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Virtual Teacher Collaboration: A Case Study of Singleton High School Teachers

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Education

by

Jennifer Lynn Lark

2022

ABSTRACT OF THE DISSERTATION

Virtual Teacher Collaboration: A Case Study of Singleton High School Teachers

by

Jennifer Lynn Lark

Doctor of Education

University of California, Los Angeles, 2022

Professor Megan L. Franke, Co-Chair

Professor Kristen L. Rohanna, Co-Chair

Teacher professional learning communities (PLCs) provide a promising approach for improving teacher practice and student learning. However, challenges such as a lack of stable settings, lack of content-alike PLC groupings for singleton teachers, and interpersonal issues related to the collaborative inquiry process, impede their effective implementation in schools. Virtual PLCs (vPLCs) may solve some logistical obstacles yet exacerbate interpersonal issues, given their own unique challenges. This descriptive case study examines how a strategically designed vPLC was implemented to foster group social connection among four geographically spread singleton high school teachers, who sought to improve psychology instruction. This study utilizes observations, participant perceptions, and web-based document analyses to provide a detailed description of a 12-week vPLC. Specifically, it investigates the establishment and development of group social connection, and ways in which the vPLC was implemented to support group social connection.

The study imparts two broad categories of findings. First, the findings suggest the importance of establishing and developing two interrelated types of group social connection in the virtual context: group social presence, and collegiality via joint productive activity (JPA). Practitioners can privilege and structure group social connection by providing time and space for teachers to engage in intentionally designed tasks and prompts that support teachers' interpersonal interactions and JPA. Second, evidence suggests that group social connection is supported by technical mediators enacted by a trained facilitator to promote media naturalness in the virtual context. Practitioners can specifically support group social connection by intentionally addressing three dimensions of media naturalness to support group social connection in the virtual context: audiovisual, collaboration, and facilitation naturalness.

The dissertation of Jennifer Lynn Lark is approved.

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2022

DEDICATION

To my exaltation of Larks.

Peter J. Lark, you are my treasured co-facilitator. Ben and Tommy Lark, you are our most valuable teammates. Together, we continually prove that “teamwork makes the dream work.”

I dedicate this manuscript to you, my Dream Team.

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CHAPTER 1: INTRODUCTION

Teacher professional development is a driving force to improve teachers' practice and students' academic success. Policymakers and educators annually invest billions of dollars in a multitude of teacher professional development models. However, not all models achieve their intended aims. Some have proven more viable and fruitful than others. Much research has shown the promise of Teacher Professional Learning Communities (PLCs) for improving teaching practices and student achievement, yet there are still key logistical challenges to implementing them effectively in American schools (Carpenter, 2018; Darling-Hammond, Hyler, & Gardner, 2017; Goodwin, 2014; Hord, 2004; Lomos, Hofman, & Bosker, 2011). These challenges include a lack of stable settings, a lack of content-alike PLC groupings for singleton teachers, and interpersonal issues related to the collaborative inquiry process. Virtual PLCs (vPLCs) may solve some logistical obstacles yet exacerbate interpersonal issues, given their own unique challenges (Carpenter & Munshower, 2020; Durr, Hales, & Browning, 2020; McConnell, Eberhardt, Koehler, & Lundeberg, 2013; Wang, Yu, Wang, & Chen, 2019). More research is necessary to understand how to overcome these challenges. Though a PLC's potential to effectively improve teaching and learning hinges on its ability to generate learnings through effective collaborative group processes, we lack empirically based research explaining how to design and implement a PLC that fosters these key conditions for effectiveness within the virtual environment. The present study explores the implementation of an innovative, research-based vPLC designed to address known interpersonal obstacles.

Statement of the Problem

Teacher professional development is a national priority for improving teachers' practice and students' academic success. Expenditures on Title II of the Elementary and Secondary Education Act (ESEA), which annually provides K-12 schools with funds to support teacher professional development, were budgeted at \$2.6 billion for 2020 – a \$500 million increase over 2019 (ASCD, 2021). Despite such investment, not all professional development models create lasting change in teachers' practice (Loveless, 2014). For instance, many K-12 school districts continue to rely on top-down, episodic workshops and presentations delivered by outside experts (Borko, 2004; Darling-Hammond et al., 2017; Wei et al., 2009a). These short-term events may impart information about abstract educational principles to large groups of teachers from all subject areas and grades, without regard for teachers' context-specific, individual needs (Kesson & Henderson, 2010; Wei & Darling-Hammond, 2009a). Such broad information may be disconnected from teachers' lived experiences in the classroom, and teachers may not find them relevant or useful (Darling-Hammond et al., 2017; Wei & Darling-Hammond, 2009a). In these instances, top-down, short-term models may not transform teachers' practice.

By contrast, teachers value active participation in long-term, job-embedded, collaborative professional development- support that is grounded in their daily practice, with opportunities for feedback and reflection (Darling-Hammond et al., 2017, Wei & Darling-Hammond, 2009a). Professional development of this nature builds teachers' instructional capacity. It provides content-specific, evidence-based practices, and improves teachers' practice and students' academic achievement (Darling-Hammond et al., 2017; Darling-Hammond & Richardson, 2009; Garet et al., 2008; Knapp, 2003; Weiss & Pasley, 2006). One such promising professional development model is the teacher PLC.

PLCs Influence Teachers' Practice and Student Achievement

PLCs have been broadly defined as a model for job-embedded collaborative groupings of educators (DuFour, DuFour, Eaker, & Karhanek, 2004). Members of a PLC collaborate on improving their instructional practice and student learning (Carpenter, 2018; DuFour and DuFour, 2013; Vescio, Ross, & Adams, 2008). Research links well-implemented PLCs to increased teacher self-efficacy, teacher instructional improvement (Cochran-Smith & Lytle, 2009; Darling-Hammond & Richardson, 2009; Ermeling, 2010; Levine & Marcus, 2007; Gallimore, Ermeling, Saunders, & Goldberg, 2009), and increased student achievement (Darling-Hammond & Richardson, 2009; Egodawatte, McDougall, & Stoilescu, 2011; Goddard, Goddard, & Tschannen-Moran, 2007; Lomos et al., 2011; Ronfeldt, Farmer, McQueen, & Grissom, 2015; Vescio et al., 2008). However, while PLCs are a promising strategy to improve teachers' practice and increase student achievement, key logistical and interpersonal obstacles regularly impede effective implementation in most American schools (Carpenter, 2018; Darling-Hammond et al., 2017; Goodwin, 2014; Hord, 2004; Lomos et al., 2011).

Key Challenges Impede Effective PLC Implementation

Two key challenges to effective PLC implementation are group configuration, and group dynamics. Collaboration around a common, content-specific problem of practice is a key condition of high-quality PLCs (Gallimore, Ermeling, Saunders, & Goldberg, 2009). Yet geographically isolated teachers often lack access to co-located colleagues who share the same subject areas, goals, or interests (Durr et al., 2020; McConnell et al., 2013). Additionally, a lack of co-located colleagues regularly prevents singleton teachers from engaging in content-alike PLC groups regardless of their geographical location (Hagin,

2020). A singleton teacher is one who is the only teacher of a particular course or grade level within their school. When schools implement PLCs, singleton teachers are typically placed into interdisciplinary or nontraditional PLCs where they do not have content-alike peers with whom to collaborate. Thus, singleton teachers are regularly asked to participate in PLCs that are less likely to serve their needs. Even ideally configured groups regularly struggle with group dynamics related to the collaborative inquiry process. Interpersonal challenges with communication skills, lack of conversational direction, and unequal participation regularly impede collaborative inquiry efforts (Charner-Laird, Ippolito, & Dobbs, 2016). These challenges must be addressed for PLCs to effectively improve teaching and learning.

vPLCs Provide Solutions and Unique Challenges to Effective PLC Implementation

vPLCs provide a potential solution to the challenge of group configuration, yet introduce new challenges related to group dynamics. vPLCs have been used to connect content-alike teachers across physical distance (Carpenter & Munshower, 2020; Durr et al., 2020, McConnell et al., 2013; Wang et al., 2019). However, the virtual environment exacerbates challenges related to group social connection. Site-based PLCs typically group content-alike teachers with some degree of preexisting personal and professional connection. By contrast, vPLCs connect teachers from separate school sites that must establish and maintain social presence within a virtual workspace- where fewer opportunities exist to engage in natural, informal dialogue around nonprofessional topics (McConnell et al., 2013).

Additionally, the virtual context can impede teachers' ability to engage in a practice-focused process of collaborative dialogue and work, in which joint productive activity leads to a sense of common purpose and shared knowledge building. Recent empirical studies identify lower than expected levels of teacher discourse and engagement, communication

awkwardness, and problematic communication patterns of social loafing and social dominance as challenges to effective vPLC interactions (Carpenter & Munshower, 2020; Durr et al., 2020; McConnell et al., 2013; Wang et al., 2019). These challenges may negatively impact the collaborative inquiry process, which is essential for generating new learnings.

While these and other studies provide broad practical guidance about *what* to do to establish key conditions for vPLCs, little is known about *how* to design and implement a vPLC that effectively establishes and maintains group social connection. Because a PLC's potential to effectively improve teaching and learning hinges on its ability to generate learnings through effective group processes, we need more empirically based research explaining how to design and implement a vPLC that fosters these key conditions.

Statement of the Project

The current study explores the implementation of a vPLC designed to address known interpersonal obstacles according to research-based recommendations. I conducted a qualitative case study in which I served as the researcher-facilitator of a vPLC composed of four additional high school singleton teachers. I worked with a teacher inquiry expert with over 20 years' field experience to design the vPLC according to research-based recommendations and documented its implementation by examining and triangulating data from researcher-facilitator observations, web-based work products, and participant perceptions throughout the study. I explored the following questions:

Research Questions

How was a strategically designed vPLC of singleton high school teachers implemented to foster group social connection?

In what ways, if at all, did the vPLC foster group social connection?

How was the vPLC implemented to support group social connection?

Research Design

Overview of Research Design, Site, and Population

I employed a qualitative, descriptive single case study to answer these research questions. The case was a 5-member (including myself) vPLC of geographically spread high school singleton teachers, convening weekly within a virtual Zoom context. Specifically, I used purposeful sampling to recruit four singleton high school teachers from geographically distant sites. Research shows that this group size is large enough to facilitate effective collaborative discussion, yet small enough to promote individual involvement and discourage social loafing (Goodwin, 2014). During and between weekly meetings, I investigated how group social connection was established and developed over time within the Zoom virtual context, with a focus on specific features of the group's process. Because my research questions focused on understanding how particular features of a group's process play out in real time, within a natural setting, a qualitative case study was the best fit (Creswell & Creswell, 2018; Merriam & Tisdell, 2016).

Throughout the study, I employed multiple methods designed to collect, record, analyze and triangulate data. Due to my positionality as both researcher and vPLC facilitator, it was important to collect a variety of data to increase the credibility of my findings. Thus, each research question was informed by data collected from multiple sources via multiple methods, including participant observations, facilitator notes, web-based work products, and participant perceptions.

Study Significance

This study potentially benefits both researchers and educators, as it is an empirically based case study about how to design and implement a vPLC that fosters key conditions for effectiveness. While existing literature broadly recommends *what* to do to address key conditions, practical knowledge about *how* to effectively address these conditions is lacking. This study aimed to fill that gap by providing a detailed description of how one vPLC, intentionally designed according to research-based conditions, contributed to group social connection among singleton teachers. This detailed description also provides specific examples of practitioner knowledge to inform the design and implementation of vPLCs at other school sites. Such knowledge can especially benefit singleton teachers lacking co-located content-alike colleagues with whom to collaborate. Further, transferable knowledge about vPLC program features that contribute to group social connection may extend to face-to-face PLCs as well, as existing literature documents continued challenges in these areas.

This study is also timely. With recent increased emphasis on virtual collaboration due to emerging technology and a global pandemic, high-quality virtual PLCs not only hold promise to connect singleton teachers around problems of practice, but also to provide important benefits to other schools and teachers: increased access to high-quality experts or facilitators regardless of geographical location; expanded flexibility of team configurations- connecting teachers within and across districts; increased flexibility in scheduling sessions free from typical travel time and cost restraints; and decreased need for physical meeting facilities.

CHAPTER 2: REVIEW OF THE LITERATURE

This study aimed to understand how we can implement strategically designed vPLCs that foster key conditions for effectiveness. As such, this chapter begins with a discussion of the teacher PLC as an effective professional development model: I broadly define PLCs and review evidence that links well-implemented PLCs to improved teacher practice and student academic success. I then describe key conditions for effective PLCs and identify ongoing challenges impeding effective PLC implementation. I specifically highlight singleton teacher group configuration as an ongoing obstacle to effective PLC implementation in schools. Here, I propose virtual PLCs (vPLCs) as an innovative solution for singleton teacher group configuration and identify unique interpersonal challenges within the vPLC context. Finally, I situate my study in a conceptual framework drawn from Vygotsky's (1978) sociocultural theory applied to virtual teacher professional development (Shabani, 2016), Knight's (2020) practical guidance for fostering key conditions for vPLCs, Garrison, Anderson, and Archer's (2000) Community of Inquiry framework for online communities, Ermeling and Graff-Ermeling's (2019) conceptualization of collegiality and joint productive activity, and Lefstein, Louie, Segal, & Becher's (2020) conceptualization of productive pedagogical talk.

PLCs Influence Teachers' Practice and Student Achievement

PLCs have been broadly defined as a model for job-embedded collaborative groupings of educators (DuFour et al., 2004). Members of a PLC work together to collaborate on improving their instructional practice and student learning (Carpenter, 2018; DuFour and DuFour, 2013; Vescio et al., 2008). This joint work often follows the inquiry cycle format. Inquiry cycles take teachers through an examination of student data, through a generation of research-based ideas to address related problems of instructional practice, to

implementation of instructional innovations, and finally to a reflective phase that often includes the launch of a new or revised cycle (Carpenter, 2018; Vescio et al., 2008). Protocol-guided, structured conversations led by a trained facilitator are often the vehicle for productive collaborative inquiry cycles (Ermeling, Tatsui, & Young, 2015; Gallimore et al., 2009). As teachers collaborate, productive dialogue transforms their individual thinking by surfacing assumptions and clarifying theories-in-use, eventually leading the group to adopt a set of shared meanings and a common thinking process (West, 1996). Driven by the collective expertise and questions that teachers bring to their practice, collaborative inquiry via productive dialogue drives the types of context-specific changes necessary to improve teaching and student learning.

Research links well-implemented PLCs to teacher instructional improvement and increased teacher self-efficacy (Cochran-Smith & Lytle, 2009; Darling-Hammond & Richardson, 2009; Levine & Marcus, 2007; Ermeling, 2010; Gallimore et al., 2009). Facilitated collaborative inquiry guides teachers' conversation toward instructional dilemmas and promotes the generation of useful knowledge that can lead to positive changes in teachers' practice (Cochran-Smith & Lytle, 2009). Accordingly, teachers who engage in productive collaborative inquiry are more likely to learn and use a new approach than those who work in isolation (Levine & Marcus, 2007). Collaborative inquiry can also lead to changes in teachers' perceptions of their own practice (Ermeling, 2010; Gallimore et al., 2009). Specifically, Gallimore et al., 2009 found that teachers who had engaged in collaborative inquiry cycles more readily attributed improved student learning to this PLC work than a comparison group of teachers, who more readily attributed such changes to fixed student attributes or external factors. In this study, teachers acquired a new ability to examine

their own practice in relation to student learning. Given these benefits to teacher practice and self-efficacy, it's not surprising that well-implemented PLCs are also linked to increased student achievement (Darling-Hammond & Richardson, 2009; Egodawatte et al., 2011; Goddard et al., 2007; Lomos et al., 2011; Ronfeldt et al., 2015; Vescio et al., 2008).

Effective PLCs: Key Conditions, Implementation Obstacles, and What we Need to Know

While PLCs are a promising strategy to improve teachers' practice and student achievement, they are only effective when key research-based conditions exist. These conditions can be grouped according to how they successfully promote long-term, ongoing, job-embedded support; a healthy collaborative culture; and active engagement in reflective, facilitated inquiry. Key conditions for effective PLCs mirror research-based conditions for effective teacher professional development and play a critical role in the success of any PLC group. However, research suggests that PLCs have yet to be implemented effectively in most American schools (Carpenter, 2018; Darling-Hammond et al., 2017), and do not adequately meet the needs of all teachers (Carpenter, 2018; McConnell et al., 2013). Darling-Hammond et al.'s (2017) research recently examined PLCs as a model that combines several key conditions of effective professional development, while acknowledging that many PLCs were "poorly implemented and superficial in their design" (pg. 17). Known obstacles to effective implementation include a lack of stable settings, a lack of content-alike PLC groups for singleton teachers, and interpersonal issues related to the collaborative inquiry process. If PLCs are to fulfill their promise, we need more empirically based research explaining how to successfully design and implement PLCs that address these obstacles.

Sustained, Ongoing, Job-Embedded Support. Stable settings consisting of small, content-alike teacher teams promote continuity and relevance within the PLC process

(Ermeling & Graff-Ermeling, 2016; Goodwin, 2014; Lomos et al., 2011). PLC meetings are most effective when they are proactively planned to occur consistently throughout the school year and are protected from other distractions or schoolwide commitments (Ermeling & Graff-Ermeling, 2016; Gallimore et al., 2009). For some schools, this planning includes repurposing existing stable settings like department meetings to focus on collaborative inquiry. For other schools, this planning requires carving out new settings within the school day. These stable, protected settings provide the continuity necessary for small teams of content-alike teachers to move their collaborative inquiry work forward.

Within stable PLC settings, group composition influences the collaborative inquiry experience. The PLC model requires teachers to identify common student needs, collaborate on their instructional practice, and seek improvement together. Thus, when PLCs are a group of *content-alike* teachers that share common goals and needs, the team is more effective at transforming educator practice (Hord, 2004; Lomos et al., 2011). Effective collaborative inquiry also requires openness to change, and equal participation among group members. Accordingly, content-alike teacher teams should be large enough to support innovation, yet small enough to discourage social loafing (Goodwin, 2014). Small teams of content-alike teachers collaborating within stable settings over time are most likely to improve instructional practice and student achievement.

While the typical PLC model includes small teams of content-alike teachers working in the same school building (Ferriter, Graham, & Wight, 2013; Hansen, 2015), most schools employ singleton teachers who do not have a co-located counterpart. A singleton teacher is one who is the only teacher of a particular course or grade level within their school. Typically, singletons are elective-subject, world language, or arts teachers such as those

teaching psychology, French, or drama – but any teacher that is the only one teaching a subject at a school is a singleton (Hansen, 2015). Rural schools typically have numerous singletons, making it difficult to create teacher teams with similar goals and needs (McConnell et al., 2013; Ullman, 2010; Vescio et al., 2008). Yet regardless of geographical location, singleton status regularly prevents teachers from engaging in course-alike PLCs (Hagin, 2020). Thus, the typical PLC model is not designed to meet the unique professional development needs of singleton teachers and is often not implemented effectively with this group.

When PLCs include teachers who do not share a common goal, teams are less likely to be effective in bringing about changes in teacher practice (Smith, Wilson, & Corbett, 2009). Physically convening singleton teachers from multiple schools can alleviate this problem, yet teachers are reluctant to travel long distances due to time and cost constraints (McConnell et al., 2013). Virtually convening singleton teachers within a shared workspace can remove the physical barriers impeding content-alike groups for singletons, yet a virtual model also introduces unique challenges related to stable settings. Many traditional schools struggle to implement the PLC model due to inadequate availability of time for sustained yearlong professional development (Chappius, Chappius, & Stiggins, 2009) and lack of shared teacher meeting time within the school day (McConnell et al., 2013). This struggle is exacerbated in a virtual setting that convenes teachers with mixed availability for shared meeting time, from multiple schools with different bell schedules. More empirically based research is needed that explains how to effectively design and implement PLCs with stable settings for small groups of content-alike singleton teachers.

Group Dynamics and Collaborative Inquiry. When implemented well, PLC collaboration is a systematic process in which teachers jointly analyze and adapt their practice to improve results for their students and their team (Carpenter, 2018; Gallimore et al., 2009; Vescio et al., 2008). Different from other teams in academic institutions, PLCs are driven by a shared vision and values. Senge's (1990) classic work on learning organizations underscored the importance of a shared commitment to continuous improvement that promotes experimentation and risk-taking as foundational to collaboration within PLCs. As each teacher approaches instruction differently, conflict may arise throughout the collaborative inquiry process (Little, 2003). Productive PLC discourse requires authentic sharing, questioning, investigating, and reflecting on challenges within a safe environment. Predicated on trust, authentic PLC discourse within a safe environment provides the foundation necessary for intellectual interaction where teachers question assumptions, deepen understandings, and find shared meanings that enrich learning and lead to changes in instructional practice (Leftstein et al., 2019; Vescio et al., 2008).

Research shows that facilitation is crucial for the success of PLC group dynamics and collaborative inquiry, and thus for teachers' professional learning and growth (Cabrera, 2020; Charner et al., 2016; Margalef & Roblin, 2016). Positioned in social constructivist and andragogic principles, PLC facilitation is understood foundationally as guidance (Cabrera, 2020). The function of a PLC facilitator is to ensure a safe space in which all members productively move through the collaborative inquiry process with an equal opportunity to connect and contribute to joint productive activity (Cabrera, 2020; Charner et al., 2016). In a study examining ways in which facilitators specifically supported their PLC members, Margalef and Roblin (2016) found that effective leaders provided: (1) group work strategies,

including creating a culture of trust, (2) knowledge-building strategies, including providing access to relevant research and the inquiry process, and (3) reflection strategies, including debriefing questions that challenged assumptions and pedagogical beliefs.

Facilitated Group Work Strategies. PLC facilitators play a pivotal role in group dynamics. Collaborative and reflective PLC work requires professional interaction involving serious, oftentimes difficult, intellectual discussion (Cabrera, 2020). PLC facilitators create a supportive, safe workspace for authentic group work and discussion when they establish norms, promote a climate of trust and mutual respect, encourage all voices, challenge assumptions, mitigate conflicts and tension, provide constructive feedback, stimulate reflection, and actively listen to all group members (Cabrera, 2020; Charner et al., 2016; Hargreaves et al., 2013; Moon, 2010). Facilitation of this supportive, safe workspace is critical as teachers learn to move from “congenial conversations” – which focus on safety, privacy, and preserving the status quo, to “collegial conversations,” which focus on digging into practice, wrestling with disagreements, and building shared new knowledge and practice together (Nelson, Deuel, Slavit, & Kennedy, 2010).

Facilitated Knowledge-building and Reflection Strategies. Building upon the necessary foundation of healthy group dynamics within a safe workspace, effective facilitators utilize structured protocols to focus group discussion and engage teachers in experimentation and discovery through inquiry and reflection (Cabrera, 2020; Charner et al., 2016; Ermeling & Graff-Ermeling, 2016). Protocols foster effective collaborative inquiry in the following ways: they (1) ensure that the group’s work follows essential steps in the inquiry process, while allowing for context-specific adaptations; (2) foster a shared process and shared meanings; (3) nurture important inquiry and reflective skills; (4) equip facilitators

to provide focus and continuity necessary for joint productive activity (Ermeling & Graff-Ermeling, 2016). Research shows that PLCs are most effective when teachers reflect on data, asking questions about student work as it relates to their teaching. Accordingly, effective protocols promote reflection and activities that involve making judgements based on reflection as part of the inquiry process (Moon, 2010). In summary, facilitators successfully guide PLC groups by cultivating healthy group dynamics within a safe workspace and utilizing inquiry-based protocols to guide members through productive cycles of collaborative inquiry in a way that provides all members with an equal opportunity to connect and contribute to the group's joint productive activity.

Despite the substantial body of literature providing practical guidance regarding what processes should occur within effective PLCs, ongoing obstacles to effective implementation include collaborative inquiry challenges such as lack of interpersonal communication skills, lack of conversational direction, and unequal participation. Many PLC efforts “seem predicated on the idea that if we just gather teachers together to talk about practice, something good will happen” (Bryk, 2009, p. 599). However, merely asking content-alike teachers to engage in collaborative inquiry within a shared workspace does not guarantee success. Collaborative structures, alone, are unlikely to produce results, particularly if they are created without attention to the need for facilitation (Charner et al., 2016). Because participants are rarely taught how to work collaboratively or provided with ongoing guidance for how to best utilize PLC time together, many teachers in PLCs struggle to collaborate effectively. Instead, some teachers might choose to work independently while in the same space or shift the focus to logistical matters rather than problems of practice (Charner et al., 2016). Even with a leader present, teachers do not always know how to collaborate

effectively, nor is it always clear what they might discuss (Troen & Boles, 2012). Finally, multiple studies cite challenges associated with unequal participation, including social loafing and free rider behaviors- the tendency to reduce individual effort when working in groups compared to working alone (Lee, 2008), and conversational domination by a few politically strong teachers (Saito, 2012; Saito & Atencio, 2013). To further guide PLC practitioners, empirically based research needs to extend beyond practical guidance about what should occur and explain how to effectively enact these processes. Videoconferencing offers a PLC solution for isolated singleton teachers; yet more empirical research is needed to explore this potential solution and investigate the nuances of how to design and implement effective PLCs within the virtual environment.

Videoconferencing Tools can Overcome Key Obstacles to Effective Implementation

In the field of education, videoconferencing is becoming increasingly popular and has been used to facilitate a variety of distance learning and professional development experiences. Videoconferences are meetings where geographically separated participants use the internet to come together in learning communities that allow them to be meaningfully engaged in the learning process (Huang & Hung, 2013). Online, the term “learning communities” involves a broad range of experiences where learners can engage in collaborative efforts to extend their learning (Daley et al., 2008). A key feature of videoconferencing is its synchronous nature. Synchronous teaching and learning assume that all learners are present and participating online in real time. Enabled by videoconferencing, synchronous learning allows learners to see and hear each other, and share information simultaneously (Huang & Hung, 2013; Mader & Ming, 2015).

When effectively used to support PLCs, videoconferencing can provide a virtual learning environment where teachers actively establish healthy group dynamics and engage in facilitated collaborative inquiry in real time. Further, videoconferencing tools provide for synchronous communication that closely resembles face-to-face communication. Specifically, videoconferencing provides the opportunity for participants to perceive important nonverbal cues like body language, and receive immediate feedback in response to questions, concerns, and other conversational contributions. According to Kock (2005b) the more natural an e-communication medium, the less it will increase participants' cognitive effort, the less it will increase communication ambiguity, and the more it will increase physiological arousal. In this regard, videoconferencing is a promising tool to overcome logistical challenges preventing singleton teachers from convening in content-alike PLCs, while fostering the necessary synchronous shared workspace for healthy group dynamics and collaborative inquiry.

Research outlines key considerations for the selection and use of videoconferencing tools to facilitate effective online learning within a shared virtual workspace. As each learning context is unique, it is important to select technology solutions that align with context-specific learning goals (Ermeling et al., 2015). For example, primary goals for a group of spread singleton teachers might include building relationships and facilitating learning. Web-based videoconferencing (WVC) tools support these goals, as they mimic face-to-face interactions, promote dynamic collaborative efforts, and provide reliable means to assess individuals' roles in discussion (Al-Samarraie, 2019). Additionally, effective selection and use of technology tools includes: (1) selecting technology tools that are easily accessible and usable by all teachers, (2) providing basic training focused both on technical

aspects and the use of specific tools to support group dynamics, teaching and learning, and (3) ensuring appropriate technology support across various sites (Al-Samarraie, 2019). A small body of research has emerged demonstrating the use of two-way videoconferencing technology to support distance learning (O'Steen, 2007; Sallnas, 2005), hybrid learning (Mader & Ming, 2015), teacher preparation courses (Schmidtt & Eilderts, 2018), classroom observations (Dyke, Harding, & Liddon, 2008), and teacher learning communities (Durr et al., 2020; Charalambros, Michalinos, & Chamberlain, 2004; Ford, Branch, & Moore, 2008; Holmes, 2013; Matzat, 2013; Moodley, 2019; Sorensen & Murchu, 2004; Wang et al., 2019). Yet few studies have examined the use of videoconferencing to support synchronous vPLCs (Carpenter & Munshower, 2020; McConnell et al., 2013).

Existing Synchronous vPLC Research and Gaps

Empirical findings related to computer-mediated communication in teacher professional development emphasize the importance of establishing group social connection and collaborative learning. These are key conditions of effective vPLCs. Yet we have more to learn about how to successfully design and implement vPLCs in a way that fosters these key conditions. While two recent empirical studies investigated participants' perceptions of some general benefits and drawbacks of vPLCs, they lack detail about how specific vPLC program features were designed and implemented to foster group social connection and collaborative learning (Carpenter & Munshower, 2020; McConnell et al., 2013).

In their qualitative study exploring the use of videoconferencing to support vPLCs, McConnell et al., (2013) employed phenomenological perspective and comparative case study methodologies to compare the experiences of vPLC members with face-to-face PLC members. The researchers sought to understand how vPLCs compared to face-to-face PLCs,

and what distinct advantages and disadvantages presented in a vPLC environment. Teachers from across central Michigan enrolled in the Problem-based Learning Project (PBL) to improve their inquiry-based science instruction. Teachers were assigned to one of eleven different PLCs. Nine PLCs met face-to-face while two met virtually. All PLCs began with a 10-day, in-person summer intensive experience. Subsequent virtual meetings occurred in real time via videoconferencing software, with teachers logging in from their classrooms or homes.

Importantly, focus group interviews and participant reflections revealed that teachers in vPLCs using videoconferencing software experienced similar benefits to face-to-face groups. However, these teachers reported a strong preference for face-to-face groups due to perceptions that “more personal” and “better discussions” occurred in person as opposed to online. While interview and reflection data identified specific benefits associated with vPLC collaboration, this study lacks key details about *how* specific vPLC program features were designed and implemented in a way that contributed to these benefits.

McConnell et al. (2013) also stated that the 10-day, in-person summer intensive experience contributed to a foundational sense of group social connection and recommended that future vPLCs provide initial in-person community building time to foster community. The authors further stated that when initial in-person sessions are not possible, leaders need to “explore other ways to build a sense of community” in the virtual environment (p. 274). The authors also recommended that future research examine the features of technology programs that are most helpful in fostering the sense of group social connection needed to support collaboration within a vPLC. Thus, the McConnell et al. (2013) study provides useful initial findings regarding the perceived benefits and challenges of one vPLC, yet more

information is needed about *what* specific vPLC program features contribute to group social connection- particularly in the absence of an initial in-person experience, and *how* such features are implemented in a way that contributes to group social connection.

In a more recent qualitative study exploring the use of vPLCs to connect subject-alike teachers from several schools, Carpenter and Munshower (2020) also investigated participants' perceptions of the benefits of vPLCs. However, like McConnell et al. (2013), their study lacks detail regarding the processes for successfully implementing vPLCs that foster group social connection. The researchers employed a phenomenological case study-based approach to investigate how participants perceived the use of a vPLC. Teachers from across Texas and the Dominican Republic participated in vPLCs. Meetings occurred in real time via Google classroom as the meeting platform.

Like McConnell et al. (2013), participant interview and survey data revealed that vPLCs provided similar teacher experiences and benefits to that of a similar face-to-face PLC model. However, participant reflections showed that rural educators preferred face-to-face meetings due to the more "personal" nature of in-person discussion. Further, researchers found that while the collaborative inquiry process was similar, vPLCs featured lower relative levels of discourse in the shared workspace, compared to face-to-face PLCs. Finally, this study did not address the establishment or maintenance of group social connection, which underlies the collaborative inquiry process.

Both McConnell et al. (2013) and Carpenter and Munshower (2020) suggest that educational leaders provide and coordinate vPLCs for singleton teachers and isolated rural teachers. Yet to design and implement effective vPLCs for singleton teachers, practitioners need to know *what* specific vPLC program features foster the group social connection

necessary for collaborative learning, and *how* these features are implemented over time in a way that contributes to these key conditions. Because a PLC's potential to effectively improve teaching and learning hinges on its ability to generate learnings through effective collaborative group processes, we need more empirically based research explaining how to design and implement a vPLC that fosters these critical conditions.

The Current Study

The current study explores how a strategically designed vPLC of singleton high school teachers is intentionally implemented to foster group social connection. The study specifically focused on how particular research-based vPLC program features were implemented to yield these results. Empirical findings informing how these vPLC program features supported group social connection provides useful knowledge for practitioners seeking to design and implement effective vPLCs that improve classroom practice and student learning.

My research was situated in a conceptual framework drawn from theories and practical guidance that inform teacher learning and social interactions within PLCs (Vygotsky, 1978), key conditions that support social connection within PLCs, and application of these conditions to the virtual PLC context (Garrison et al., 2000; Knight, 2020; Shabani, 2016). This conceptual framework informed my research questions and methods, the design and implementation of the vPLC, the operational definition of group social connection, the development of my data collection protocols, and the deductive coding framework used for analysis.

Teacher Learning and Social Interactions within PLCs

Grounded in social constructivism, PLCs situate teacher learning and growth within a collaborative learning environment. Social constructivist theory places social interaction at the center of meaning-making. Vygotsky (1978) argued that learning “awakens a variety of internal developmental processes” through interaction with artifacts and cooperation with peers. For Vygotsky, the sociocultural aspect of cognition is fundamental to learning. Specifically, interactions between learners and artifacts are essential in constructing new ideas. Thus, Vygotsky’s social constructivist framework advocates creating environments supporting social learning. These facilitate interpersonal connection, collaboration, joint reflection, and reciprocation (Vygotsky, 1978). This qualitative case study investigated collaborative processes in action within the vPLC context, centering group social connection.

Key Conditions Support Social Connection and Teacher Learning within vPLCs

Theoretical articles (Knight, 2020; Shabani, 2016) informed the design and implementation of specific program features in this study. In his theoretical application of Vygotsky’s sociocultural approach for effective virtual teacher professional development, Shabani (2016) states that in effective vPLCs, (a) members receive ongoing support from mediators (both community leaders and technical platforms), and that (b) relationships among members, regardless of their relative experience, are both collaborative and mutually beneficial. To achieve these conditions, Knight (2020) states that online community leaders must establish an infrastructure that (a) ensures that participants possess the requisite foundational knowledge to navigate technology platforms and tools to access meaningful learning opportunities, (b) privileges group interactions, and (c) stimulates ongoing engagement. The vPLC under study employed a trained facilitator as community leader, a specific virtual platform, and virtual protocols/ strategies, as mediators providing ongoing

support to group members. The conceptual framework posits that specific supports provided by the program and session design, virtual platform, virtual protocols and strategies, and trained facilitator contribute to the conditions necessary for group social connection and the completion of collaborative inquiry cycles, which leads to learning.

Finally, theoretical guidance informed my operational definition of social connection within the virtual context, and thus informed the development of my data collection instruments and protocols, and the deductive coding framework used for data analysis. Specifically, I distinguish between two types of social connection- social presence, and collegiality via Joint Productive Activity (JPA). Social presence refers to participants' ability to identify with the community, communicate purposefully in a trusting environment, and develop interpersonal relationships by projecting their individual personalities through the medium of communication being used (Garrison et al., 2000). Collegiality refers to participants' ability to engage in a practice-focused process of collaborative work, where JPA leads to a sense of common purpose, shared knowledge building, and a strengthened sense of connection over time (Ermeling & Graff-Ermeling, 2019).

Social Presence. Garrison et. al's (2000) Community of Inquiry theoretical framework states that an effective online community of inquiry necessitates social interdependence sustained by relationships and strong emotional ties, and shared knowledge building with a clear focus on practice and collaboration. Group social connection is facilitated by what Garrison calls social presence, defined above, or as the ability of participants in a community of inquiry to project themselves socially and emotionally, as "real" people (share their full personality), through the medium of communication being used (Garrison et al., 2000).

Collegiality via Joint Productive Activity (JPA). Ermeling and Graff-Ermeling (2019) define JPA as a specific activity or task – such as engaging in each step of a vPLC collaborative inquiry cycle-that is “collaborative, sustained, and results in a joint product.” The central premise of JPA is that learning occurs most effectively when experts, novices, and/ or peers dialogue and work together to achieve a common aim and are thereby motivated to assist each other. According to the researchers, one important outcome of JPA is intersubjectivity-a shared understanding between two or more minds. When teachers engage in effective JPA, they develop shared language and shared understandings about their practice, a shared history of obstacles and accomplishments, and a shared set of values and interpretations about teaching and learning. These shared understandings and experiences add depth and meaning to their professional work, and over time, further strengthen ongoing social connection within a group. Characteristics of effective JPA include collectively defined roles and responsibilities, collectively defined goals and objectives of collaboration, and pedagogically productive dialogue – discourse that is rich in pedagogical concepts and reasoning and that has the power to develop participating teachers’ professional judgment (Lefstein et al., 2020).

This conceptualization of group social connection as social presence and collegiality via JPA informed the development of data collection protocols, and the data analysis process, further articulated in chapter three. Taken together, these theoretical frameworks and practical guidance comprised a conceptual framework that informed my research questions and methods, the design and implementation of vPLC program features, the operational definition of group social connection, the development of my data collection protocols, and the deductive coding framework used for analysis.

Conclusion

Though a PLC's potential to effectively improve teaching and learning hinges on its ability to generate learnings through collaborative group processes, we lack empirically based research explaining *how* to design and implement a PLC that fosters effective conditions within the virtual environment. Existing vPLC literature provides theoretical and practical guidance on what broad steps can be taken to establish and implement a vPLC but lacks detailed information regarding how to effectively undertake those steps. The current study offers an in-depth account of implementing a vPLC with specific program features designed to yield effective outcomes, thereby confirming, and extending empirical and practical knowledge about vPLC program design and effective implementation.

CHAPTER 3: METHODS

This chapter presents the research methods and data analyses I used to investigate how a vPLC was enacted to support social connection in a group of singleton high school teachers. First, I provide an overview of the study design and rationale, followed by information about participant selection and recruitment, data collection, coding, and data analysis procedures. Next, I describe my positionality. Then, I identify and address issues of credibility and trustworthiness. The specific research questions for this study were:

Research Questions

How was a strategically designed vPLC of singleton high school teachers implemented to foster group social connection?

In what ways, if at all, did the vPLC foster group social connection?

How was the vPLC implemented to support group social connection?

Research Design and Rationale

This study used case study methodology to explore the implementation of one vPLC designed and implemented to address known interpersonal obstacles according to research-based recommendations. Specifically, I conducted a qualitative, descriptive single case study in which I served as the researcher-facilitator of a vPLC composed of four additional high school singleton teachers. The phenomenon under study was the ongoing group social connection within the 5-member vPLC, which convened weekly within the Zoom virtual context. During and between weekly meetings, I investigated how group social connection within the vPLC was established and developed, with a focus on specific features of the group's process. Because my research questions focused on understanding how particular features of the group's process played out in real time, within a natural setting, a qualitative

case study was the best fit to answer my research question and inform research and practice in this area (Creswell & Creswell, 2018; Merriam & Tisdell, 2016).

Methods

Site and Population

I used purposeful sampling to recruit four singleton high school teachers from geographically distant sites to participate in the vPLC and my case study. I recruited teachers with a principal or other instructional leader that (a) had prior experience with a PLC framework, and (b) was committed to supporting teachers' collaborative, reflective practice. Research shows that facilitative principal leadership and regular principal involvement are related to the presence of PLCs in schools (Bryk, Camburn, & Louis, 1999). Thus, schools with facilitative, involved principals represent schools where we would expect to see a vPLC model gain traction and succeed over time. I recruited singleton high school teachers because they represent a group who cannot fully participate in schoolwide PLCs – they lack site-based content-alike colleagues with whom to form PLC groups. I recruited four teachers because research shows that this group size is large enough to facilitate effective collaborative discussion, yet small enough to promote individual involvement and discourage social loafing (Goodwin, 2014). I recruited Advanced Placement Psychology teachers, my area of content/ pedagogical expertise. Facilitating within my own area of expertise allowed me to focus more intently on group dynamics and the research process. Lastly, I recruited Advanced Placement Psychology teachers from high schools in the Pacific Time Zone, within my national private school network. Teachers from these schools could naturally continue working together beyond this study. Selecting teachers in the Pacific Time Zone provided the simplest proof of concept, in terms of scheduling logistics.

I had access to a PLC expert’s network of contacts that met these criteria. I began the physical recruitment process by contacting AP Psychology teachers to determine their interest in participating in the project, to discuss whether their principals met my selection criteria, and to understand their unique scheduling parameters (bell schedule, teacher planning periods). Upon finding a match between teacher interest, principal support, and schedule availability, I asked each teacher whether they’d like to take part in my vPLC. From there, I established physical and emotional access by scheduling a Zoom meeting with each teacher where I (a) formed an initial social connection, (b) explained the study, (c) highlighted ways in which their participation in the study could benefit their teaching and learning, and (d) obtained informed consent. My experience teaching Psychology facilitated an easy Initial social connection with fellow Psychology teachers. In these ways, I gained physical and emotional access to study participants.

Participants and Context

The recruitment process yielded four Advanced Placement Psychology teachers from schools in the Pacific Standard Time zone within my national private school network. All participants were singletons who had no prior experience working with other Advanced Placement Psychology teachers, and little to no experience with rigorous collaborative inquiry. Three out of four participants predominately taught subjects other than Advanced Placement Psychology, given its elective status. Each teacher cited the opportunity to collaborate with other Advanced Placement Psychology teachers as their primary motivation to join the group. Table 1 provides a brief profile for each of the four teacher participants.

Pseudonym	Years of Experience	Predominant Subject Area
Tom	20	U.S. and World History
Amaya	8	Psychology
Kellie	2	English

James	1	Head Football Coach
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Table 1. Participant Profiles

The group spent a total of 12 weekly meetings (14 total hours) engaging in social connection activities and working through one collaborative inquiry cycle. Each meeting began with an opening connection segment designed to establish and develop group social presence, followed by a collaborative inquiry segment designed to establish and maintain collegiality via joint productive activity (JPA). I incorporated opening connection segments to provide time and space for participants to develop interpersonal relationships, which foster the sense of trust and community necessary to support collegiality via JPA. I collaborated with Dr. Brad Ermeling, a recognized teacher inquiry expert with over 20 years' field experience, to adapt his face-to-face PIER (Plan, Implement, Examine, Reflect) Model to support teacher collaborative inquiry within the virtual context. Selecting a research-based, productive face-to-face model for teachers' collaborative inquiry allowed me to focus more intently on the nuances of supporting group social presence and collegiality via JPA within the virtual context.

Between each vPLC meeting, Dr. Ermeling and I engaged in 60-minute weekly support meetings, wherein we debriefed ongoing group processes and outcomes, and utilized the PIER facilitator guide to design subsequent vPLC meetings based on the group's progress. Table 2 presents the topics for each meeting's opening connection and collaborative inquiry segments, with a breakdown of total time spent per meeting. Each two-hour meeting included 30 minutes of opening connection time followed by 90 minutes of collaborative inquiry. Each one-hour meeting included 10 minutes of opening connection time followed by 50 minutes of collaborative inquiry. All meetings occurred online on the same collectively chosen day and time each week, via Zoom video conferencing software. In

these ways, the vPLC was implemented within stable weekly settings, via a video conferencing software that all teachers had experience using, according to research-based effective practices.

Meeting	Opening Connection Topic	Collaborative Inquiry Topic	Total Hours
1	Get to Know You	Introduction: Identify T&L Problem	2.0
2	Cup-Filler	Learning Progression; Lesson Context	2.0
3	High, Low, Buffalo	Instructional Solution and Hypothesis	1.0
4	Weekend Highlight	Plan-Lesson Summary and Storyline	1.0
5	Unstructured	Plan-Evidence Criteria and Rubric	1.0
6	Unstructured	Plan-Learning Stations	1.0
7	Unstructured	Plan-Learning Stations	1.0
8	Unstructured	Plan-Lesson Details and Dry Run	1.0
9	Unstructured	Plan-Revise and Finalize Lesson	1.0
10	Unstructured	Examine-Evidence Tally Chart	1.0
11	Unstructured	Examine-Analysis	1.0
12	Unstructured	Reflect-Priorities for Future Instruction	1.0

Table 2. Implementation Timeline and Topics

Data Collection Methods

Throughout the study, I employed multiple methods designed to collect, record, analyze and triangulate data. Due to my positionality as both researcher and vPLC facilitator, it was important to collect a variety of data to increase the credibility of my findings. Thus, each research question was informed by data collected from multiple sources via multiple methods, including researcher-facilitator observations, web-based work products, and participant perceptions.

Participant observations. Participant observations of vPLC features that supported group social connection were conducted using a digital semi-structured protocol (see appendix A). The protocol was designed to collect data specific to key vPLC program features, and ways in which they supported, if at all, observed evidence of participants’ social presence and collegiality via joint productive activity. Because I served as both researcher and facilitator, I conducted 12 observations by viewing and transcribing a videorecording of

each 60 or 120-minute vPLC session upon its conclusion. All protocols were stored on a secure Google Drive.

Artifact Analysis: vPLC documents and Web-based work products. Web-based vPLC work products (the protocol-embedded virtual chartbook, teacher lesson plans, student work) were also collected throughout the study. These work products, particularly the protocol-embedded virtual chartbook, provided evidence of group social connection. Additionally, as the researcher-facilitator, I kept a detailed digital journal (see appendix B) where I documented my planning activities and processes (including weekly attendance records, session preparation notes, proposed meeting agendas, immediate post-meeting informal observations, notable conversations, details regarding why particular decisions were made, and personal reflections applicable to both researcher and facilitator roles). This journal described how key vPLC features were designed and implemented to support group social connection. All web-based work products were stored on a secure Google Drive.

Participant Exit Tickets. Participants' perceptions of vPLC features that contributed to group social connection were collected through an anonymous Google Form exit ticket at the end of four strategic vPLC sessions – first upon completion of the initial kickoff session, next upon completion of the setup stage of the inquiry cycle, again upon completion of the planning stage of the inquiry cycle, and finally upon completion of the reflection stage of inquiry cycle. Open-ended questions were designed to capture participants' perceptions of session-specific features that contributed to group social connection. Specifically, I asked participants: “What (if any) aspects of our collaborative experience were meaningful/ useful for you this evening? What (if any) session features (activities, zoom features, aspects of the virtual chartbook, facilitation choices, other features) contributed to those meaningful/ useful

aspects? As applicable, elaborate to explain how the session features you identified contributed to those aspects.” I reserved 10 minutes at the end of each vPLC session for participants to complete and submit these questions via Google Form as an exit ticket, to ensure timely participation.

Data Analysis Methods

Data analyses occurred in several stages throughout the study. Analyses utilized a deductive approach driven by the conceptual framework and research questions, and an inductive approach that allowed incorporation of emergent themes into the analyses. Specifically, I looked for evidence of social connection (defined as social presence and collegiality via joint productive activity), and evidence of ways in which key vPLC program features supported observed evidence of social connection.

Coding Procedures. For participant observations, artifact analyses, and participant exit tickets, I established a deductive coding scheme, and I also tracked emerging themes. A-priori codes were derived from the literature for social presence (Garrison, 2011; Garrison & Akyol, 2013; Garrison et al., 2000) and collegiality via joint productive activity (Ermeling & Graff-Ermeling, 2019; Lefstein et al., 2020). A-priori codes were derived from theory and practice for key vPLC program features (Ermeling & Graff-Ermeling, 2016; Knight, 2020; Shabani, 2016). Analytic memos were also written throughout the first coding cycle. Pattern coding was used during the second coding cycle to organize codes and attribute meaning to them (Saldana, 2013). The coding framework is shown in Appendix C.

Social Presence. Social presence was defined as participants’ ability to identify with the community, communicate purposefully in a trusting environment, and develop interpersonal relationships by way of projecting individual personalities through the medium

of communication being used (Garrison et al., 2000). A decade of research recognizes interpersonal, open, and cohesive communication as the main categories that constitute online social presence (Garrison, 2011; Garrison & Akyol, 2013; Garrison et al., 2000). Thus, these became the three major coding categories for social presence in my study. According to the literature, I further sub-coded for specific indicators within each main category. Codes for interpersonal communication included: “self-disclosure,” “use of humor,” “affective expression.” Codes for open communication included: “referring explicitly to others’ messages,” “asking questions,” “complimenting/ expressing appreciation,” “expressing agreement.” Codes for cohesive communication included: “inclusive pronouns,” “vocatives.” According to this framework, the focus of social presence is on the progressive development of relationships of community members through meaningful and purposeful collaboration (Garrison & Akyol, 2013).

Collegiality via Joint Productive Activity (JPA). Collegiality via JPA was defined as participants’ ability to engage in a practice-focused process of collaborative dialogue and work (Ermeling & Graff-Ermeling, 2019; Lefstein et al., 2020). Emerging research suggests effective teacher collaborative dialogue as a key mechanism for changing teachers’ practice (Lefstein et al., 2020; Saunders et al., in press). Such dialogue is rich in pedagogical concepts and reasoning and can develop teachers’ professional judgment. Lefstein et al. (2020) characterize this pedagogically productive talk according to a specific set of principles, which constituted the five major coding categories for collegiality via JPA in my study: teacher dialogue “is focused on local problems of practice,” “includes pedagogical reasoning,” “includes rich representations of practice,” “includes a combination of support and critique to handle differing views” and “is shaped by multiple voices” (Lefstein et al.,

2020). According to the literature, I further sub-coded for specific indicators of these characteristics (see Appendix C). I also tracked teachers' completion of individual and joint tasks throughout the study, as evidence of JPA. According to this framework, the focus of collegiality via JPA is on participation in pedagogically productive talk that socializes teachers into productive ways of thinking, talking about, and reflecting on their practice as they engage in joint productive activity.

vPLC Implementation. vPLC enactment was derived from theory and practice (Ermeling & Graff-Ermeling, 2016; Knight, 2020; Shabani, 2016). The four major coding categories in my study included: “program/ session segments,” “virtual technology platform,” “virtual protocol,” and “facilitator moves.” I further sub-coded for specific indicators of these characteristics throughout the study (see Appendix C). While a-priori codes for social presence and collegiality via JPA remained stable throughout the study, some vPLC enactment codes were collapsed, as they were not substantiated by the data.

Participant Observations. Upon the completion of each vPLC session, I reviewed my research questions and coding framework. Accordingly, they were fresh in my mind going into the data analysis process. I then viewed the vPLC session video and recorded within the semi-structured protocol major meeting time segments, instances of social presence and collegiality via JPA, evidence of specific vPLC program features that supported the documented instances of social connection, and additional notes. Next, I transcribed the video using Rev.com, and pulled relevant chunks of dialogue into the observation protocol. I coded the data using the a-priori codes described above for social presence, collegiality via JPA, and vPLC program features, while allowing room for new codes to emerge.

Artifact Analysis: vPLC documents and Web-based work products. Upon completion of each vPLC session, I made a copy of our virtual chartbook to capture session-specific written entries. The virtual chartbook was a protocol-embedded Google document with designated workspaces to document collective decision-making. I read the virtual chartbook entries, reviewed transcriptions of dialogue and interactions among team members, and highlighted the chartbook with a-priori codes to capture ways in which discourse and the chartbook together revealed evidence of collegiality via JPA. I then re-read my journal notes and coded for evidence of specific program features as applicable, keeping the session context in mind.

Participant Exit Tickets. Upon completion of four different strategic vPLC sessions, I coded participants' Google form exit tickets using applicable a-priori codes described above, while allowing room for new codes to emerge.

Finally, I used journal notes, video evidence, transcript evidence, virtual chartbook evidence, and participant perception evidence (as applicable) to answer a series of prompts—some which informed my research questions, and some which allowed me to note emerging themes, alternative explanations, potential biases, and participant reactivity (see Appendix B).

Positionality

I carefully positioned myself first as a trained PLC facilitator with content/pedagogical expertise in psychology, and then as a UCLA graduate student researcher. Because I wanted to explore *authentic* human behavior as it occurred over time within a natural environment, I positioned myself as a group insider to decrease the likelihood of participant reactivity. When participants viewed me as “just another group member,” they

were more likely to behave naturally – increasing the likelihood that I would gather authentic data. This “insider” role posed unique benefits and challenges while I conducted my study. While my role provided access to all vPLC planning documents, protocols, and meetings – allowing me to craft a detailed narrative of the groups’ process, it also impacted my research lens. My insider perspective, combined with the methodological limitations of my qualitative data, subjected my research to some notable credibility threats. These threats, and the steps I took to address them, are discussed next.

Ethical Issues

My study faced potential ethical issues related to informed consent, minimal risk to participants, and confidentiality. Because participants engaged in an intensive, long-term vPLC process influenced by many factors over time, it was not possible for me to explain exactly what they would encounter throughout their participation. Further, I asked participants to devote substantial time and effort to their vPLC group participation (14 hours spread across 12 weeks). I addressed these risks to the extent possible via the informed consent process. I provided a detailed description of program logistics and participant expectations, while acknowledging that some things may arise that I could not predict.

I mitigated these minor risks by working to provide benefits to participants and their school leaders. I believed that teachers would experience benefits from being part of a content-alike vPLC. Because many singleton teachers function as “islands” within their organization, I thought that psychology teachers (particularly those who regularly participate in “content-adjacent” PLC groups) would welcome collaboration with content-alike colleagues and would collectively generate useful learnings to improve their instruction via participation in the content-specific vPLC. In addition to these intrinsic benefits, I provided

participants with gift cards upon completion of the study to show my appreciation for their participation. In the long-term, I plan to provide the following to participants and their school leaders: a vPLC Case Study that illustrates and celebrates our group processes and outcomes, and a useful summative report of findings to inform the formation and implementation of future vPLC groups across school sites.

Finally, while confidentiality was not a major issue in my study, I protected participants' confidentiality by using pseudonyms. I reminded participants to protect each other's identity by not sharing names or identifying information outside of the group. I also maintained all data in a secure google folder. In these ways, I addressed ethical issues related to my study.

Study Limitations – Threats to Credibility and Trustworthiness

My study faced potential credibility threats of bias, reactivity, and insufficient evidence to support my conclusions. As the vPLC co-designer and facilitator, I had specific ideas about what program features would contribute to group social connection. To address this personal bias, I collected and triangulated data from multiple sources, rigorously examined both supporting and discrepant data, and considered alternative explanations.

While participants may have initially exhibited behavioral reactivity in the vPLC, I believe that their behavior eventually returned to “normal” due to their intensive, ongoing involvement in the project. Triangulating data addressed participant reactivity.

While my sample and qualitative methods preclude generalization to other settings, I took several steps to yield a detailed description of findings that provide transferable knowledge for practitioners. Specifically, the intensive, long-term, multimethod nature of my study generated detailed information and examples of practitioner knowledge that provide

depth and specificity of findings. I systematically documented and described my procedures, and I regularly conversed with Dr. Ermeling and my advisors to ensure that I was employing rigorous, appropriate data collection and analysis procedures.

Conclusion

This study investigated how a vPLC was implemented to support social connection in a group of singleton high school teachers. The singleton high school teachers selected for this study represent a group who cannot fully participate in schoolwide PLCs – they lack site-based content-alike colleagues with whom to form PLC groups. Further, teachers were selected from geographically distant sites with a principal or other instructional leader that (a) had prior experience with a PLC framework, and (b) was committed to supporting teachers' collaborative, reflective practice. These selection criteria provided participants that stand to benefit most from a vPLC and represent schools where we would expect to see a vPLC model gain traction and succeed over time. Utilizing a descriptive single case study design, this study seeks to expound how vPLC program features contributed to desired group processes and outcomes, to generate transferable knowledge for practitioners.

CHAPTER 4: FINDINGS

This descriptive single case study investigated the implementation of a vPLC designed to foster social connection among a group of singleton high school teachers. I specifically sought to address the following questions:

How was a strategically designed vPLC of singleton high school teachers implemented to foster group social connection?

In what ways, if at all, did the vPLC foster group social connection?

How was the vPLC implemented to support group social connection?

This chapter shares my key findings from exploring these questions, based primarily on my analysis of participant observation data (videotaped meetings), as well as participant perceptions captured via exit tickets, web-based documents generated during the collaborative inquiry process, and my detailed researcher journal. This chapter first reports several key findings that emerged demonstrating group social connection, followed by a description of findings about how the strategically designed vPLC was implemented to support these outcomes.

Group Social Connection

Group social connection plays an integral role in effective vPLCs (Holmes, 2013; McConnell et al., 2013; Wang et al., 2019), and is comprised of at least two key elements—group social presence and collegiality via joint productive activity (JPA). Group social presence is defined as participants’ ability to identify with the community, communicate purposefully in a trusting environment, and develop interpersonal relationships by projecting their individual personalities through a selected medium of e-communication (Garrison, 2011; Garrison & Akyol, 2013; Garrison et al., 2000). Social presence provides the

foundational trust and sense of community necessary for teachers to engage in collegiality via JPA. Collegiality via JPA is defined as participants' ability to engage in a practice-focused process of collaborative dialogue and work (Ermeling & Graff-Ermeling, 2019; Lefstein et al., 2020). JPA undergirds the teacher learning necessary to enact positive changes in practice. Yet recent studies document challenges to establishing and developing group social connection within the virtual environment (Carpenter & Munshower, 2020; Durr et al., 2020; McConnell et al., 2013; Wang et al., 2019). In the case of this vPLC, analysis of videotaped meetings, participant perceptions captured via exit tickets, and outcomes documented in the virtual chartbook revealed key findings about the group social presence and collegiality via JPA that teachers established and developed over 12 weeks.

Teachers Established and Developed Group Social Presence During the vPLC

This section reports the open, cohesive, and interpersonal communication that occurred during the study. Representative excerpts from vPLC session transcripts and observation field notes are presented to illustrate key communication indicators evident in group dialogue and observed nonverbal behavior. These excerpts also illustrate how interpersonal communication developed over 12 weeks. Exit ticket quotes further reveal that teachers valued the social presence they established and developed throughout the study.

Open and Cohesive Communication. Teachers engaged in cohesive and open communication during each vPLC meeting. Cohesive communication included instances of teachers identifying as part of the community, like referring to each other by name, and using inclusive pronouns to address the group. From the first meeting through the last, cohesive communication occurred naturally and consistently across all pedagogically focused meeting segments, while open communication occurred naturally and consistently across all meeting

segments. The “cohesive and open communication” interchange below illustrates representative cohesive communication features that occurred in group dialogue and observed nonverbal behavior throughout the study. Specifically, teachers referred to each other by name and used inclusive pronouns to address the group during each pedagogically focused meeting segment in 12/12 vPLC sessions. Note (in the interchange below) how the teachers refer to each other by name (see underlined examples) and use inclusive pronouns to address the group (e.g., when Amaya states, “*Jenny gave us that link,*” “*thinking about where we’re heading,*” and “*something we’ve also talked about*”).

Additionally, open communication occurred naturally and consistently across all meeting segments. Open communication included instances of teachers communicating purposefully within the virtual context, such as asking questions, referring to others’ messages, expressing agreement or appreciation, and complimenting each other. The interchange below also illustrates representative open communication features that occurred in group dialogue and observed nonverbal behavior throughout the study. Specifically, teachers referred to others’ messages, expressed agreement with or appreciation for others, and complimented each other during 12/12 sessions. Note the ways that teachers refer to/ express agreement with, or appreciation for/ complement each other, and how multiple teachers participate in doing so.

*J: (after reading Amaya’s notes in the chartbook) Amaya, that’s a **very advanced or expert level of draft notes** there (Amaya and Jenny smile).*

*A: **Very kind of you, James. Thanks.** It helped that Jenny gave us that link to Bloom’s...*

(Kellie copies/ pastes her notes from a private document into the chartbook.)

T: (referring to Kellie's contribution) Nicely done. Wow.

*A: Kellie, man. **I'm a fan. You got the words, girl** (Kellie smiles).*

K: It's the English teacher side of me...

(Teachers discuss the essential skills articulated in the learning progression draft.)

A: But then to see what Kellie wrote, I'm like, 'no, that's advanced. Maybe that's where I need to get with my students.'

*K: **I agree.** As I was writing the advanced...I think that they could do...I don't know if I give them enough opportunity to actually demonstrate that they can take it there...*

*T: And **I love your idea** of the case study, because it's almost like detective work.*

A: Yeah. And with your wording, Kellie, I feel like, thinking where we're heading with neurotransmitters...it's going to be so natural to apply it to clinical psychology, which is something we also talked about.

Together, these cohesive and open communication indicators demonstrate teachers' collective identification with, purposeful communication about, and shared ownership of our improvement task.

Interpersonal Communication. Teachers' interpersonal communication developed over time. Interpersonal communication included instances of teachers demonstrating trust and emotional ties, including self-disclosing personal information, demonstrating vulnerability, using humor like joking and sarcasm, and using verbal and nonverbal affective expressions to demonstrate emotion. Initial interpersonal communication was characterized by highly structured, polite, positive interchanges where teachers shared personal information about pre-determined topics. These interchanges were limited to our "opening connection" meeting segments. By session five, "opening connection" interpersonal communication

(verbal and nonverbal) was characterized by unstructured, authentic interchanges where teachers shared a wide range of personal information, demonstrated vulnerability, used humor, and expressed emotions regarding topics of their choice. The interchange below illustrates representative interpersonal communication indicators that occurred in group dialogue and observed nonverbal behavior during unstructured opening connection times. Specifically, teachers shared personal information, demonstrated vulnerability, used humor, and verbally/ nonverbally expressed emotions during 12/12 opening connection segments during the study.

I began session nine by asking, *“How was everyone’s day?”* Tom openly responded by sharing personal information and using humor, stating, *“It was a challenging day. So please excuse my beverage of choice this evening (holds up an unopened bottle of wine and points to it, then jokingly makes a cheers gesture).”* Teachers laughed, and Amaya authentically responded, *“It was a terrible day. Tom, we’re drinking the same water. It was awful today.”* Tom responded empathetically, stating, *“Sorry to see a theme here.”* Amaya then described the stress and fear she experienced while taking her infant to the emergency room that day. Demonstrating vulnerability and expressing negative emotion, she shared, *“I just live in the COVID mom brain now. So, everything is like, ‘Well, they’re probably going to die.’ It’s terrifying.”* As Amaya spoke, all teachers in the group leaned forward, shaking their heads, or expressing sad faces.

Later, during the same interchange, Kellie’s rotund French bulldog appeared in her lap. He looked directly into the video camera, ears perked, tongue hanging out the side of his mouth. All teachers immediately expressed happiness via smiles. Amaya expressed humor, stating, *“Kellie is in a very good place. Oh Alfie, I really needed to see you tonight.”* I stated,

“Oh Alfie, you’re so well fed.” Teachers laughed, and we proceeded to discuss Alfie’s eating habits.

Still later, during the same interchange, James entered the zoom room eight minutes late upon completing his football practice. Tom held up his unopened bottle of wine in one hand, and a coffee mug in the other. He stated, *“Hi James, this is how my day went. How was yours?”* James looked from the coffee mug to the wine, smiled widely, and stated, *“I wish!”* Teachers laughed. We then talked briefly about James’ recent football game, and I transitioned the group into our collaborative inquiry segment.

This interchange illustrates group members openly sharing personal information about varied topics (daily challenges, emergency room visits, pets), using humor (Tom’s wine references, Alfie’s size), and expressing multiple emotions (fear, empathy, happiness). It also demonstrates Amaya’s vulnerability-sharing a difficult experience with the group, and teachers’ empathetic responses to her story. During the study, I consistently observed how these 10-minute unstructured “opening connection” interchanges helped develop teachers’ interpersonal connections and nurtured a sense of trust and community among group members.

Over the course of the 12-week vPLC, teachers evolved from a group of polite strangers into a self-identified community of colleagues and friends. The excerpt below, which occurred during the final 15 minutes of session 12, illustrates the group social presence that developed during the study. Amaya and Tom indicate the group’s shared social identity (see underlined examples – inclusive language). Amaya states that it’s been fun to *“watch how we’ve performed as a group...where we were and where we are.”* Tom refers to the group as a *“community,”* and indicates that he’d like to *“keep the community going.”*

Amaya also refers to group members as “*friends*.” She states that it’s “*cool to have someone...I feel like I could reach out to any of you if I get stuck*,” indicating that interpersonal connection developed among group members (see emboldened examples – emotional ties).

*A: And it’s also been fun just to, even though we literally just see each other’s floating heads, to watch how we’ve performed as a group (teachers smile, nod). Kind of where we were and where we are, and we’ve been together a while now, and that’s pretty fun too. I feel like if I were to run into you at a conference or at a coffee shop, I’d be like, “**Friend**, what’s up? Fill me in on all the things and give me all of your resources (everyone is smiling and nodding).” And so **that’s cool to have someone. I know I can reach out. I feel like I could reach out to any of you if I get stuck on a lesson or if I’m struggling with something**. And I haven’t had that as a psychology teacher when it comes to other teachers actively teaching, so that’s really cool.*

T: Yeah. It’d be nice to keep the community going because I think we all feel lonely sometimes with this.

Jenny: What, if anything, would you guys like to do to stay connected moving forward?

A: You think it’d be feasible...what if we would still meet once a month? And, it’s mostly just to share content or ideas? I don’t know if people would be interested in that (all teachers nod), but I know I would make time for that personally.

J: You guys send me an invite. I’ll be there (teachers smile).

K: Yeah, I would like that too. I think that was one of the best things, just like being

able to be with other psych teachers that are encountering the same difficulties with learning. And like, "How do you do that stuff?" So, I would absolutely do that.

Exit ticket data further revealed that participants valued the social connection they developed during the study. A participant stated,

"It was just really nice to work with such a great group of professionals. I've never been able to spend this kind of time with other AP Psych teachers so it was great to have that type of collegiality and I loved my time with everyone, even on Monday nights when I was tired and ready to be done for the day."

Together, the data presented in this section demonstrate the sense of community, purposeful communication, and interpersonal relationships that developed among teachers during the vPLC. This group social presence is important because it affects participation and social interaction among teachers, which are essential to support collegiality via JPA—the type of collaborative dialogue and work that leads to sustained changes in teachers' practice. Next, I will report key findings about the collegiality via JPA that teachers established and developed during the vPLC.

Teachers Established and Developed Collegiality via JPA During the vPLC

This section reports the types of pedagogically productive talk (PPT) that occurred, and corresponding inquiry tasks that were completed during the study. Representative excerpts from vPLC session transcripts and observation field notes are presented to illustrate key features of PPT evident in group dialogue. Corresponding excerpts from/ references to the virtual chartbook (Appendix D) are presented to show collectively completed inquiry tasks resulting from teachers' PPT. Finally, exit ticket quotes reveal that teachers valued the collegiality via JPA they established and developed throughout the study.

Pedagogically Productive Talk (PPT). Teachers collaboratively engaged in focused and productive dialogue during all pedagogically focused meeting segments, across all meetings. The predominant types of observed PPT aligned to the meeting segment's purpose and tasks. The sections below provide excerpts from transcripts and observation field notes that illustrate key features of *each* type of PPT evident in group dialogue throughout the study, and a description of how each type of talk aligned to a specific meeting segment's purpose and tasks.

Discourse Focused on Problems of Practice. The goal of our first pedagogically focused meeting segment was to select a substantive problem of practice. Accordingly, teachers' collaborative discourse focused on local problems of practice, or discussion of dilemmas situated in their own classrooms. The interchange below illustrates teacher collaborative discourse focused on local problems of practice. This excerpt specifically shows teachers collaboratively identifying disparities between expected student learning outcomes, and student performance in their classes (see underlined examples of common student struggles). This excerpt also serves as an example of multi-voiced PPT because teachers not only identify common student struggles, but also build upon each other's ideas to select a shared, substantive problem of practice for further inquiry.

Jenny: All right. If we look at that first skill set (listed in the chartbook) ... what stood out to us regarding disparities between student work and those skills?

A: I was thinking about how my kids struggle to understand certain components of neurotransmitters, like remembering which ones influence certain functions in the body, and which ones are involved with particular psychological disorders. I think there's a lot more they could be doing with that to have a better understanding.

K: I also wrote down neurotransmitters, and the connection between psychoactive drugs and also mental health, was what I wrote down. I know last year my kids were struggling with neurotransmitters in those ways too, Amaya (teachers nod).

T: Well, and I like that idea of the impact of drugs on neurotransmitters and why it's so dangerous to abuse recreational drugs or prescription drugs ... I know my students also struggle with neurotransmitter functions and how they impact behaviors and disorders. I think this can all tie together ...

J: Yeah. I just think this one seems to hit not only just in the biological sense, it hits across other areas and keeps coming up (in the curriculum throughout the year).

Completed problem-selection chartbook tasks (see Appendix D, pp. 2-3) provide written documentation of collaborative teacher discourse focused on problems of practice that occurred during this meeting segment. Task responses A, B, and C (captured by the facilitator) demonstrate teachers' jointly constructed inventory of expected learning outcomes, identified disparities in student work, and selection of our shared, substantive problem of practice: *"how do we help students apply psychological concepts to explain behavior and mental processes in authentic contexts?"* and more specifically, *"how do we help students apply conceptual knowledge of neurotransmitters to explain behavior and mental processes in a vignette or case study?"*

Exit ticket data revealed that participants *also* described their experience engaging in dialogue focused on problems of practice and found such talk useful to their collaborative experience. As one participant stated,

"We were able to discuss shared problems and concerns regarding course content and student learning. We discussed what has worked for us and what hasn't worked

for us. As the only AP Psych teacher at my school, it made me feel like less of an island and identified gaps in student learning that were common across the board (which was reassuring).”

This chartbook-directed teacher collaborative discourse intentionally focused on problems of practice connected teachers through their shared desire to investigate a common, substantive problem they all faced in their respective A.P. Psychology classrooms.

Discourse Includes Rich Representations of Practice and Pedagogical Reasoning.

During subsequent pedagogically focused meeting segments, the predominant types of PPT observed were rich representations of practice and pedagogical reasoning. These PPT elements were again aligned to each meeting segment’s purpose and tasks. For example, upon selecting a shared, substantive problem for collaborative inquiry, our next goals were to articulate a student learning progression, solidify a lesson context in which to study the problem, and create a detailed lesson plan to address the problem. Accordingly, teacher discourse included rich representations of practice and pedagogical reasoning about what to include in each lesson plan segment, and what we would expect to see in student work. Rich representations of practice included instances of teachers discussing lesson plans, student work, video recordings, and/ or artifacts representing student thinking and perspectives. Pedagogical reasoning included instances of teachers suggesting/ justifying/ refining a course of action, offering alternative courses of action, assessing evidence, and/ or clarifying reasoning about evidence. The interchange below illustrates representative discourse including rich representations of practice and pedagogical reasoning that occurred in group dialogue throughout the study. Specifically, teachers engaged in pedagogical reasoning about student work, lesson plans, or both in 12/12 pedagogically focused meeting segments. This

excerpt specifically shows teachers discussing lesson plan details (see underlined examples) and sharing pedagogical reasoning about why or how particular teaching and learning activities would benefit students' learning, in terms of our shared teaching and learning problem (see emboldened examples).

Jenny: What is the value of an initial brief discussion?

*J: I feel like the discussion part of it **may help some students in reflecting, seeing it from a different perspective**, somebody else has something to say with regard to that neurotransmitter, or that influence, I just feel like being able to have them talk about it, maybe they really don't quite understand it, or they do and **they can help others understand it**. I like the idea of them being able to have a dialogue with their peers first.*

*A: So, something I was thinking about is, I do think we need an opening discussion. I think it needs to be very finite in time... you have three minutes to discuss some of the key takeaways and information. Because I also **think that will give me the ability to walk around the classroom and see which groups are going to benefit from extra assistance**. But then I also think about **making sure they stay focused**, because that's my other concern. **I think there should be something driving it and I think that will give us a good idea of who's actually ready for this activity, and who's not, so that we can be ready to assist groups as needed.***

T: I agree, and I like giving them a little bit of a roadmap for that time.

*K: I think that makes sense. I think **giving them that structure too during the time is going to guide their conversation**. And I agree that the pre-activity discussion time is still super important to help them later on, because I think it will produce better*

focus in the class, or at least get them in the right mindset. But I like that because it revisits all of the resources, which they're going to be asked to do as they work through the activity.

Completed chartbook tasks provide additional documentation of teachers' dialogue including rich representations of practice that occurred during these meeting segments. Specifically, the learning progression task (see Appendix D, p. 6) demonstrates teachers' jointly created student learning progression, which anchored their conversational focus on what we would expect to see in student work. Each teacher compiled ideas separately and then copied and pasted their notes into the virtual chartbook for collective discussion. The detailed lesson planning tasks (see Appendix D, pp. 12-15) demonstrate teachers' jointly designed major lesson segments, as well as detailed plans and anticipated student responses for each segment, woven together into a lesson storyline. These tasks anchored teachers' conversational focus on the links between teaching and student learning.

Exit ticket data revealed that participants also acknowledged and valued their collaborative discourse that included rich representations of practice and pedagogical reasoning. A participant stated, *"Everyone brings insights and resources to the table, and now we have many new and great resources to apply to our own classrooms."* This teacher collaborative discourse including rich representations of practice and pedagogical reasoning connected teachers in intersubjectivity. Teachers listened to each other, using their talk to collectively develop an increasingly detailed and nuanced lesson plan that would have been difficult for any individual teacher to design independently.

Discourse Includes a Combination of Support and Critique to Handle Differing Views.

During 8/12 pedagogically focused meeting segments, teachers' dialogue demonstrated a

combination of support and critique to handle differing views, including instances of open disagreement, challenging thinking within relationships of collegiality and trust, navigating tensions, and resolving conflict. Teachers specifically navigated differing views related to our student learning progression, instructional approach selection, details associated with each major lesson segment-including our Free Response Question (FRQ) criteria, various instructional resources and scoring student work. The interchange below, which occurred while teachers collectively scored student work, provides an example of the teacher discourse that included a combination of support and critique to handle differing views. Specifically, this excerpt shows teachers disagreeing openly and challenging each other's thinking (see underlined examples), navigating conflict, and resolving conflict kindly-using humor to lighten the mood during instances of disagreement (see emboldened examples).

Jenny: Ok, and for serotonin? (Jenny, James, Tom, and Kellie each hold up one finger, indicating a score of one, while Amaya holds up two fingers, indicating a score of two.)

A: (realizing her score is different from the group) Oh, you don't feel like she did a good enough job telling how it would help her do good on the paper?

J: Yeah (Tom, Kellie, Jenny nod).

A: Oh, come on. But if you are in a good mood, then you're going to do good on the paper (gesturing, big eyes, smiling)!

Jenny: Why?

A: Because you're happy! (Amaya is gesturing animatedly, huge eyes, Tom is laughing, Kellie and Jenny are smiling.)

T: (joking) We already established this. She doesn't find writing papers makes her happy. She would have already done that, and she wouldn't have procrastinated.

A: Oh, you're- (Amaya makes a playful face)

Jenny: What more would we be looking for her to say?

K: Personally, I think there should be some connection to the writing process itself (James and Tom nod).

Jenny: That's the goal. Yeah. There's no 'why' at all.

A: Time out. Does the 'why' have to come before? Can it come after? Because the other ones that we've read, the paper doesn't have to be the reason that neurotransmitters are released, is it?

Jenny: No, but the student doesn't even say why it would help if they were happy before, though. I could be happy and write a terrible paper, because I'm distracted by the fun plans I'm about to do when I finish, so I rush through it. You could make an argument either way.

A: I just noticed what you are saying there.

Jenny: So, are we ok with the one?

A: Give her the one. I would've given her a two (using a fake angry tone and facial expression, all other teachers are smiling).

Exit ticket data further revealed that participants valued engaging in collaborative discourse that included a combination of support and critique to handle differing views. Noting the group's need to reconcile differing points of view during this meeting segment, a representative participant stated,

“Working through the FRQs together was a huge eye opener. It was extremely beneficial to examine the data we collected with one another. I think it may have given us some of our greatest insight which allowed us to consider what went well and what may need adjusting moving forward.”

Regarding the same meeting segment, another participant shared that scoring the FRQs as a group *“was useful in ensuring grade ‘norming.’ It helped me check the ways in which I grade student writing even outside of this specific application. I think this helped us to be more objective in our approach to grading and provide the most accurate results possible.”*

Teachers’ social presence was also evident throughout this interchange, as they used humor to navigate differing points of view and come to collective decisions regarding how to score student work.

Discourse is Shaped by Multiple Voices. Importantly, teachers’ collaborative discourse was shaped by multiple voices during all pedagogically focused meeting segments, across all meetings. Multiple voices included instances where two or more teachers contribute to conversation, attend to each other, and build upon each other’s ideas or contributions. The previously presented pedagogically focused meeting excerpts show that *all* teachers contributed to the conversation. They attended to each other verbally and non-verbally, demonstrating connection. The excerpts further show teachers building upon each other’s ideas to select a substantive problem of practice, solidify important lesson details, and score student data, respectively. Exit ticket data reveal that teachers acknowledged and valued the multiple voices. One participant shared, *“I really appreciate how we are able to build off of each other’s ideas in a way that I could not do alone. It’s been fun to see how quickly our collaboration is manifesting into some very cool results.”*

Together, the data presented in this section show teachers connecting via productive dialogue and working to address a shared problem of practice. This collegiality via JPA resulted in the successful completion of one full cycle of collaborative inquiry over the course of the study. Overall, group social connection data reveal that singleton AP Psychology teachers established and developed group social presence and collegiality via JPA during the 12-week vPLC. Next, I will report key findings about how the vPLC was enacted to support this group social connection.

How the vPLC was Implemented to Support Group Social Connection

This 12-week vPLC was strategically designed and implemented to support group social connection. Specifically, opening connection segments were designed to provide time and space for participants to develop interpersonal relationships, which foster the sense of trust and community necessary to support collegiality via JPA. PIER collaborative inquiry segments were designed to guide teachers through an evidence-based process of collaborative dialogue and work that could lead to positive changes in practice. These opening connection and PIER collaborative inquiry segments represent elements of effective face-to-face Professional Learning Communities (PLCs). Yet previous studies indicate that even when effective face-to-face strategies were enacted in the virtual context, teachers reported a strong preference for face-to-face groups due to perceptions that “*more personal*” and “*better discussions*” occurred in person as opposed to online (Carpenter & Munshower, 2020; McConnell et al., 2013).

This vPLC strategically utilized virtual strategies and technology tools to enact effective face-to-face design principles in ways that promote natural communication to support group social connection within a synchronous virtual context (Zoom). Analysis of

my detailed researcher journal, participant observations (videotaped meetings), participant perceptions captured via exit tickets, and group work products documented in the virtual chartbook revealed key findings about how these technical mediators were enacted by a trained facilitator (myself) to support group social connection.

The Zoom Platform Promoted Audiovisual Media Naturalness to Support Connection

This section reports the ways I, as the facilitator, used Zoom features to promote audiovisual media naturalness to support connection. Using information from my detailed researcher journal, I describe how I strategically used these features to promote natural communication and support social connection among group members. Excerpts from vPLC session transcripts and observation field notes illustrate how participants used information provided by these features in ways that supported group social presence and collegiality via JPA. Finally, exit ticket quotes provide further evidence that teachers valued our strategic use of Zoom features and found them useful to the collaborative process.

Audiovisual Features. Intentional use of Zoom’s audiovisual features enabled natural, clear, efficient communication to support group social connection. During our first session, an initial goal was to articulate a set of virtual communication norms to guide our collaborative dialogue and work. Per Dr. Ermeling’s advice during our planning session, I facilitated an initial norm-setting conversation in which I asked teachers to keep their video cameras and microphones on, while utilizing headphones to maximize sound quality. I explained that these strategic audiovisual choices allowed us to convey and observe important nonverbal communication behaviors like facial expressions and body language, to convey and listen to each other’s conversational contributions, and to respond to each other quickly – mimicking face-to-face communication and avoiding technology-related

communication awkwardness to the extent possible within the Zoom context. Teachers' access to such naturally flowing audiovisual information enabled them to convey, observe, and immediately respond to each other's nonverbal and verbal contributions during opening connection and collaborative inquiry meeting segments-supporting group social connection via natural, clear, efficient communication.

The interchange below illustrates teachers' natural communication to support group social connection within the Zoom context. Specifically, Amaya and Kellie use nonverbal and verbal cues to convey, observe, and respond to each other's use of humor (see underlined example of Amaya teasing Kellie) and sarcasm (see emboldened example of Kellie's response to Amaya) during our discussion of promising instructional approaches. Leading up to this interchange, James dropped out of the Zoom room for a few moments, missing our discussion of one approach. He rejoined the group, and I asked Amaya or Kellie to recap the approach for James.

Jenny: Who wants to describe it (our instructional approach) to James?

A: (her eyes open widely, and she smiles, moving her pen back and forth, pointing toward Kellie, based on where Kellie resides on Amaya's Zoom screen). Kellie, you're on! Kellie is on this side of me (Jenny and James smile).

*K: **(smiles, uses overly excited sarcastic tone) Thanks so much, Amaya!** (She proceeds to explain the approach we discussed in James' absence). Was that, OK?*

A: I thought it was good. Better than I would have said (Jenny nods and smiles, gives Kellie a thumb's up).

Teachers enacted these audiovisual strategies for the duration of each session- enabling natural, clear, efficient virtual communication that so closely mimicked face-to-face

communication, one participant even described our Zoom communication as such: *“I really felt the roundtable style of communication we had via Zoom meeting face-to-face allowed for our comments and concerns to be heard and immediately a conversation started.”*

Information-Sharing Features. Strategic utilization of Zoom’s chat feature further supported natural, clear, efficient visual information-sharing among group members, mimicking the use of handouts or other “hard copy” visual information-sharing strategies utilized in face-to-face PLC settings. Throughout the study, I regularly used Zoom’s chat feature to share information important to our collaborative inquiry process- including links to the virtual chartbook and relevant supplemental resources, which guided and fueled our joint dialogue and the completion of inquiry tasks each session. During session 2, one shared goal was to draft an initial student learning progression- a description of what we’d expect to see in students’ work as they moved from novice to advanced, based on our shared problem of practice. As we initiated this collaborative task, I was concerned that some teachers would feel nervous about sharing their descriptions with the group. Accordingly, to build teachers’ confidence, I provided a link to Bloom’s Taxonomy via the Zoom chat to support their individual thinking. Per Dr. Ermeling’s advice during our planning session, I also provided independent work time for teachers to privately write down their ideas in a private document before sharing them with the group in the virtual chartbook. The brief interchange below illustrates how Amaya used the link to Bloom’s information to support her thinking and written notes (see Appendix D, Chartbook p. 4) about our student learning progression, which eventually influenced teachers’ PPT about what we’d expect to see in students’ work.

J: (after reading Amaya’s notes in the chartbook) Amaya, that’s a very advanced or expert level of draft notes there (Amaya and Jenny smile).

A: Very kind of you, James. Thanks. It helped that Jenny gave us that link to Bloom's...

Exit ticket data further reveal that teachers valued Zoom's chat feature for natural, efficient information-sharing, and found it useful for the collaborative process. As one participant stated,

"I love how you are providing supporting documents to help us with our thinking and brainstorming. For example, giving us a link to Bloom. At the end of a long day, it was nice to have that right there and it was super helpful."

Another participant more generally valued *"the ability to share each other's content immediately, whether through the chat or talking over Zoom, we had instant access to years of work dedicated to refining the curriculum and teaching methods."* Overall, strategic use of Zoom's audiovisual and information sharing features promoted natural, clear, efficient communication that supported group social connection during the vPLC.

Technology Tools Promoted Collaborative Media Naturalness to Support Connection

Intentional utilization of technology tools promoted collaborative media naturalness for structured, organized communication, which supported group social presence and collegiality via JPA. This section reports the ways I, as the facilitator, used protocol-embedded google documents to promote natural collaboration that supported connection. Using information from my detailed researcher journal, I describe how I strategically used these tools to structure and organize communication and support social connection among group members. Representative excerpts from vPLC session transcripts and observation field notes illustrate how these tools supported participants' social presence and collegiality via

JPA. Finally, exit ticket quotes further reveal that teachers valued these protocol-embedded google documents and found them useful to the collaborative process.

Guiding Google Documents. I strategically used guiding google documents to structure and organize teachers' interpersonal communication during initial opening connection segments to support group social presence. During our first session, an initial goal was to establish interpersonal relationships among teachers- a trusting foundation from which to investigate a shared problem of practice. I anticipated that teachers might exhibit varying degrees of comfortability and openness while initially sharing personal information with a group of strangers. Accordingly, I created a highly structured "get-to-know-you" activity using Google documents, to ensure that teachers engaged in relatively equal self-disclosure about similar topics, for even amounts of time. Specifically, teachers received a link via the Zoom chat feature which forced them to make a personal copy of a google document housing a set of "get-to-know-you" guiding questions. These questions asked teachers to share information about the important people in their lives, their areas of passion outside of school, their dominant personality traits, and their professional background. I asked teachers to spend five minutes thinking about and organizing brief written responses to these questions, before verbally sharing with the group.

While I could have relied solely on verbal cues to guide group dialogue around these questions, I used Google documents to further structure and organize teachers' interpersonal communication within the virtual space. Google documents provided the additional benefits of visual instructions/ reminders to complement my verbal instructions, and private space for teachers to think about and respond to each question in writing before verbally sharing with the group. In this way, I strategically used Google documents to structure and organize our

opening connection activity to reduce chances of communication ambiguity, thereby freeing participants' cognitive load to focus on genuine communication and connection with the group.

This pre-planned, highly structured opening connection activity supported an episode of interpersonal communication in which 4/4 teachers spent roughly 3 minutes each self-disclosing personal information about their family and a personal passion (see underlined examples below), their personality and why they teach (see emboldened examples below). Here is a representative excerpt from this opening connection segment.

*“All right, so my people would be my fam – my wife, and God blessed me with three daughters because I also coach football. So, he always gives me 100 boys every fall. My passion would be, I’m very passionate about leadership. I really like to see how people cultivate character, ownership, and discipline... **Personality wise, I am a little more extroverted... My why really is my family, whether that’s my blood family or my (school) family that’s been assigned to me.**”*

This excerpt revealed a targeted, succinct, thoughtful teacher response that included self-disclosure of personal information to support group social presence. All teachers' responses further revealed common interests and shared values among the group – a firm foundation upon which to build interpersonal relationships. Exit ticket data further revealed that teachers valued our opening connection time, and my use of guiding Google documents to structure and organize our interpersonal communication. One participant stated,

“The community building was very helpful. It was helpful to get to know the different individuals before we started working toward a common goal. It was important to feel comfortable with the group in order to have healthy and effective communication.”

Another stated, *“I loved how you incorporated docs in the Zoom that allowed me to see more specific content but also edit to write down some of my thoughts.”* In this way, my strategic use of guiding Google documents structured and organized teachers’ interpersonal communication to support group social presence.

PIER Chartbook. The PIER Chartbook (a protocol-embedded Google document with designated workspaces for collective decision-making) structured and organized teachers’ practice-focused dialogue and work during collaborative inquiry segments to support collegiality via JPA. Specifically, the Chartbook served as a tool for face-to-face PIER protocols to be enacted in the virtual workspace. As designed by Dr. Ermeling, PIER workgroups systematically work through a set of tasks and prompts as they develop and reflect on research lessons to address shared problems of practice. Face-to-face workgroups collaborate in classrooms, using chart paper as a shared focal point. Dr. Ermeling’s PIER Chartbook served as our virtual shared focal point and allowed for teachers’ joint construction and collaborative interaction within a shared, interactive workspace (Google document).

I utilized the PIER Chartbook to support PPT and work throughout each session by guiding the group through a set of topic-specific tasks and prompts relevant to each stage of the inquiry cycle, and a set of accompanying progress-checks to ensure effective collaborative processes and outcomes. During our first session, our shared inquiry goal was to identify a shared, substantive teaching and learning problem. Chartbook prompts associated with this goal asked,

“A. What are some of the core elements of the curriculum shared by all members of your workgroup that are recursive and are foundational for future learning? B. What

major disparities do you see between these expected learning outcomes and the current reality of students in your classes?”

As I prepared to facilitate group dialogue and work, I anticipated the complexity of geographically spread singleton teachers selecting a shared problem of practice, with each employing slightly different curriculum scope and sequences at their school sites.

Accordingly, I prepopulated the Chartbook with an initial response to prompt A. I specifically added key enduring skills articulated in the College Board AP Psychology Course and Exam Description (CED) document (utilized by all AP Psychology teachers to plan instruction), to initiate conversation and provide initial common ground for our expected learning outcomes dialogue.

Given that teachers hailed from different schools and were still developing trust, I also wondered whether they would note similar disparities in student work, and whether they would be willing to share these with the group. Per Dr. Ermeling’s advice, for this portion of the meeting segment, I asked teachers to brainstorm independently on a private Microsoft Word or Google document before verbally sharing their thoughts with the group in the chartbook. I hoped this independent, safe space for initial reflection would benefit subsequent dialogue. Finally, I wanted to ensure collective buy-in for our problem selection.

Accordingly, I deliberately listened for commonly shared expected learning outcomes and disparities (Task B) as I guided group dialogue. In this way, I utilized the PIER Chartbook to structure, organize, and guide our practice-focused collaborative dialogue and work.

These prompts initiated a key episode of collegiality via JPA and rich “discourse focused on problem of practice” evidenced in the Group Social Connection findings. Multiple teachers built upon each other’s conversational contributions as they collectively

identified a shared challenge students faced in their respective AP Psychology classrooms—the struggle to conceptually understand and apply knowledge of neurotransmitters in real-world scenarios. The chartbook further focused teachers’ attention on the quality of our final problem selection via a set of “progress check” questions: *“Is it shared by all members of the group? Is it recursive? Is it compelling?”* The completed work from these problem-selection tasks (see Appendix D, pp. 2-3) also provided a visual record of teachers’ dialogue and joint outcomes, organized in a logical progression for ongoing reference throughout the inquiry process.

Exit ticket data further revealed that teachers valued the structure and organization provided by the Chartbook, as well as my pre-population strategy to support our joint dialogue and work. One participant shared, *“I liked how the information (in the Chartbook) was front-loaded with examples. This helped me visualize and know the types of issues we were trying to address and the process to achieve them.”* Regarding structure, a participant stated, *“the virtual chartbook was very helpful. As a visual learner, I found it very helpful to clearly see each step of the process with a description.”* Regarding organization, a participant shared, *“the chartbook was very useful to keep everything organized in a step-by-step fashion. The visual presentation/ layout made everything easy to locate and find each time we met and reinforced our methodological approach to planning.”*

Overall, one participant summarized the Chartbook’s value in this way,

“The virtual chart book was very useful. It allowed us to reference our previous work. It provided a logical progression of each step of our process and contained all of the necessary information in one place. For me, this type of visual is very useful and beneficial in organizing my own thoughts and reflections as well.”

In these ways, the virtual chartbook facilitated PPT and work throughout the study by providing what one participant dubbed a “*visual conversation with engaged professional educators.*”

Virtual Strategies Promoted Facilitation Media Naturalness to Support Connection

Virtual strategies promoted facilitation naturalness to keep meetings flowing smoothly, which supported group social presence and collegiality via JPA. This section reports the ways in which my strategic virtual setup and routines kept meetings flowing smoothly to support connection. I describe how I set up and navigated the virtual workspace to support social connection among group members using information from my detailed researcher journal. Excerpts from vPLC session transcripts and observation field notes illustrate how these strategies supported participants’ social presence and collegiality via JPA. Finally, exit ticket quotes further reveal that teachers valued these virtual strategies and found them useful to the collaborative process.

Virtual Setup and Routines. My strategic virtual setup and routines promoted facilitation naturalness to keep meetings flowing smoothly, which supported group social connection. Throughout the study, I utilized two computer monitors to facilitate teachers’ dialogue and work. I began each session with teachers’ video images “located” on the monitor directly in front of me, utilizing Zoom’s “gallery” view for an equal visual representation of each person during our opening connection segments. This allowed me to “read the room” for important nonverbal cues that informed my facilitation choices during our relationship-building time. As we transitioned into each collaborative inquiry segment, I dragged the Zoom video to a second monitor situated to the right of my primary monitor, maintaining the gallery view (and ability to read the room). I then used my principal monitor

to guide the technical aspects of each meeting, focusing my attention primarily on my detailed facilitation notes, and our shared focal point: the PIER Chartbook. During each inquiry segment, I also monitored the presence of teachers' circular icons at the top of the chartbook to track their participation, and the location of their cursors within the chartbook, to track their attention. In these ways, my virtual setup allowed me to simultaneously read the room and guide technical inquiry elements to keep each session running smoothly, as I would do in a face-to-face setting.

My weekly pre-planning routines further structured and organized our communication within the virtual workspace, privileging our focus on smoothly flowing group social connection. Each week, I engaged in 3 hours (on average) of pre-work to optimize teamwork, including 60-minute meetings with Dr. Ermeling. During these meetings, we used the PIER Facilitator Guide to create personalized, detailed facilitation notes that I used to guide teachers through each step of the collaborative inquiry process, specifically tailored to the virtual context. These plans included our anticipated teacher responses, and corresponding facilitator moves to optimize interpersonal communication and collegiality via JPA. Additionally, I independently prepared or curated supplemental resources (guiding Google documents, instructional resources) to further structure, organize, and support teachers' dialogue and work. These weekly pre-planning routines promoted teacher's structured, organized communication, and kept meetings flowing smoothly, which supported connection.

During session 10, one shared goal was to examine evidence to measure outcomes and study the relationship between our teaching and students' learning. As we transitioned into our collaborative inquiry segment, I asked teachers to open the Chartbook, scroll to our

Evidence Tally, and click their cursors “*next to letter A. List the specific criteria you will be looking for in student work. What do we want students to understand at the end of this lesson, related to our T&L problem?*” I anticipated that these singleton teachers had little to no experience collectively grading student work, and that the grading process could become a logistical nightmare if not well-organized. Per Dr. Ermeling’s advice, I prepopulated the Evidence Tally with a link to our Free Response Question (FRQ) prompt, our collectively articulated scoring criteria, and anchor examples I’d created to guide our analysis process. I also prepared our 10 student work samples and linked them directly into the Evidence Tally for teachers’ easy access during our analysis task.

Upon confirming 4/4 teachers’ “presence” on the Evidence Tally via their icons and cursors, I verbally reviewed our FRQ prompt, scoring criteria, and anchor examples to frame our work. The FRQ provided a vignette, and asked students to apply knowledge of four key neurotransmitters to explain how each might help someone complete a task, according to the information provided. Our criteria distinguished between incorrect applications (which scored 0), general applications (which scored 1), and detailed, specific applications (which scored 2) for each neurotransmitter. Accordingly, we collectively engaged in the following process, working through each consecutive student work sample. First, teachers silently, independently read the sample and scored each neurotransmitter application. Upon my verbal prompt for each neurotransmitter within the sample, each teacher held up fingers (2, 1, or the shape of a zero) to indicate their score. Then, the group discussed the score for each neurotransmitter until coming to consensus. Throughout the process, I guided dialogue and typed our scores into the tally chart.

This carefully structured and organized virtual Evidence Tally activity led to an episode of collegiality via JPA in which 4/4 teachers spent 50 minutes engaging in PPT that included rich representations of practice (student work), pedagogical reasoning (about why student work should be scored a 0, 1, or 2), and support/ critique to handle differing views (when coming to scoring consensus) as they completed the analysis task. The corresponding transcript excerpt and observation field notes are presented as evidence of collegiality via JPA- “discourse includes a combination of support and critique to handle differing views” within the Group Social Connection findings.

Exit ticket data further revealed that teachers valued our virtual setup and my pre-planning routines and found them useful to the collaborative process. One representative participant stated, “*Zoom is a great option for PLC. It makes it a reality to work with people anywhere. It definitely takes an intentional leader like Jenny to make it work and keep the flow of the sessions running smoothly.*” Another stated, “*It was great to click a link and go directly to a source that was relevant to the discussion. Everything was so well organized and on point. I appreciated you making the most of our time by being so well organized.*” Overall, my strategic virtual set up and weekly pre-planning routines kept our sessions running smoothly and optimized our vPLC time to focus on productive collaborative dialogue and work. As one representative participant summarized, “*It was helpful to have Jenny navigating the work and timeline. She helped to hold us accountable but still allowed for creativity and discussion. This has been the most productive PLC I have been a part of.*”

Conclusion

The ultimate purpose of teacher PLCs is to generate the learnings necessary for teachers to enact positive changes in practice. This investigation yielded key findings about

how a strategically designed vPLC of singleton high school teachers was implemented to foster the social connection that supports such learning within the virtual context.

Specifically, findings revealed that teachers established and developed group social presence and collegiality via JPA during the 12-week vPLC. Findings further revealed that specific virtual strategies and technology tools enacted by a trained facilitator supported group social connection within the synchronous virtual context (Zoom). In the following chapter, I will discuss the significance of these findings considering the knowledge base of the PLC literature, reflect on implications for practitioners, and provide recommendations for future research.

CHAPTER 5: DISCUSSION

In this descriptive case study, I documented the implementation of a vPLC designed to support geographically spread singleton teachers' group social connection, including their substantive collaboration around AP Psychology teaching and learning. I derived key findings from my analysis of videotaped meetings, participant perceptions, collaborative inquiry documents, and my researcher journal. My investigation revealed that teachers established and developed group social connection during the 12-week vPLC. Findings further revealed how the vPLC was enacted to support group social connection. In this chapter, I summarize key findings, and discuss their significance in relation to previous research. I then address implications for school-based practitioners. I conclude by discussing limitations of the study and recommending areas for further research.

Summary of Findings

This study's evidence suggests that teachers established and developed two important, interrelated types of group social connection in the virtual context: group social presence, and collegiality via joint productive activity (JPA). First, teachers established and developed group social presence-the ability to identify with the community, communicate purposefully in a trusting environment, and grow interpersonal relationships by projecting their individual personalities via virtual communication (Garrison, 2011; Garrison & Akyol, 2013; Garrison et al., 2000). This social presence provided the foundational trust and sense of community necessary for teachers to engage in collegiality via JPA- a practice-focused process of pedagogically productive dialogue and work (Ermeling & Graff-Ermeling, 2019; Lefstein et al., 2020). During the study, teachers also established and developed collegiality

via JPA. They engaged in the types of talk and work necessary to effectively address shared problems of practice, which led to the completion of a collaborative inquiry cycle.

Importantly, each type of group social connection positively and reciprocally influenced the other during the vPLC. Teachers' social presence infused and energized their pedagogically focused talk and work. For instance, teachers referenced shared personal knowledge and jokes when navigating instances of tension or disagreement during collaborative inquiry, which helped them resolve conflict and propel their work forward. Simultaneously, collegiality via JPA further strengthened teachers' interpersonal relationships and sense of community, as their collective construction of instructional innovations bonded them together as a group. In sum, this study's social connection evidence suggests that it is possible for teachers, at least in the circumstances described for this context, to establish both group social presence and collegiality in the virtual context, and that JPA was a key mechanism for facilitating these connections. It further suggests that both types of group social connection should be intentionally cultivated, as each plays an integral, interrelated role in effective vPLCs.

This study's evidence further suggests that group social connection was supported by technical mediators enacted by a trained facilitator to promote media naturalness in the virtual context. PIER program protocols (tasks and prompts for collaborative lesson research, embedded in a shared google document) structured, organized, and initiated teachers' pedagogically productive talk and work during each pedagogically focused meeting segment throughout the study. These protocols ensured that the group's talk and work followed essential steps of the inquiry process, fostered a shared language and intersubjectivity among teachers, supported teachers' inquiry and reflection, and equipped me as a facilitator to guide

and sustain productive action. In the virtual context, embedding these protocols within a shared google document provided an elegant balance between structured collaborative process and organic, generative discussion. In addition to these benefits, the PIER chartbook preserved teachers' work in an organized manner for future reference and use. In sum, the case study findings point to the value of utilizing protocol-embedded technology tools to structure, organize, and preserve teachers' pedagogically productive talk and work. These tools provide a readily accessible structure for the virtual collaborative process, while also allowing for organic, innovative discussion focused on improving teaching and learning.

My virtual facilitation strategies and weekly routines privileged group social connection throughout the study. The dual-monitor setup allowed me to "read the room" and guide interpersonal aspects of the meeting from one screen (privileging group social presence), while using facilitation notes and the PIER chartbook to guide our systematic inquiry process from the other screen (privileging collegiality via JPA). My weekly pre-planning meetings with Dr. Ermeling further allowed me to anticipate teachers' responses and identify helpful facilitator moves to privilege group social connection in the virtual workspace. Helpful virtual facilitation moves included my strategic use of Zoom's audiovisual features to optimize communication, as well as my strategic use of google documents (private and shared), and targeted supplemental resources to build teachers' confidence and guide, extend, and preserve their thinking. Additional helpful pre-planning activities included frontloading chartbook notes between meetings (to minimize time spent on less important tasks), and creating instructional resources for our research lesson, to move our work forward according to our implementation timeline. In sum, the findings help

substantiate the value of a well-prepared facilitator to thoughtfully setup and navigate the virtual context in ways that privilege group social connection.

Finally, this study's evidence suggests that media naturalness was optimized in this virtual environment- enabling clear, structured, smoothly flowing communication to support group social connection. For this study, media naturalness was achieved through the convergence of three distinct elements. Strategic audiovisual choices (audio and video always on, headphones to optimize sound quality) and information-sharing via the chat feature enabled clear, efficient virtual communication that closely mimicked face-to-face communication. The virtual PIER chartbook enabled structured communication via a shared focal point that closely mimicked the type of face-to-face collaboration in which teachers typically engage via a classroom white-board or chart paper. My virtual setup and facilitation strategies enabled me to "read the room" and guide our systematic inquiry process to keep meetings flowing smoothly in ways that closely mimicked face-to-face facilitation. In sum, this study's evidence suggests the value of taking a multidimensional, tactical approach to maximizing naturalness in support of group social connection in the virtual context.

Interpretation of Findings

The significance of my study's findings is derived from their integration into the ongoing study of virtual and face-to-face PLCs. This study confirms, extends, and provides some contrasting evidence for earlier studies while also providing important implications for school-based practitioners and future research. This section is organized according to key concepts and ideas that I introduced in chapter two and will now reconsider in the context of my research findings.

Establishing and Developing Group Social Connection

Prior studies show that group social connection plays an integral role in effective virtual and face-to-face PLCs (Holmes, 2013; Lefstein et al., 2019; McConnell et al., 2013; Saunders et al., in press; Wang et al., 2019). Yet recent studies document challenges to establishing and developing group social connection within the virtual environment (Carpenter & Munshower, 2020; Durr et al., 2020; McConnell et al., 2013; Wang et al., 2019). My study extends previous knowledge about developing group social presence, while providing some contrasting evidence for previously documented obstacles to effective collegiality via JPA in the virtual context.

In their qualitative study exploring the use of videoconferencing to support vPLCs, McConnell et al., 2013, stated that a face-to-face summer intensive contributed to a foundational sense of group social presence among vPLC members. The researchers recommended that future vPLCs provide similar face-to-face intensives to support an initial sense of community among group members. My study shows that it is possible to establish group social presence *without* the in-person community building opportunities recommended in earlier work. It further extends previous knowledge by describing *how* group social presence was established and developed- via deliberately structured “opening connection segments” that provided time and space for teachers to engage in natural, informal dialogue around nonprofessional topics.

While this was one small group of teachers, my study showed no evidence of the conversational obstacles to collegiality via JPA documented in previous vPLC studies, such as low levels of discourse, communication awkwardness, social loafing, or domination patterns (Carpenter & Munshower, 2020; Durr et al., 2020; McConnell et al., 2013; Wang et al., 2019). Rather, teachers evenly contributed to pedagogically productive talk and work

across all pedagogically focused meeting segments. The findings offer insight into the value of intentionally designing tasks and prompts that require teachers to engage in these types of talk and work, and to enact them in a way that values all voices within the group.

Protocols to Structure and Initiate Teachers' Pedagogically Productive Talk and Work

Previous literature reveals the importance of protocol-guided, structured conversations to support the completion of productive collaborative inquiry cycles (Ermeling et al., 2015, Gallimore et al., 2009; Margalef & Roblin, 2016). My study confirms the work of these previous researchers while extending our knowledge of how to enact these protocols to support group social connection in the virtual context. Specifically, my study's findings suggest that embedding protocols within a shared google document (or other technology tool that provides a shared workspace) allows for teachers' joint construction and collaborative interaction that closely mimics what occurs in a face-to-face classroom with a white board or chart paper. Such collaborative naturalness supports teachers' pedagogically productive talk and work in the virtual context.

Facilitation Strategies to Privilege Group Social Connection

Multiple studies show that trained facilitators play an integral role in successful group dynamics and collaborative inquiry (Cabrera, 2020; Charner et al., 2016; Ermeling et al., 2015, Gallimore et al., 2009; Margalef & Roblin, 2016). My study confirms the work of these previous researchers while extending our knowledge about how facilitators can setup and navigate the virtual context in ways that privilege group social connection. For example, in their study examining ways in which facilitators specifically supported their face-to-face PLC members, Margalef & Roblin (2016) found that effective leaders provided groupwork strategies that created a culture of trust, knowledge-building strategies that provided access to

relevant research and the inquiry process, and reflection strategies that challenged assumptions and pedagogical beliefs. My findings describe how these aims can be achieved in the virtual context. Specifically, a dual-monitor setup allows facilitators to simultaneously “read the room” while engaging teachers in important groupwork, knowledge-building, and reflection strategies. Further, embedding knowledge-building and reflection protocols within a google document (or similar technology tool) equips facilitators with a structured, shared workspace that focuses teachers’ attention and guides their joint dialogue and work. Finally, facilitators can use videoconferencing chat features to provide teachers with immediate access to relevant research, and audiovisual features (i.e., establishing norms for keeping audio and video on) to support clear, efficient, natural communication among group members. This study suggests the importance of helping facilitators learn about important groupwork, knowledge-building, and reflection strategies, as well as *how* to enact such strategies in the virtual context in ways that privilege group social connection. This might be more readily accomplished by building facilitator capacity with the virtual technology platform features, technology tools, and virtual facilitation strategies documented in this study.

Media Naturalness to Enable Effective Communication

Prior studies outline key considerations for the selection and use of videoconferencing tools to facilitate effective online learning within a shared virtual workspace. My study confirms Al-Samarraie’s (2019) findings that web-based videoconferencing tools (such as Zoom) support virtual relationship-building, as they allow for interchanges that closely mimic face-to-face interactions, promote dynamic collaborative efforts, and provide reliable means to assess individuals’ roles in discussion. According to

Kock (2005b), e-communication mediums that closely resemble face-to-face communication result in decreased communication ambiguity, increased cognitive effort, and increase physiological arousal in participants. That is, media naturalness promotes clear communication, cognitive effort, and engagement among participants. My study lends confirming evidence to Kock's conceptualization of audiovisual media naturalness and extends it by suggesting the value of a multidimensional, tactical approach to maximizing naturalness in three domains within the virtual environment: audiovisual, collaboration, and facilitation naturalness.

The strategies outlined in this study comprehensively addressed audiovisual naturalness via specific choices with Zoom features, collaboration naturalness via the PIER virtual chartbook, and facilitation naturalness via strategic choices enacted to minimize distraction and maximize potential enhancements inherent in the virtual workspace. Analysis of this team's vPLC experience further suggests some enhancements provided by a synchronous virtual medium. For example, in my role as facilitator, I found that monitoring four teachers' facial expressions and body language was easier for me in the virtual context than in a similar face-to-face context. Zoom's gallery view provided equal visual access to teachers' faces in my direct line of sight, and enabled me to gaze at individuals (to interpret their nonverbal cues) longer than would be considered "normal" in a face-to-face context. Further, I was able to repurpose the energy I'd typically spend configuring a physical room to promote group social connection, and focus instead on the quality of social connection within Zoom. Finally, the ability to record our vPLC meetings provided efficient access for group members to "catch up to speed" in the rare cases when teachers missed a meeting. In these

ways, our virtual communication medium not only closely resembled face-to-face interactions, but it also surpassed them in terms of efficiency.

Implications for Practitioners

The findings in this study describe how a vPLC might be enacted to support group social connection in the virtual context, which undergirds the teacher learning necessary to enact positive changes in practice. As such, this study provides important practical implications for school-based practitioners seeking to design and implement effective vPLCs. In this section, I discuss implications for vPLC design and implementation, and suggest additional uses of Zoom (or similar videoconferencing software) to extend valuable vPLC knowledge and expertise in ways that uniquely address the diverse needs of K-12 schools and districts across the country.

Privilege and Structure Group Social Connection

Group social connection represents one key ingredient in the process of teacher learning that supports the study and improvement of practice. Accordingly, school-based practitioners would do well to intentionally design and implement vPLCs that privilege and structure group social presence and collegiality via JPA. Specifically, practitioners can consider providing dedicated time and space during each vPLC session for teachers (particularly geographically spread singletons who do not initially know each other) to engage in natural, informal dialogue around nonprofessional topics. This dedicated connection time can reestablish and strengthen social presence each week, while energizing the group for subsequent collaborative inquiry tasks.

While group social presence provides foundational trust and a sense of community among teachers, it does not include the types of pedagogically productive talk and work

necessary for teachers to engage in the systematic study of practice. Accordingly, practitioners can deliberately design tasks and prompts that elicit such talk and work, and ensure that each session provides dedicated time and space for teachers' collaborative inquiry. Practitioners can also consider allowing limited time and space for social presence to infuse teachers' pedagogically productive talk and work. Minor "infusions" such as personal references or jokes can energize the rigorous work of systematic inquiry, while helping teachers navigate tension and resolve the conflicts that naturally arise throughout the collaborative process.

Design and Enact vPLCs That Promote Three Dimensions of Media Naturalness

In addition to providing dedicated time, space, and tasks to privilege group social connection, practitioners can intentionally address three dimensions of media naturalness within the virtual context. This section provides an overview of each dimension, and a corresponding set of questions that practitioners can ask themselves as they thoughtfully plan to promote media naturalness to support group social connection in a vPLC.

Videoconferencing Features to Promote Audiovisual Media Naturalness.

Practitioners can leverage audiovisual features within their chosen videoconferencing platform to promote virtual communication that closely mimics face-to-face communication.

Key questions for consideration might include:

1. How might I instruct participants to use audio and video camera features to convey and observe important nonverbal communication cues like facial expressions and body language within the virtual platform (i.e., audio and video camera always on)?
2. How might I instruct participants to use such features to promote smoothly flowing, immediate verbal communication within the virtual platform?

3. How might I differentiate the use of these features to support group social presence and collegiality via JPA (i.e., video front-and-center to support group social presence, web-based interactive document front-and-center to support collegiality via JPA)?

Protocol-Embedded Technology Tools to Promote Collaboration Naturalness.

Practitioners can leverage protocol-embedded technology tools (i.e., web-based interactive documents) to structure, organize, and guide collaboration in ways that closely mimic face-to-face collaboration.

Key questions for consideration include:

1. What specific tasks and prompts might I incorporate that will help initiate teachers' pedagogically productive talk and work in relation to our meeting goals (tasks and prompts should provide a structured process while allowing for organic, generative discussions)?
2. What specific technology tool might we use to embed these tasks and prompts and to structure, organize, and guide our work (tools, such as pre-formatted Google docs, should offer a shared workspace and serve as a shared focal point for teachers' attention, dialogue, and work)?

Virtual Strategies to Promote Facilitation Naturalness. Practitioners can leverage virtual setup and weekly routines to keep virtual meetings flowing smoothly, in ways that closely mimic face-to-face facilitation.

Key questions for consideration include:

1. How might I setup my device screens and virtual environment to simultaneously gauge participant's reactions/ attention while also guiding the technical aspects of each meeting with other documents, notes, and tools?

2. How might I employ the following facilitation strategies to support group social presence and collegiality via JPA?
 - a. Establishing virtual communication norms
 - b. Providing clear verbal/visual signals for navigating upcoming exchanges/work
 - c. Providing independent think time via private documents prior to collective work
 - d. Pre-planning and preparing helpful resources between meetings

Leverage Videoconferencing to Extend Expertise and Resources. Beyond its use to unite geographically spread singletons around common problems of practice, well-structured, video-based collaboration might also be used to provide important vPLC-related benefits to other schools and teachers: increased access to high-quality experts or facilitators regardless of geographical location; expanded flexibility of team configurations – connecting teachers within and across districts; increased flexibility in scheduling or providing support for meetings free from typical travel time and cost restraints; and decreased need for physical meeting facilities. School-based practitioners can explore ways to use videoconferencing to “level the playing field” of financial resources by connecting valuable vPLC expertise and resources with specific areas of need within and across districts or geographical regions.

Implications for Research

The field of education would benefit from additional research related to vPLCs. More research is needed to guide practitioners as they seek to design and implement effective vPLCs that lead to positive changes in teachers’ practice and student learning. Future research could expand upon my study in three ways. First, other researchers could duplicate the methods employed in this study- Zoom, protocol-embedded technology tool, trained

facilitator- to see if they generate similar data across different group configurations. Second, researchers could design a study to better distinguish which of the vPLC feature(s) described in this case might have the most prominent effect on group social connection. Finally, researchers could design an extended investigation examining multiple inquiry cycles focused on classroom observations and possible changes in practice-important elements that were beyond the scope of this study.

Limitations

This study, like other research studies, has a few notable limitations. Specifically, I recognize that these qualitative findings describe the experience of one small group of geographically spread singleton high school teachers in the Pacific Standard Time zone who opted into a vPLC that convened weekly via Zoom. As such, these findings might not occur with groups that notably differ across a number of dimensions, including teachers' singleton status, opt-in status (versus mandatory participation), subject(s) and curriculum taught, type of school, time zones, overall group size, total number of sessions, and technology platform utilized. Additionally, I implemented a research-based protocol with demonstrated success engaging teachers in the collaborative inquiry process. I met weekly with the protocol designer, a teacher inquiry expert with over 20 years of field and research experience, to plan and debrief each meeting throughout the study. That said, this expert assistance and research-based protocol were implemented by an instructional leader (myself) with limited experience in the virtual context, and purposefully documented to make them accessible to other instructional leaders. While my findings could differ based on the specific vPLC group characteristics mentioned above, the goal of my study was to provide a detailed account of

one group's experience that yields specific examples of practitioner knowledge, and that will eventually converge with other studies to build a more comprehensive knowledge base.

Conclusion

Despite the promise of teacher PLCs for improving practice and student achievement, key logistical challenges prevent their effective implementation in American schools (Carpenter, 2018; Darling-Hammond et al., 2017; Goodwin, 2014; Hord, 2004; Lomos, Hofman, & Bosker, 2011). vPLCs may solve some logistical implementation obstacles by providing stable settings for geographically spread singleton teachers to engage in content-alike work groups. Yet recent studies document challenges to establishing and developing group social connection in the virtual environment (Carpenter & Munshower, 2020; Durr et al., 2020; McConnell et al., 2013; Wang et al., 2019). These studies indicate that even when effective face-to-face strategies are enacted in the virtual context, teachers report a strong preference for face-to-face groups due to perceptions that “*more personal*” and “*better discussions*” occur in person as opposed to online (Carpenter & Munshower, 2020; McConnell et al., 2013). A vPLC's potential to effectively improve teaching and learning hinges on its ability to generate learnings through effective collaborative group process. Accordingly, this study sought to inform research and practice by investigating the implementation of a vPLC strategically designed to foster group social connection among a group of singleton high school teachers.

Evidence suggests that this study's strategic optimization of three distinct elements of media naturalness supported the establishment and development of teachers' group social presence and collegiality via JPA during the 12-week vPLC. Specifically, the vPLC provided an e-medium of communication that closely mimicked face-to-face communication by

comprehensively addressing audiovisual, collaboration, and facilitation naturalness in the virtual context. Deliberate planning and implementation in each of these areas supported teachers' natural communication, group social connection, and completion of a collaborative inquiry cycle in this study. This kind of "natural" vPLC holds promise not only for uniting geographically spread singleton teachers in productive content-alike workgroups with the potential to change practice, but also for providing important vPLC-related benefits to other schools and teachers across the country via strategic sharing of resources. As one vPLC participant shared during our closing session,

“Without the use of this technology, the opportunity we just experienced would have been impossible. This is something we need to take with us as we move forward out of pandemic teaching. I believe opportunities like this have the ability to change classrooms and schools. I see it as being a means of reducing teacher burnout and creating opportunities for that connection and fellowship we all need as (singleton) educators but may not get as we walk around the halls of our own schools.”

Appendix A

Participant Observation Protocol Template

Meeting #/ Topic:	Observer:
Meeting Date:	Write-Up Date:
Meeting Time:	Participants Present:

Video Time Marks	Observations			Observer Notes
	(i) Observed evidence of group social presence and/or collegiality via JPA	(ii) Evidence of what preceded or instigated the episode of group social presence and/ or collegiality via JPA	(iii) Evidence of what resulted from the episode of social presence or group collegiality	

Appendix B

Researcher Journal Template

Meeting # / Topic
Date/ Time

Pre-Meeting Notes

Session Preparation

--

Proposed Attendance and Agenda

--

Pre-Meeting Meeting Segments (Time) Detailed Plans	Pre-Meeting Anticipated Teacher Reactions or Responses & Facilitator Moves/ Responses to Teachers/ Notes	Post-Meeting Actual Teacher Reactions or Responses & Facilitator Moves/ Responses to Teachers Key Points to Look for in Observations
Opening Connection (10 min)		
Collaborative Inquiry (60 min)		

Brad's Insights: What did I gain via our dialogue, with regards to RQs?

Additional Immediate Post-Meeting Notes

Actual Attendance and Agenda

--

Researcher-facilitator Notes (data dump - thoughts and ideas)

--

Obstacles/ questions to address during the next pre-meeting

--

Weekly Data Analysis Process/Routine

- Review RQs and Coding Framework
- Watch video and record meeting time segments, notes, evidence of social connection/enactment: Observation Protocol ([link](#))
- Transcribe video and read/ highlight - color code evidence of social connection/enactment within the transcript ([link](#))
- *As Applicable*: Read through PIER Virtual Chartbook ([link](#)) - color code evidence of collegiality via JPA/ compare with observation protocol evidence/ transcript evidence
- *As Applicable*: Read participant perception data - color code evidence of enactment/ social connection
- Use journal pre- and post-meeting notes, video evidence, transcript evidence, PIER chartbook evidence, and participant perception evidence to complete/ answer the following:

Part I

Evidence of social presence

Interpersonal Communication

Affective Expression
Self-Disclosure
Use of Humor

Open Communication

Referring explicitly to others' messages
Expressing Agreement
Asking Questions
Complementing, Expressing Appreciation

Cohesive Communication

Vocatives (names)
Inclusive Pronouns (we, us, our group)

Evidence of collegiality via JPA

Complete Tasks

Problems of Practice

Pedagogical Reasoning

Rich Representations

Support & Critique to Handle Differing Views

Multiple Voices

In what ways, if at all, does the opening connection segment support social presence?

In what ways, if at all, does the PIER inquiry segment support collegiality via JPA?

In what ways, if at all, do zoom features contribute to social presence/ collegiality via JPA?

Video

Audio

Chat

Info-sharing

In what ways, if at all, does the Chartbook contribute to social presence/ collegiality via JPA?

In what ways, if at all, do virtual strategies/ facilitator moves contribute to social presence/ JPA?

What evidence, if any, points to a lack of social connection?

Individual Teacher Notes

Name (Pseudonym):

Name (Pseudonym):

Name (Pseudonym):

Name (Pseudonym):

Part II

Emerging themes, patterns, evidence of connections between enactment/ social connection?

Alternative explanations?

Potential biases? Participant Reactivity?

Other?

Appendix C

Participant Observation and Transcript Coding Framework

Social Presence Definition: participants' ability to identify with the community, communicate purposefully in a trusting environment, and develop interpersonal relationships by projecting their individual personalities through the medium of communication being used

Observed evidence of group Social Presence (derived from Garrison, 2011)

Interpersonal Communication (IC) - trust, developing relationships, emotional ties

Self-Disclosure - presents details of life outside the group, or expresses vulnerability

Use of Humor - joking, teasing, cajoling, irony, understatements, sarcasm

Affective Expression - including written or "tech" expressions

Open Communication (OC) - communicate purposefully

Referring explicitly to others' messages

Asking Questions (of teammates and/ or facilitator)

Complementing, Expressing Appreciation - for others, contents of others' communication

Expressing Agreement

Cohesive Communication (CC) - identify with the community

Vocatives - Addressing or referring to participants by name

Inclusive Pronouns - Addresses group as we, us, our, group

*Track Attendance (necessary to foster ongoing connection among participants)

Collegiality via Joint Productive Activity Definition: participants' ability to engage in a practice-focused process of collaborative dialogue and work where JPA leads to a sense of common purpose and shared knowledge building

Observed evidence of group Collegiality via Joint Productive Activity (JPA)

Pedagogically Productive Talk (Lefstein et. al) - "practice-focused process of collaborative dialogue"

Discourse is focused on local problems of practice (PP)

Dilemmas local to teachers' own classroom (situated)

Discuss what purposes to pursue to address dilemmas

Discourse includes pedagogical reasoning (PR)

Assessment of evidence

Clarifying reasoning about evidence

Inquiry into causes of evidence

Offering alternatives/ Suggesting, justifying, refining a course of action

Discourse includes rich representations of practice (RR)

Student work

Lesson plans

Video recordings
Discourse is shaped by multiple voices (MV)
Multiple perspectives
Attending to one another
Building upon one another
Discourse includes combination of support & critique to handle differing views (DV)
Cast doubt on common assumptions and practices
Able to disagree openly
Challenge thinking within relations of collegiality and trust
Navigate tensions
Resolve conflict
Adherence to collectively agreed upon responsibilities - Complete Tasks “practice-focused process of collaborative work”

Evidence of what preceded or instigated episodes of group social presence & JPA:

Program design features for Social Presence (PD)
Opening Structured Connection Activity

Virtual Technology Choices (VT)

Video choices - video always on, video *front and center* for social presence
Video choices - video always on, video *to the side or behind Chartbook* for JPA
Audio choices to increase naturalness - audio unmuted
Chat box choices - everyone share in chat, private chat disabled

Facilitator Moves (FM)

Articulate, review, reference community norms to guide group process
Articulate, review, reference rationale for VT choices
Model appropriate responses and communication
SP Guide dialogue - ask personal questions, affirm personal responses, make connections among group members’ shared experiences and values, encourage all voices, demonstrate active listening
JPA Guide dialogue - ask questions, provide clarification, give constructive feedback, mitigate conflict/ tension, facilitate “building” upon others’ ideas, encourage all voices, demo active listening, redirect the conversation
Provide clear signals for navigating upcoming exchanges and work-verbal/ visual
Provide think time with private docs before asking participants to share
JPA-Classify prep work (wordsmithing, formatting, organizing) vs. teamwork (focus session on collaboration and JPA)
JPA-Provide clearly articulated examples of commonly referenced terms
JPA-Virtual Moves - 2 monitors, watch icons and cursors to see where people are working and what they’re attending to

Virtual Chartbook (VC)

Visual review/ reference of community norms to begin each session
Shared, synchronously edited document focuses group attention on inquiry stage
Clearly articulated joint tasks for each inquiry stage

Clearly articulated process checks for each inquiry stage
Clearly articulated planning and reflective prompts guide dialogue for each inquiry stage
Logically organized group processes and outcomes

Appendix D

PIER Virtual Chartbook

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