Education Policy Analysis Archives/Archivos Analíticos de Políticas Educativas*, *13*, 1-48.

Darling-Hammond, L., Hyler, M. E., Gardner, M. (2017). *Effective Teacher Professional Development*. Palo Alto, CA: Learning Policy Institute.

Daro, V., Diekmann, J., Martin, D., Renner, N., Schultz, S., & Wei, R.C. (2015). Examining high leverage instructional practices that support equitable use of performance assessment at Summit Public Schools. *Stanford Center for Assessment, Learning, and Equity*.

Dash, S., Magidin de Kramer, R., O'Dwyer, L. M., Masters, J., & Russell, M. (2012). Impact of online professional development or teacher quality and student achievement in fifth grade mathematics. *Journal of research on technology in education*, *45*(1), 1-26.

Deans for Impact. (2016). Practice with purpose: The emerging science of teacher expertise. Austin, TX: Deans for Impact. https://deansforimpact.org/wp-content/uploads/2016/12/Practice-with-Purpose_FOR-PRINT_113016.pdf

Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life's domain. *Canadian Psychology, 49,* 14–23.

Dede, C. (2006). *Online professional development for teachers: Emerging models and methods.* Harvard Education Press.

Dede, C., Eisenkraft, A., Frumin, K., & Hartley, A. (Eds.). (2016). *Teacher learning in the digital age: Online professional development in STEM education*. Harvard Education Press.

Dede, C., Ketelhut, D., Whitehouse, P., Breit, L., & McCloskey, E. M. (2009). A research agenda for online teacher professional development. *Journal of Teacher Education*, *60*(1), 8–19.

Dede, C., Richards, J., & Saxberg, B. (Eds.). (2018). *Learning engineering for online education: Theoretical contexts and design-based examples*. Routledge.

Denzin, N., & Lincoln, Y. (2018). The discipline and practice of qualitative research. In Denzin, N., & Lincoln, Y. *The SAGE handbook of qualitative research, 5th ed* (pp. 1-26). SAGE Publications.

Desimone, L. (2009). Improving Impact Studies of Teachers' Professional Development: Toward Better Conceptualizations and Measures. *Educational Researcher*, *38*(3), 181–199.

Desimone, L., & Garet, M. S. (2015). *Best Practices in Teachers' Professional Development in the United States*.

Desimone, L., Smith, T., Baker, D., & Ueno, K. (2005). The distribution of teaching quality in mathematics: Assessing barriers to the reform of United States

mathematics instructionfrom an international perspective. *American Educational Research Journal, 42*(3), 501–535.

Desimone, L. M., Smith, T. M., & Phillips, K. J. R. (2013). Linking Student Achievement Growth to Professional Development Participation and Changes in Instruction: A Longitudinal Study of Elementary Students and Teachers in Title I Schools. *Professional Development*, 46.

Díaz-Maggioli, G. (2004). *Teacher-centered professional development*. ASCD.

Dick, B. (2014). *Action research: Qualitative methodology: A practical guide*. SAGE Publications

Dick, W., Carey, L., & Carey, J. O. (2005). *The systematic design of instruction (5th ed.)* Allyn & Bacon.

Dixson, M. D. (2010). Creating effective student engagement in online courses: What do students find engaging?. *Journal of the Scholarship of Teaching and Learning*, 1-13.

Dixson, M. D. (2015). Measuring student engagement in the online course: The Online Student Engagement scale (OSE). *Online Learning, 19*(4), n4.

Duffy, T., Kirkley, J. R., Del Valle Martin, R., Malopinsky, L., Scholten, C., Neely, G.R. & Chang, J. (2006). Online teacher professional development: A learning architecture. In Dede, C. *Online Professional Development for Teachers* (pp. 175-197). Harvard Education Press.

Egalite, A. J., Kisida, B., & Winters, M. A. (2015). Representation in the classroom: The effect of own-race teachers on student achievement. *Economics of Education Review, 45*, 44–52.

Emdin, C. (2016). *For white folks who teach in the hood ... and the rest of y'all too: Reality pedagogy and urban education.* Boston: Beacon Press

Elliott, J. C. (2017). The evolution from traditional to online professional development: A review. *Journal of Digital Learning in Teacher Education, 33*(3), 114-125.

Fackler, S., & Malmberg, L.-E. (2016). Teachers' self-efficacy in 14 OECD countries: Teacher, student group, school and leadership effects. *Teaching and Teacher Education, 56*, 185–195.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics (5th ed.)*. Sage Publications.

Fink, L. D. (2013). *Creating significant learning experiences: An integrated approach to designing college courses*. John Wiley & Sons.

Fischer, C., Fishman, B., Dede, C., Eisenkraft, A., Frumin, K., Foster, B., Lawrenz, F., Levy, A. J., & McCoy, A. (2018). Investigating relationships between school context, teacher professional development, teaching practices, and student achievement in response to a nationwide science reform. *Teaching and Teacher Education, 72*, 107–121.

Fishman, B., Konstantopoulos, S., Kubitskey, B., Vath, R., Park, G., Johnson, H., & Edelson, D.(2013). Comparing the impact of online and face-to-face professional development inthe context of curriculum implementation. *Journal of Teacher Education, 64*(5), 426-438.

Fishman, B., Konstantopoulos, S., Kubitskey, B. W., Vath, R., Park, G., Johnson, H., & Edelson, D. (2014). The future of professional development will be designed, not discovered: Response to Moon, Passmore, Reiser, and Michaels, "Beyond comparisons of online Versus face-to-face pd." *Journal of Teacher Education, 65*(3), 261–264.

Fontaine, G., Cossette, S., Maheu-Cadotte, M. A., Mailhot, T., Deschênes, M. F., Mathieu-Dupuis, G., & Dubé, V. (2019). Efficacy of adaptive e-learning for health professionals and students: a systematic review and meta-analysis. *BMJ open, 9*(8), e025252.

Fraenkel, J. R. & Wallen, N. E. (2005). Validity and reliability, in J. R. Fraenkel and N. E. Wallen, *How to design and evaluate research in education with PowerWeb,* pp. 152-171, Hightstown, NJ: McGraw Hill Publishing Co.

Francescucci, A., & Rohani, L. (2019). Exclusively synchronous online (VIRI) learning: The impact on student performance and engagement outcomes. *Journal of Marketing Education, 41*(1), 60–69.

Fredricks, J., Blumenfeld, P., & Paris, A. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59-109.

Fusarelli, & Fusarelli. (2015). Chapter 8: Federal education policy from Reagan to Obama: Convergence, divergence, and "control." In Cooper, B. S., Cibulka, J. G., & Fusarelli, L. D. (Eds.), *Handbook of Education Politics and Policy* (2nd ed., pp 189-210). Routledge.

Francescucci, A., & Rohani, L. (2019). Exclusively synchronous online (VIRI) learning: The impact on student performance and engagement outcomes. *Journal of marketing Education, 41*(1), 60-69.

Gagné, M., & Deci, E. L. (2005). Self-determination theory and work motivation. *Journal of Organizational behavior, 26*(4), 331-362.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(4), 915–945.

Garrison, D. R., Anderson, T, & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2*, 87–105

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: Review, issues, and future directions. *The Internet and higher education, 10*(3), 157-172.

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education, 53*(2), 106–116.

Gelo, O., Braakmann, D., & Benetka, G. (2008). Quantitative and Qualitative Research: Beyond the Debate. *Integrative Psychological and Behavioral Science, 42*(3), 266–290.

Gibbs, G. (2007). *Analyzing Qualitative Data*. SAGE Publications, Ltd.

Gorski, P. (2002). Dismantling the digital divide: A multicultural education framework. *Multicultural Education*, Fall 2002, 28-30.

Greenleaf, C. L., Litman, C., Hanson, T. L., Rosen, R., Boscardin, C. K., Herman, J., ... & Jones, B. (2011). Integrating literacy and science in biology: Teaching and learning impacts of reading apprenticeship professional development. *American Educational Research Journal, 48*(3), 647-717.

Grossman, P., Kavanagh, S. S., & Dean, C. P. (2018). The turn to practice in teacher education. In P. Grossman (Ed.), *Teaching core practices in teacher education*. Cambridge, MA: Harvard Education Press

Guest, G., MacQueen, K. M., & Namey, E. E. (2012). *Applied thematic analysis*. Thousand Oaks, CA: Sage.

Guskey, T. R. (2000). *Evaluating Professional Development*. ERIC Clearinghouse.

Guskey, T. R. (2002). Does it make a difference? Evaluating professional development. *Educational leadership, 59*(6), 45.

Guskey, T. R. (2003). What Makes Professional Development Effective? T*he Phi Delta*

Kappan, *84*(10), 748–750.

Guskey, T. R. (2016). Gauge impact with 5 levels of data. *JSD, 37*(1), 32-37.

Guskey, T.R., & Sparks, D. (2002). *Linking professional development to improvements in student learning*. ERIC Clearinghouse.

Guskey, T. R., & Yoon, K. S. (2009). What Works in Professional Development? *The Phi Delta Kappan*, *90*(7), 495–500. JSTOR.

Hall, G. E., & Hord, S. M. (1987). *Change in Schools Facilitating the Process. SUNY Series in Educational Leadership* . Distributed by ERIC Clearinghouse.

Hammond, Z., & Jackson, Y. (2015). *Culturally responsive teaching and the brain: Promoting authentic engagement and rigor among culturally and linguistically diverse students*. Corwin, a SAGE company.

Hattie, J. (2003). Teachers Make a Difference, What is the research evidence?. http://research.acer.edu.au/research_conference_2003/4/

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81–112

Hauser, M., & Kavanagh, S. S. (2019). *Practice-based teacher education*. Oxford Research Encyclopedia of Education.

Hawley, W. D., & Valli, L. (1999). The essentials of effective professional development. In L. Darling-Hammond & G. Sykes (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 127-150). Jossey-Bass

Heneman, H. G., Kimball, S., & Milanowski, A. (2006). *The Teacher Sense of Efficacy Scale: Validation Evidence and Behavioral Prediction. WCER Working Paper No. 2006-7*. Wisconsin Center for Education Research.

Herr, K., & Anderson, G. (2005). *The action research dissertation: A guide for students and faculty*. SAGE Publications, Inc.

Hill, H. C. (2007). Learning in the teaching workforce. *The Future of Children, 17*(1), 111-127.

Hill, H. C., Beisiegel, M., & Jacob, R. (2013). Professional development research: Consensus, crossroads, and challenges. *Educational Researcher, 42*(9), 476–487.

Hillmayr, D., Ziernwald, L., Reinhold, F., Hofer, S. I., & Reiss, K. M. (2020). The

potential of digital tools to enhance mathematics and science learning in secondary schools: A context-specific meta-analysis. *Computers & Education, 153,* 103897.

Holzberger, D., Philipp, A., & Kunter, M. (2014). Predicting teachers' instructional behaviors: The interplay between self-efficacy and intrinsic needs. *Contemporary Educational Psychology, 39*(2), 100-111.

Hone, K. S., & El Said, G. R. (2016). Exploring the factors affecting MOOC retention: A survey study. *Computers & Education, 98,* 157-168.

Hord, S. M., & Sommers, W. A. (Eds.). (2008). *Leading professional learning communities: Voices from research and practice.* Corwin Press.

Horn, M. B., & Staker, H. (2014). *Blended: Using disruptive innovation to improve schools*. John Wiley & Sons.

Hsiao, Y.-J. (2015). The culturally responsive teacher preparedness scale: An exploratory study. *Contemporary Issues in Education Research, 8*(4), 241–250.

Hsu, H., Wang, C., & Levesque-Bristol, C. (2019). Reexamining the impact of self-determination theory on learning outcomes in the online learning environment. *Education and Information Technologies, 24*(3), 2159–2174.

Ingvarson, L., Meiers, M., & Beavis, A. (2005). Factors affecting the impact of professional development programs on teachers' knowledge, practice, student outcomes & efficacy. *Professional Development for Teachers and School Leaders,* 1.

Ivankova, N.V. (2015). *Mixed methods applications in action research: From methods to community action*. Sage.

Jacob, A. & McGovern, K. (2015). The mirage: Confronting the hard truth about our quest for teacher development. TNTP.

Jacobs, J. (2017). Pacesetter in personalized learning: Summit Charter network shares its model nationwide. *Education Next, 17*(4), 16-25.

John-Steiner, V., & Holbrook, M. (1996). Sociocultural approaches to learning and development: A Vygoskian framework. *Educational Psychologist, 31*(3/4), 191-206.

Jonassen, D. H. (1991). Objectivism versus constructivism: Do we need a new philosophical paradigm?. *Educational technology research and development, 39*(3), 5-14.

Joyce, B., & Showers, B. (2002). *Student achievement through staff development*. Association for Supervisionand Curriculum Development. *Professional development for teachers and school leaders*, 1.

Kavanagh, S. S., Metz, M., Hauser, M., Fogo, B., Taylor, M. W., & Carlson, J. (2020). Practicing responsiveness: Using approximations of teaching to develop teachers' responsiveness to students' ideas. *Journal of Teacher Education, 71*(1), 94-107.

Kelley, K., & Preacher, K. J. (2012). On effect size. *Psychological Methods, 17*(2), 137–152.

Kennedy, M. M. (2016). How does professional development improve teaching? *Review of Educational Research, 86*(4), 945–980.

Khalil, H., & Ebner, M. (2014, June). MOOCs completion rates and possible methods to improve retention-A literature review. In *EdMedia+ innovate learning* (pp. 1305-1313). Association for the Advancement of Computing in Education (AACE).

King, A. (1993). From Sage on the Stage to Guide on the Side. *College Teaching, 41*(1), 30–35.

Kissau, S., & Algozzine, B. (2015). The impact of mode of instructional delivery on second language teacher self-efficacy. *ReCALL: the Journal of EUROCALL, 27*(2), 239.

Kleiman, G. M. (2004). Meeting the need for high quality teachers: E-learning solutions. Paper presented at the U.S. Department of Education Secretary's No Child Left Behind Leadership Summit (July 12–13).

Knowles, M. (1975). *Self-Directed Learning*. Follet.

Knowles, M. (1984). *Andragogy in Action*. Jossey-Bass.

Koro-Ljungberg, M., Yendol-Hoppey, D., Smith, J. J., & Hayes, S. B. (2009). (E)pistemological awareness, instantiation of methods, and uninformed methodological ambiguity in qualitative research projects. *Educational Researcher, 38*(9), 687–699.

Ladson-Billings, G. (1994). *The dreamkeepers: Successful teachers of African American children.* Jossey-Bass.

Ladson-Billings, G. (2013). Lack of achievement or loss of opportunity? In P. L. Carter & K. G. Welner (Eds.), *Closing the opportunity gap* (pp. 11–22).

Lampert, M., Franke, M. L., Kazemi, E., Ghousseini, H., Turrou, A. C., Beasley, H., Crowe, K. (2013). Keeping it complex: Using rehearsals to support novice teacher learning of ambitious teaching. *Journal of Teacher Education, 64*(3), 226-243.

Lench, S., Fukuda, E., & Anderson, R. (2015). Essential skills and dispositions: Developmental frameworks for collaboration, creativity, communication, and self-direction. *Center for Innovation in Education at the University of Kentucky.*

Lim, J. (2016). The Relationship between Successful Completion and Sequential Movement in Self-Paced Distance Courses. *The International Review of Research in Open and Distributed Learning*, *17*(1).

Little, C. A., & Housand, B. C. (2011). Avenues to professional learning online: Technology tips and tools for professional development in gifted education. *Gifted Child Today, 34*(4), 18-27.

Loveless, T. (2014). What do we know about professional development? Brookings. https://www.brookings.edu/research/what-do-we-know-about-professional-development/

Luo, H., Yang, T., Xue, J., & Zuo, M. (2019). Impact of student agency on learning performance and learning experience in a flipped classroom. *British Journal of Educational Technology, 50*(2), 819-831.

Mäkinen, M. (2006). Digital empowerment as a process for enhancing citizens' participation. *E-Learning and Digital Media*, *3*(3), 381–395.

Mandernach, B. J. (2015). Assessment of student engagement in higher education: A synthesis of literature and assessment tools. *International Journal of Learning, Teaching and Educational Research*, *12*(2).

Marshall, G., & Jonker, L. (2011). An introduction to inferential statistics: A review and practical guide. *Radiography*, *17*(1), e1–e6.

Martin, F., Parker, M. A., & Deale, D. F. (2012). Examining interactivity in synchronous virtual classrooms. *The international review of research in open and distributed learning*, *13*(3), 228.

McCaffrey, J. R., Lockwood, D. F., Koretz, D. M., & Hamilton, L. S. (2003). *Evaluating value added models for teacher accountability* [Monograph]. Santa Monica, CA: RAND Corporation. http://www.rand.org/pubs/monographs/2004/RAND_MG158.pdf

McDonald, L. (2011). Transfer of Training in Teacher Pd: A Process-Outcome Orientation. *Procedia-Social and Behavioral Sciences*, *29*, 1885–1894.

McHugh, M. L. (2013). The chi-square test of independence. *Biochemia Medica, 23*(2), 143–149. doi:10.11613/BM.2013.01

McTighe, J., & Wiggins, G. (2011). *The Understanding by Design Guide to Creating High-Quality Units*. ASCD.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). *Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies* [Monograph]. Centre for Learning Technology. https://repository.alt.ac.uk/629/

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development, 50*(3), 43–59.

Mertens, D. M. (2015). *Research and evaluation in education and psychology* (4th ed.). Sage.

Mertler, C. (2017). *Action research: Improving schools and empowering educators* (5th ed.). Sage.

Meyer, A., Rose, D.H., & Gordon, D. (2014) *Universal design for learning: Theory and practice*. CAST.

Miltiadou, M. and Savenye, W.C. (2003). Applying social cognitive constructs of motivation to enhance student success in online distance education. *AACE Journal*, *11*(1), 78-95.

Moore, M. (1989). Three types of interaction. *American Journal of Distance Education, 3*(2), 1–6.

Nagel, L., & Kotzé, T. G. (2010). Supersizing e-learning: What a CoI survey reveals about teaching presence in a large online class. *The Internet and Higher Education, 13*(1-2), 45-51.

National Research Council (NRC). (2000). *How people learn: Brain, mind, experience, and school*, Expanded edition. J.D. Bransford, A.L. Brown, and R.R. Cocking (Eds.), Washington, DC: National Academy Press.

National Research Council (NRC). (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. National Academies Press.

Nieto, S. (2015). *The light in their eyes: Creating multicultural learning communities*. Teachers College Press.

Nye, B., Konstantopoulos, S., & Hedges, L. V. (2004). How large are teacher effects? *Educational Evaluation and Policy Analysis, 26*(3), 237-257

O'Dwyer, L. M., Master, J., Dash, S., De Kramer, R. M., Humez, A., & Russell, M. (2010). E-learning for educators: Effects of online professional development on teachers and their students: Findings from four randomized trials. http://www.bc.edu/research/intasc/PDF/EFE_Findings2010_Report.pdf

Papert, S. (1987). Computer criticism vs. technocentric thinking. *Educational Researcher, 16*, 22-30.

Parsons, S. A., Hutchison, A. C., Hall, L. A., Parsons, A. W., Ives, S. T., & Leggett, A. B. (2019). US teachers' perceptions of online professional development. *Teaching and Teacher Education: An International Journal of Research and Studies, 82*(1), 33-42.

Penuel, W. R., Fishman, B. J., Yamaguchi, R., & Gallagher, L. P. (2007). What makes professional development effective? Strategies that foster curriculum implementation. *American Educational Research Journal*, *44*(4), 921–958.

Penuel, W. R., Gallagher, L. P., & Moorthy, S. (2011). Preparing teachers to design sequences of instruction in Earth systems science: A Comparison of three professional development programs. *American Educational Research Journal, 48*(4), 996–1025.

Polly, D., McGee, J., Wang, C., Martin, C., Lambert, R., & Pugalee, D. K. (2015). Linking professional development, teacher outcomes, and student achievement: The case of a learner-centered mathematics program for elementary school teachers. *International Journal of Education Research, 72*, 26–37

Powell, C. G., & Bodur, Y. (2019). Teachers' perceptions of an online professional development experience: Implications for a design and implementation framework. *Teaching and Teacher Education, 77*, 19-30.

President's Information Technology Advisory Committee. (2000). Resolving the digital divide: Information, access and opportunity.

Reeve, J., & Tseng, C. M. (2011). Agency as a fourth aspect of students' engagement during learning activities. *Contemporary Educational Psychology, 36*, 257–267.

Reeves, T. D., & Chiang, J. L. (2019). Effects of an asynchronous online data literacy intervention on pre-service and in-service educators' beliefs, self-efficacy, and practices. *Computers & Education, 136*, 13-33.

Reeves, T. D., & Pedulla, J. J. (2013). Bolstering the impact of online professional

development for teachers. *The Journal of Educational Research, 1*, 50-66.

Richardson, J. C. & Alsup, J. (2015). From the classroom to the keyboard: How seven teachers created their online teacher identities. *International Review of Research in Open and Distributed learning, 16*(1), 142-167.

Rienties, B.; Brouwer, N., & Lygo-Baker, S. (2013). The effects of online professional development on higher education teachers' beliefs and intentions towards learning facilitation and technology. *Teaching and Teacher Education, 29*, 122-131.

Riggs, S. A., & Linder, K. E. (2016). *Actively Engaging Students in Asynchronous Online Classes*. IDEA Paper# 64. *IDEA Center, Inc.*

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences, 4*(2), 155–169.

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*(2), 417-458.

Rockoff, J. (2004). The impact of individual teachers on student achievement: Evidence from panel data. *American Economic Review, 94*(2), 247-252

Rockoff, J. E., Jacob, B. A., Kane, T. J., & Staiger, D. O. (2011). Can you recognize an effective teacher when you recruit one?. *Education finance and Policy, 6*(1), 43-74.

Rogers-Shaw, C., Carr-Chellman, D. J., & Choi, J. (2018). Universal design for learning: Guidelines for accessible online instruction. *Adult learning*, *29*(1), 20-31.

Rose, T. (2016). *The end of average: How to succeed in a world that values sameness*. San Francisco, CA: HarperOne.

Russell, M., Carey, R., Kleiman, G., & Venable, J. D. (2009). Face-to-face and online professional development for mathematics teachers: A comparative study. *Journal of asynchronous learning networks*, *13*(2), 71-87.

Russell, M., Kleiman, G., Carey, R., & Douglas, J. (2009). Comparing Self-paced and Cohort-based Online Courses for Teachers. *Journal of Research on Technology in Education*, *41*(4), 443–466.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of

intrinsic motivation, social development, and well-being. *American Psychologist, 11*.

Saldaña, J. (2015). *The coding manual for qualitative researchers*. Sage.

Saldaña, J. (2018). Researcher, analyze thyself. *International Journal of Qualitative Methods*, *17*(1).

Sample McMeeking, L.B., Orsi, R. & Cobb, R.B. (2012). Effects of a teacher professional development program on the mathematics achievement of middle school students. *Journal for Research in Mathematics Education, 43*(2), 159–181.

Santagata, R., Kersting, N., Givvin, K. B., & Stigler, J. W. (2011). Problem implementation as a lever for change: An experimental study of the effects of a professional development program on stu- dents' mathematics learning. *Journal of Research on Educational Effectiveness, 4*, 1–24.

Schallert, D. L., & Martin, D. B. (2003). A psychological analysis of what teachers and students do in the language arts classroom. In J. Flood, D. Lapp, J. R. Squire, & J. M. Jensen (Eds.), *Handbook of research on teaching the English language arts* (2nd ed., pp. 31-45). New York: Macmillan.

Schwartz, S. (2019, May 15). *What do teachers really want from professional development? Respect.* Education Week. https://www.edweek.org/ew/articles/2019/05/15/what-do-teachers-really-want-from-professional.html

Shaha, S. H., & Ellsworth, H. (2013). Predictors of success for professional development: Linking student achievement to school and educator successes through on-demand, online professional learning. *Journal of Instructional Psychology, 40.*

Shaha, S., Glassett, K., Copas, A., & Ellsworth, H. (2015). Title I schools: The student-based impact of online, on-demand professional development on educators. *Contemporary Issues in Education Research, 8*(4), 227-234.

Shulman, R. D. (2018, January 26). *EdTech Investments Rise To A Historical $9.5 Billion: What Your Startup Needs To Know*. Forbes. https://www.forbes.com/sites/robynshulman/2018/01/26/edtech-investments-rise-to-a-historical-9-5-billion-what-your-startup-needs-to-know/?sh=53e2b2fa3a38

Smith, M. L. & Glass, G. V. (1987). Experimental studies in M. L. Smith and G. V Glass (Eds.), *Research and Evaluation in Education and the Social Sciences* (pp. 124-157). Allyn and Bacon.

Snow-Renner, R., & Lauer, P. (2005). Professional development analysis. McREL Insights. *Mid-Content Research for Education and Learning (McREL)*

Spector, J. M. (2014). Conceptualizing the emerging field of smart learning environments. *Smart Learning Environments, 1*(1), 2.

Spellings, M. (2005). *10 Facts About K–12 Education Funding.* https://www2.ed.gov/about/overview/fed/10facts/10facts.pdf

Sun, A., & Chen, X. (2016). Online education and its effective practice: A research review. *Journal of Information Technology Education: Research, 15*, 157–190.

Steenbergen-Hu, S., & Cooper, H. (2014). A meta-analysis of the effectiveness of intelligent tutoring systems on college students' academic learning. *Journal of educational psychology, 106*(2), 331.

Swan, K., Garrison, D. R., & Richardson, J. C. (2009). A constructivist approach to online learning: The community of inquiry framework. In Information technology and constructivism in higher education: *Progressive learning frameworks* (pp. 43-57). IGI global.

Tallent-Runnels, M. K., Thomas, J. A., Lan, W. Y., Cooper, S., Ahern, T. C., Shaw, S. M., & Liu, X. (2006). Teaching courses online: A review of the research. *Review of Educational Research, 76*(1), 93-135.

Teddlie, C., & Yu, F. (2007). Mixed methods sampling: A typology with examples. *Journal of Mixed Methods Research, 1*(77), 77-100.

Tobin, T. J. (2014). Increase online student retention with universal design for learning. *Quarterly Review of Distance Education, 15*(3).

Trotter, Y. D. (2006). Adult learning theories: Impacting professional development programs. *Delta Kappa Gamma Bulletin, 72*(2), 8.

Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education, 17*, 783-805.

U.S. Department of Education, Office of Educational Technology. (2010). *National education technology plan.* https://www.ed.gov/sites/default/files/netp2010.pdf

U.S. Department of Education, Office of Educational Technology. (2017). *2017 National education technology plan update.* https://tech.ed.gov/netp/

Villegas, A. M., & Lucas, T. (2002). *Educating culturally responsive teachers: A coherent approach*. State University of New York Press.

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wenglinsky, H. (2000). *How teaching matters: Bringing the classroom back into discussions of teacher quality*. The Milken Family Foundation and Educational Testing Service.

Wilka, M. & Cohen, J. (2014). Self-Directed Learning at Summit Public Schools. FSG. https://www.fsg.org/publications/self-directed-learning-summit-public-schools

Wiske, M.S., Perkins, D., & Spicer, D.E. (2006). Piaget goes digital. Negotiating accommodation of practice to principles. Dede, C. (Ed.). (2006). *Online professional development for teachers: Emerging models and methods*. Harvard Education Press.

Wiggins, G. P. (1998). *Educative assessment: Designing assessments to inform and improve student performance* (1st ed). Jossey-Bass.

Yurtseven Avci, Z., O'Dwyer, L. M., & Lawson, J. (2020). Designing effective professional development for technology integration in schools. *Journal of Computer Assisted Learning, 36*(2), 160-177.

Yoon, K. S., Duncan, T., Lee, S. W.-Y., Scarloss, B., & Shapley, K. (2007). *Reviewing the evidence on how teacher professional development affects student achievement* (Issues &Answers Report, REL 2007–No. 033). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest. http://ies.ed.gov/ncee/edlabs

Yoon, S. A., Miller, K., & Richman, T. (2020). Comparative study of high-quality professional development for high school biology in a face-to-face versus online delivery mode. *Educational Technology & Society, 23*(3), 68-80.

Yost, D. S. (2006). Reflection and self-efficacy: Enhancing the retention of qualified teachers from a teacher education perspective. *Teacher Education Quarterly, 33*(4), 59–76.

Zee, M., & Koomen, H. M. (2016). Teacher self-efficacy and its effects on classroom processes, student academic adjustment, and teacher well-being: A synthesis of 40 years of research. *Review of Educational Research, 86*(4), 981–1015.

Zeichner, K. (2012). The turn once again toward practice-based teacher education. *Journal of Teacher Education, 63*(5), 376–382.

APPENDIX A

SURVEY

Section 1: Participant Information

Directions: Knowing some things about you will help to improve this survey. Please answer the following questions.

1. With what grade level(s) do you work? Please check all that apply.

- ❑ Elementary
- ❑ Middle
- ❑ High School
- ❑ Not Applicable

2. What is your role?

- ❑ Teacher
- ❑ Coach
- ❑ School Leader
- ❑ Curriculum Developer
- ❑ PD Specialist

3. For how many years has your grade level team implemented SL?

- ❑ 0-1 years
- ❑ 1-2 years
- ❑ 2-3 years
- ❑ 4 or more years

4. How frequently do you meet with an administrator or instructional coach for individual support with implementing SL?

- ❑ At least once per week
- ❑ At least once per month
- ❑ At least once every 2-4 months
- ❑ At least once per year

Section 2: Teacher Beliefs

This section is designed to help us gain a better understanding of the kinds of things that create challenges for teachers implementing the Self-Direction component of the Summit Learning (SL) curriculum.

Directions: Directions: For each of the 12 questions below, please indicate your opinion by marking one of the responses ranging from *A Great Deal* to *None At All*.

Please respond to each of the questions by considering your *current* ability to do each of the following.	**A great deal**	**A lot**	**A moderate amount**	**A little**	**None at all**
1. To what extent can you explain the meaning of self-direction to adults who are new to the SL curriculum?					
2. To what extent can you explain the steps of the Self-Directed Learning Cycle to someone new to the SL curriculum?					
3. To what extent can you identify student actions that reflect effective self-directed learning strategies in the SL curriculum?					
4. To what extent can you evaluate the quality of goals students set in the Platform?					
5. How much can you do to help students set high-quality goals?					
6. To what extent can you analyze student data in the Platform to identify barriers to effective self-directed learning that individual students experience?					
7. How much do you know in the Platform to support students with developing Habits supportive of self-direction?					

8. To what extent can you use Learning Strategies in the Platform to help students improve their goals?	
9. To what extent can you explain the primary teacher roles for facilitating self-directed learning in the SL curriculum?	
10. To what extent can you establish routines for a productive environment supportive of self-directed learning?	
11. To what extent can you use data in the Platform to plan for small group workshops?	
12. How much can you do to personalize support for individual students?	

Section 3: Learner Engagement

This section is for you to reflect on your levels of engagement with the course.

Directions: Please answer using the following scale:

1. very characteristic of me
2. characteristic of me
3. moderately characteristic of me
4. not really characteristic of me
5. not at all characteristic of me

Within the course, how well do the following behaviors, thoughts and feelings describe you?	**Very characteristic of me**	**Characteristic of me**	**Moderately characteristic of me**	**Not really characteristic of me**	**Not at all characteristic of me**
1. Making sure to stay on pace					
2. Putting forth effort					
3. Listening/Reading course materials carefully					

4. Finding ways to make the course material relevant to my classroom	
5. Applying course material to my classroom	
6. Finding ways to make the course interesting to me	
7. Really desiring to learn the material	
8. Participating actively in course activities	
9. Earning high points on course activities	
10. Applying feedback to improve on course activities	
11. Responding to colleagues in discussion forums	

Section 4: Learning Experience

This section...

Directions: Please answer using the following scale:

Within the course, how well do the following behaviors, thoughts and feelings describe you?	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
1. Overall, the learning experience was more flexible than typical in-person PD workshops					
2. Being able to work at my own pace kept me engaged					
3. Being able to choose when I worked on the course kept me engaged					

4. Being able to choose the pathway of learning in this course kept me engaged	
5. The frequent opportunities to check my understanding through practice activities kept me engaged	
6. I received helpful feedback.	
7. I found the interactions with course facilitator supportive of my ability to successfully complete the course	
8.There was an appropriate degree of challenge in the course.	
9. Overall, the content I learned in this course is meaningful to my confidence teaching in a Summit Learning classroom.	

APPENDIX B

POST-PD INTERVIEW / FOCUS GROUP QUESTIONS

Part 1: Learner Experience and Instructional Design

1. Describe how you approached working on this course (when did you find yourself working, where, for how long at a time)?
    a. What was it like to be able to choose?
2. What other kinds of choices did you make as a learner?
    a. Did you work in a sequential pathway? Why or why not?
    b. Did you try any of the quizzes more than once? Why or Why not?
3. Describe the role of the course facilitator.
    a. In what ways, if at all, did interactions with the facilitator influence your experience?
4. What are some specific ways this course appealed to you as a learner?
    a. Did [example] influence your engagement with the course?
5. What ideas do you have that could improve the learning experience for this course?
6. Given the unprecedented circumstances you have faced, navigating the pandemic in your personal and professional lives, negotiating distance learning and distance collaboration, and the broadening academic and social-emotional needs of students impacted by all of this - in what ways, if at all, did this context influence your your experience with the online PD course?

Part 2: Transfer of new knowledge and skills

1. This year, in the midst of the global pandemic, has brought unprecedented challenges to teaching and learning. What has it meant for you and your students

    a. as a teacher?
    b. As a teacher new to Summit?
    c. How has it impacted the development of students' self-direction skills?
2. What about your facilitation during the self-direction block was effective?
    a. What evidence did you notice?
3. In what ways were you able to execute your plans?
    a. Can you describe any ways you may have used the Platform as part of your plans?
    b. Were there any things you had planned to do, but were unable to perform?
4. In what ways did you incorporate habits development into the lesson?
5. In what ways did you personalize supports?
6. As a whole, describe this class' development with self-directed learning.
    a. What are some whole class goals you have for the next month?
    b. Can you share some goals individuals are working toward?

APPENDIX C

COMPTENCIES RELATED TO SELF-DIRECTION

2b: Student Driven - Educators empower students to be self-directed in planning and executing a unique learning path that enables them to master learning objectives by employing any of the following sample strategies		
Teacher Look Fors	Establishing routines, procedures, and resources (such as task cards) so that students can drive their learning, know what to do when they need feedback, and can assess when to complete a task or engage in collaborative support (P)	Evidence:
1b: Goal Orientation - Educators ensure students internalize short- and long-term goals that build toward a meaningful purpose for learning and serve as guides for daily work by using any of the following sample strategies		
Teacher Look Fors	Providing direct instruction on goal setting and criteria for high quality goals (e.g., SMART goals) Facilitating daily or weekly goal-setting routines Establishing and articulating goals with students Modeling goal setting	Evidence:
4b: Academic Urgency - Educators support students in maximizing their time and energy to further progress toward goals by employing any of the following sample strategies		
Teacher Look Fors	Establishing clear routines for starting class, including a routine for entering class, a consistent response to students who arrive late, an opening activity that students can start independently, clear norms and expectations visible to students, and a procedure for taking attendance	Evidence:
3b: Essential Knowledge - Educators ensure students engage with content and concepts that are complex and challenging by using any of the following sample strategies		
Teacher Look Fors	Reinforcing the development of the self-directed learning cycle by	Evidence:

	establishing time to reflect on learning, data, or common misunderstandings	
4b: Social Emotional Habits - Educators support students in developing the social emotional habits that contribute to lifelong success by employing any of the following sample strategies		
Teacher Look Fors	Providing explicit direct instruction on key habits	Evidence:

APPENDIX D

ASU IRB APPROVAL LETTER

ASU Knowledge Enterprise Development

EXEMPTION GRANTED

Terri Kurz
Division of Teacher Preparation - Polytechnic Campus
-
Terri.Kurz@asu.edu

Dear Terri Kurz:

On 1/13/2021 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Designing for Transfer: Instructional Design for Active Learning in Online Teacher Professional Development
Investigator:	Terri Kurz
IRB ID:	STUDY00013082
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Consent Letter_Starr_01-2021_v4.pdf, Category: Consent Form; • IRB Social Behavioral_Starr Dissertation_v3.docx, Category: IRB Protocol; • Recruitment_2021.pdf, Category: Recruitment Materials; • SL Online_2020 .pdf, Category: Recruitment materials/advertisements /verbal scripts/phone scripts; • Supporting Documents_Starr_1_4_2021.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 1/13/2021.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

If any changes are made to the study, the IRB must be notified at research.integrity@asu.edu to determine if additional reviews/approvals are required. Changes may include but not limited to revisions to data collection, survey and/or interview questions, and vulnerable populations, etc.

Sincerely,

IRB Administrator

cc: Jeffrey Starr
Jeffrey Starr