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"We don't observe other teachers": Addressing professional development barriers through lesson study and video clubs

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Since the inception of formal teacher professional development (TPD), teachers have often found their learning opportunities less than satisfactory (Fullan, 2007). In spite of research demonstrating the elements of effective TPD, such as involving teachers as active learners and treating them as professionals, providing sufficient resources and relevant content, using effective media, creating opportunities for teachers to talk with each other and work together in a sustained manner (e.g., Darling-Hammond & McLaughlin, 1995; Darling-Hammond et al., 2017; Duncombe & Amour, 2004; Fishman et al., 2003; Putnam & Borko, 1997; Wilson & Berne, 1998), we still do not find many teachers wishing for more TPD. However, effective TPD models that possess the effective elements just noted and connect teachers outside of their home schools remain understudied, especially for teachers in specialized teaching contexts.

The present study examines how connecting specialized teachers through flexibly structured seminars, conversations, and shared video-recorded lessons supported teachers' perceived learning. Using a hybrid TPD model that incorporated facets of long-term in-person and virtual learning, Lesson Study with Video Club (LSVC), we measured the perceived effectiveness (as reported by participating teachers) of LSVC. We chose to implement and study the LSVC model with a specialized group of teachers (dual language teachers) in a content area (mathematics).

Theoretical Frameworks

Teacher learning

Kelly (2006) defines teacher learning as the "process by which teachers move towards expertise" (p. 514). This process does not happen automatically. Developing expertise requires opportunities for teachers to learn and practice in order to acquire sophisticated knowledge such as pedagogical content knowledge (PCK) (Shulman, 1987) and pedagogical language knowledge (PLK) (Bunch, 2013; Galguera, 2011), and apply this understanding to change their behavior (Darling-Hammond, 2008). Teachers learn best when they talk with each other, observe their students, and are provided opportunities to simultaneously dive deep into practice-informing theories while receiving continued guidance as they apply what they learn in their own classrooms (e.g., Borko, 2004; Darling-Hammond & McLaughlin, 1995). Using a situated perspective, Putnam and Borko (2000) explain how diversity in professional development groups can be beneficial as PD participants draw on each other's expertise and insights through meaningful discussion and reflection (Kizilbash, 2020). Along these lines of collaborations' role in learning, Fullan and Hargreaves' (2016) distinguished between , Professional Development (PD) and Professional Learning (PL), where PL is more as "what and how teachers learn," whereas PD "would include 'mindfulness' and 'team building' as more holistic aspects

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of the teacher learning process" (p. 63). The LSVC format used in this study accounts for both concepts, PD and PL. First, the "what" and "how," Professional Learning, is visible through the specialized content discussed and practiced through video and semi-structured discussions. The format also functioned as Professional Development, with features included to help participants establish and maintain a teacher professional community. For example, participants engaged in partnered discussions and regular interactions over a year-long period to build rapport. In this study, teachers were united not by school but by school context (Dual Language Program [DLP]) and learning focus (integration of language and mathematics). Their diversity was represented in the grades they taught, their school and district placements, and their years' experience in the profession. LSVC provided consistent opportunities for the diverse DLP teachers to use their common ground to communicate with each other about content they found valuable for their teaching practice.

Effective Features of TPD

In general, the most commonly cited feature of strong TPD is that teachers must collaborate with each other in order to make genuine professional growth (Kizilbash, 2020). A second fundamental point is that the TPD be contextualized in the teachers' own classrooms. Darling-Hammond and McLaughlin's (1995) list of effective TPD features, compiled 25 years ago, is still largely accurate. They recommend that effective professional development adhere to the following principles: (a) it must engage teachers in concrete tasks of teaching, assessment, observation, and reflection to enrich the learning and development processes; (b) it must be based in inquiry, reflection and experimentation that are participant-driven; (c) it must be collaborative, involving a shared understanding among educators and a focus on teachers' communities of practice rather than on individual teachers; (d) it must be connected to and derived from teachers' work with their students; (e) it must be sustained, ongoing, intensive and supported by modeling, coaching, and the collective solving of specific problems of practice; and (f) it must be connected to other aspects of school change (p. 598). While the sentiment of these principles remains, we argue that the conception of school-wide change must be broadened. Teachers and teaching are specialized, whether by grade level or content area, by programmatic and environmental structures, among many other possible features. TPD, as such, needs to attend to the specialized nature of teaching and cater to the specific needs of each teacher while simultaneously allowing differentiation, creativity and learning through collaborative interaction with others. For example, in order to collaborate with others, DLP teachers often need to expand their teacher networks given that there are so few DLPs available.

The principle that effective TPD must be sustained is central to the framework utilized in this study. PDs completed over several days throughout a school year are shown to be effective (Lee et al., 2008; Tong et al., 2017). The literature consistently shows strong, positive correlations between implementation of PD models sustained over a period of time and student achievement (Lee et al., 2008; Llosa et al., 2016; Tong et al., 2017). These studies illustrate that models are effective when they are (1) collaborative, offering ample opportunities for teachers to discuss and work together, (2) spread over time, in order for participants to practice methods discussed during sessions and come back to reflect together, and (3) provide explicit models.

Borko's (2004) suggestions for effective TPD build on earlier work (e.g., Darling-Hammond & McLaughlin, 1995) while also noting the difficulty or even impossibility of "scaling up" effective TPD. Borko's extension suggests that effective TPD has the following attributes: (a) focuses on the content that teachers teach, but in a way that helps them make the connection to how they will teach it in the classroom (Shulman, 1987); (b) provides opportunities for teachers to learn actively by trying

out ideas and getting feedback, including examining student work as part of their learning process; (c) is coherent around a theme or issue and yet long term enough for teachers to get feedback, practice and learn from trial-and-error in the classroom; and (d) is collective so that teachers have the opportunity to share practices with each other and to give and receive feedback (Marks & Louis, 1999). Borko's characteristics center the importance of attending to teachers' current and specific contexts, calling attention to the integration of content and relevant student work. More recently, Bigsby and Firestone (2017) identified a similar set of features necessary for effective TPD.

While these feature lists are useful, they are all limited in that they view TPD as something that always happens in-person, within the walls of a classroom or via discussion. More recently, advocates for virtual professional development (VPD) that includes formats of online blogs and other media propose that VPD has advantages over traditional formats, because it is informal, individualized, and accessible, while at the same time maintain clear goals and structures (e.g., Irby et al., 2015; Lynch et al., 2021). Vrasidas and Glass (2006) pointed out that the high cost-effectiveness of online conferences (OCs), "coupled with the capacity to provide time-flexible participation on a global scale" make VPD popular with an increasing role, as long as VPD focus on relevant content and provides the opportunity for interaction and collaboration that leads to knowledge creation and the formation of learning professional communities. However, as Leary et al. (2020) summarized, the amount of existing research studying online formats of TPD has been growing much more slowly despite the tremendous growth in online learning/teaching. Additionally, VPD models rarely explicitly invite direct collaboration and conversation between participants. Expanding on the structure of VPD and traditional PD formats, we argue that the LSVC hybrid model, which combines in-person, virtual and asynchronous activities, meets the features described and substantiated by the literature and has a significant potential to meet the needs of more teachers in a variety of specialized environments.

Integration of Mathematics and Language

One focal point of this paper is how professional development can better prepare teachers to integrate mathematics and language (the specialized content) in elementary Dual Language Program (DLP) classrooms (the specialized context). To promote biliteracy and bilingualism, rather than the one direction assimilation of language, DLPs are known to be a strategic and beneficial approach that facilitate children's language and academic needs in schools (e.g., Kim, et al., 2013). DLPs are also more likely to lead to balanced development of academic language and content areas for emerging bilinguals (EBs). Because language development happens in both language learning and subject learning, instructional attention is directed from solely developing language, in its own sense, to across subjects (Hofstetter, 2004). This asset of DLPs coincides with the rigor of the Common Core State Standards (CCSS), the Standards for Mathematical Practices (2022), and the paradigm shift toward teaching mathematics for understanding. Research supporting effective teaching methods that incorporate attention to language for non-dominant students is widely available (Moschkovich, 2013); however, few studies indicate effective methods for teaching teachers how to enact rigorous mathematics instruction for EBs, even though it is clear that content and language integration is highly effective in ensuring EBs build deep and enduring conceptual knowledge while sharpening their language skills (Lee et.al, 2008; Llosa et. al., 2016). Research is especially needed for DLP teachers who teach similar content, yet in disparate contexts (e.g., grade levels, language of instruction, program models, student demographics, etc.) to address the distinct challenges they face in their classrooms. This study contributes to addressing this gap in the literature, and provides a feasible and affordable TPD format for teachers in specialized contexts such as the DLPs to conduct rigorous instruction

that better integrates mathematics and language, by strategically combining the elements of VPD, teacher learning, and Lesson Study, with Video Clubs, elaborated more in detail below.

Lesson Study

The first component of LSVC is Lesson Study, a PD model originating in Japan (Fernandez & Yoshida, 2004; Takahashi & Yoshida, 2004). A central feature of lesson study is *konaikenshu*, which means in-school (*konai*) training (*kenshu*) (Fernandez & Yoshida, 2004). According to Fernandez and Yoshida (2004), "in school training" differs from what we imagine in American schools, in that it brings together the entire teaching staff of a school for hours to collaborate on an agreed-on school goal and action plan. In a lesson study approach, teachers conduct cycles of inquiry to ultimately facilitate student learning. The PD in this study consequently included a year of structured activities, reflection, and support via partnerships, large-group discussions, and instructional coaches. Quantitative and qualitative evidence that Lesson Study has positive effects on teacher learning outcomes has been documented in existing research (e.g., Cajkler et al., 2014; Coenders & Verhoef, 2019; Vermunt et al., 2019).

Despite the proven effectiveness of traditional Lesson Study, there are physical limitations. Teachers have to be present with each other before, during, and after lesson enactment, making it difficult for teachers to work with colleagues in other schools or districts. We hypothesized that teachers do not need to be in the same space or even share the same pupils to achieve similar outcomes of collaboration.

Video Club

The second component of the PD in the present study is Video Club (Thompson, 2008; van Es, 2012; van Es & Sherin, 2008). A wealth of research (e.g., Bitter & Hatfield, 1994; Borko et al., 2008; Brantlinger, Sherin, & Linsenmeier, 2011; Lampert & Ball, 1998) suggests that video recording lessons and teachers watching themselves in small groups supports teachers' abilities to reflect on and therefore improve instruction, subsequently leading to improved student learning. Video Clubs have been applied in various contexts and proved effective both qualitatively and quantitatively (e.g., Sherin & Han, 2004), particularly in building positive learning communities that encourage sustained conversation (Alles et al., 2019). The medium of video-recorded lesson enactments and structured, cyclical, rigorous discussions about recordings helps build a professional learning community (Alles et al., 2019; Borko et al., 2008; van Es, 2012). Existing research has documented the positive teacher outcomes associated with the use of video in classrooms (e.g., Sherin & van Es, 2005; Snoeyink, 2010).

Simply bringing teachers together does not guarantee building a professional learning community, in Lesson Study or in Video Clubs. Alles et al. (2019) found that utilizing and enforcing co-created rules of discourse among participants is necessary for teachers to establish a learning atmosphere for productive conversations regarding classroom dialogue as seen in videos of participants' own classrooms. They also noted that the teachers tended to deviate from the specific focus of the club and would discuss more general topics, needing an outside facilitator to keep the conversation focused. Even with a specified focus, such as productive classroom dialogue in the Alles et al. study, these digressions were challenging for facilitators to manage. We hypothesized that offering teachers semi-structured protocols for conversations with each other (as opposed to a facilitator) would guide their discussions. Teachers in our project recorded lessons, viewed their lesson and a partner's, held semi-structured conversations with their partner, shared reflections from these conversations with a small group and ultimately with the entire cohort.

Lesson Study with Video Club: A New Model

Despite the distinct advantages of traditional Lesson Study and Video Club, there are limitations to each model. Most limiting is the necessity for teachers to be physically present for both models. In addition to attending to this physical barrier, these models could be enhanced if Lesson Study incorporated a video element or if Video Clubs focused on a unified topic.

The LSVC model implemented included a specific curricular focus, a year of structured activities, several cycles of reflection and consistent collaborative support via partnerships, large-group discussions and instructional coaching. Taking from attributes of Lesson Study, the teachers were presented with specialized content during the first in-person workshop. Participants collaboratively planned their own mathematics lessons, attending to their grade and school curriculum standards, with the specialized goal of integrating mathematics with language and literacy through enacted lessons. The teachers recorded their lessons in their own classrooms and shared the videos with a partner, a small group and finally, the whole group of participants. Given the geographic limitations of sitting in the same physical classroom, most teachers' conversations happened via video conferencing platforms. Facilitation by the research team was present but strategically sparse. This paper reports on teachers' perceived learning and development via strategically combined features of lesson study and video club.

We hypothesized four reasons this combination of PD features would enhance DLP teacher learning and development: First, DLP teachers are often geographically isolated and hence are not able to see how other DLPs function and address such issues as the role of language in mathematics. Second, few PD resources specifically focus on the integration of mathematics and language (Hajer & Norén, 2017; Santos et al., 2012). Third, video recordings offer teachers opportunities to carefully view the subtle ways students use language in mathematical tasks (Moschkovich, 2006; Tunney & van Es, 2016). Lastly, the model centers teachers in the professional learning task, giving them agency to guide the learning.

Given the specialized nature of the DLPs we sought to support, distance and funding are debilitating factors. Lesson Study and Video Club are two formats of PD proved to be effective in various programs (e.g., Fernandez & Yoshida, 2004; van Es 2012). This study does not evaluate the effectiveness of the LSVC model on measurable overt changes in teachers' behaviors, but instead focuses on teacher learning and what participating teachers perceived as effective features and why, as compared to their prior experiences in PDs. We imagine that the features we emphasized (e.g., specialized content, peer-collaboration, development of long-distance professional relationships) might be combined and arranged in various ways to suit the specific needs of in-service teacher learning. We sought to implement a PD model that incorporated the above components in a hybrid format of Lesson Study and Video Club, which would enable teachers to learn skills and content relevant to their specialized DLP context and to expand their professional network in a way that transcended geographic boundaries.

Methods

Research Question

Utilizing quantitative survey data collected pre- and post- participation in the PD supplemented by qualitative interviews, open ended survey questions, and in-person sessions transcript data, we framed our analysis of teacher learning with the following question: Do DLP teachers perceive enhanced learning with a hybrid, specialized TPD model, LSVC, and if so, why?

Participants

In order to examine the perceived teacher learning of this PD model, we invited DLP teachers across 31 schools, 11 school districts and two states, representing a broad context of DLPs. IRB approval was obtained for the project. Consent forms were completed by every participating teacher and received prior to the execution of the project. Student consent forms were also obtained and faces were blurred if consent had not been received for a student who appeared in a video. The collected video recordings of the class teacher from all teachers were saved in a secure location with only the teachers themselves and the research team have access to by entering unique passwords every year. We examined the perceived quality and influence of experiences of three cohorts of Spanish/English DLP teachers participating in-person and online PDs centered on specialized content over year-long periods for three years. All identifying information from the teachers were removed, and all names in the paper are pseudonyms.

The content of the TPD in this study was designed to assist DLP teachers to integrate one of three types of language-oriented "pedagogies" (literacy, vocabulary or discourse) into their mathematics instruction. In the first meeting of the teachers, university-based facilitators introduced the integration of literacy, discourse and vocabulary in DLP schools, composing materials and sharing research regarding content learning and meta-language. Teachers were also given time to collaboratively plan the lessons they would record and use for the lesson study component of the TPD. Teachers then recorded their lessons, watched each other's lessons and reflected on the watched lessons during the second virtual workshop, and ultimately celebrated the year's learning at the last workshop.

For each year-long program, the research data was collected in three parts: participants completed pre-and post-surveys, which were quantitatively analyzed. Video data from the in-person and online PD was transcribed and reviewed. Finally, we conducted semi-structured interviews with a subset of participants with a range of teaching experiences. The former two parts were analyzed through inductive qualitative coding.

We recruited 71 Kindergarten-8th grade Spanish/English DLP teachers, establishing three cohorts participating in sequential years, among whom 57 completed both pre- and post-surveys. Only one set of survey responses from teachers repeating the PD was kept for analysis. The majority of the participants are women (51/57) teaching in California (36/57). Participating teachers had a range of years' experience with an average of ten years (Min=1, Max=27, SD=7). Teachers were compensated for their participation at roughly their school district's hourly pay rate, which averaged approximately $40/hour. The number of hours per year devoted to LSVC varied slightly, but most spent 20-25 hours over the course of the TPD.

Data Sources

The quantitative data utilized in this study was collected from pre- and post-survey questions regarding teachers' perceptions about the features of the LSVC PD and knowledge of mathematics, language, and literacy integration. Cronbach's Alpha was used to determine the internal consistency of items that measure the same construct. Qualitative data included video recordings of introductory in-person PD sessions, online PD sessions held in the middle of the year, one in-person and one virtual closing PD (workshops reformatted due to the COVID-19 pandemic), teachers' written responses recorded in the online meeting chat box, an online survey question, and five semi-structured interviews with volunteer participants from the first cohort. Qualitative data was analyzed using inductive procedures (LeCompte, 2000) and ELAN software.

Table 1. Teachers Interviewed

Teacher	State	Grade Level	Years of Experience
Alysa	CA	K	3
Iris	CA	5th	24
Julia	CA	2nd	20
Lila	TX	3rd	20
Madison	TX	3rd	11

*All names are pseudonyms

Data Collection

Baseline surveys were administered to the DLP teachers the day of the first PD session at the beginning of the school year in both states. Teachers were given an hour to complete the survey and ask questions prior to the session's start. Post-surveys were administered to the teachers on the day of their last PD session towards the end of the school year in both states. Following the same procedure of baseline surveys, teachers were given the survey before the final PD started.

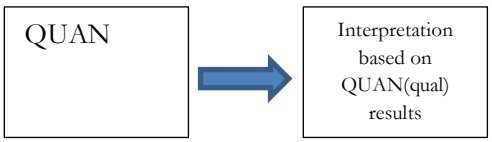
Two in-person PD launch sessions were recorded and conducted separately for the teachers from California and the teachers from Texas in the first year, covering the same content and facilitated by the researchers. Small groups met to discuss the content and to plan lessons. These discussions were recorded. Over the next four to five months, teachers video-recorded one lesson at their home school and uploaded the videos to our secure database. Mid-year, after discussing the video lessons with a partner (conversations not recorded, semi-structured conversational guidelines were suggested) and submitting a short form regarding their partner reflection, the entire cohort met virtually to reflect on learnings and the process. These forms and recordings added to the qualitative data. A final in-person PD was held to share exemplar clips from each participant and to reflect on the years' learning. Due to the COVID-19 pandemic in 2020/2021, all workshops were virtual. All group workshops were video recorded.

Five participating teachers with at least one year of LSVC were interviewed. Interviewees represented both states, lower and upper grades and various levels of experience. All interviews were transcribed and analyzed by the research team by inductive qualitative coding.

Data Analysis

This paper uses the mixed-methods approach in analyzing the quantitative data collected in the form of pre- and post-survey, and qualitative data in the form of video recording, open-ended survey questions, and interviews. Specifically, embedded mixed methods design was used, where our qualitative data was embedded in the findings from quantitative results (Creswell, 1994). The study findings presented in this study are based primarily on the quantitative results, and qualitative results play a supportive, secondary role (See table 2, adapted from Creswell, 1994).

Table 2. Embedded Design



Mixed methods enhance our interpretation of the quantitative results. For example, the quantitative analysis suggests that the LSVC model is effective for teachers' perceived learning and the qualitative data, particularly direct quotes from participations, help to substantively illustrate how and why the LSVC model is perceived effective.

Descriptive statistics were used to present features of observed scores; Wilcoxon sign-rank tests, the non-parametric method for t-test, were performed to test differences in means between pre- and post-surveys due to non-normal distribution. Confidence intervals were computed for generalizability purposes. Sample size formulas were used to compute ideal sample size needed for a future study to achieve results at desired confidence level and power.

Our qualitative analysis was influenced by Erickson's (2006) claim that video recordings offer researchers the chance to study the verbal and nonverbal, as well as the complex relationships among participants (Derry et al., 2010; Erickson, 2017). We therefore recorded and transcribed each of the in-person and online PD workshops. ELAN software was used to segment, code and analyze the videos. During workshops, we asked teachers to respond to questions about how they would teach differently after watching each other's videos and how they perceived this PD model. We interviewed five teachers in the first cohort, three from California and two from Texas. All interviews and workshop discussions were transcribed by the researchers. The transcriptions were then coded inductively and descriptively and in vivo codes were used to identify frequent items, dominant patterns and themes (Emerson et al., 1995; LeCompte, 2000). A list of sample codes and example quotations is listed in the chart below.

Table 3. Example codes with quotations

Codes	Quotes
Beneficial	"So I got to see her video and then I was like, 'oh! I can do that with my class!'"
New/ Different Perspectives	"Being in the program... I realized oh my god these were some of the things that I was lacking, and I have forgot" "And, it give us a different perspective. You know, when I was, observing the lessons that you gave us? For the video, before the video? Those, opened, my mind, you know?"
Comparison to traditional PD	"It's usually, you go get a PD and then you come to your classroom and you're like OK...done. What do I do next?" "Glow and grow...I find that useless...they never come back and talk to us about that."
Video Club	"I think that it should be part of every teacher's repertoire, every so many years to record yourself" "It's good to videotape yourself, cuz it's different you know, when you are teaching, but you don't see like the missing parts maybe"
Semi-Structured Discussion	"when we watched everyone else's videos, and I got feedback from one of my videos, I was like ... 'I didn't know I could take it even farther, and implement some of the things... So I really like that part."
Community	"I like that, I liked how you got us all back together to watch each other's video and talk about it, and see how we could improve it"
Specialized Content	"But this was special because we were all in the same track, we were all in math and literacy math, and it was really special, really good."

Results

Before analyzing survey items, Cronbach's Alpha was used to test the internal consistency among questions that measure the same construct within a scale or subscale and displayed below (Table 4). The moderate to high Cronbach's Alphas suggest that the scores teachers gave in both pre- and post-surveys are reliable.

Table 4. Internal Consistency of Survey Questions

Question	α	95% Confidence Interval
How often did the teachers engage in the listed bilingual instructional practices (5 items)	0.75	[0.65, 0.85]
How prepared/confident are the teachers to mentor preservice or intern teachers by modeling bilingual practices (11 items)	0.89	[0.84, 0.93]
How would you describe your current knowledge and/or ability in the following areas (in bilingual education) (12 items)	0.93	[0.9, 0.96]
How was the video element effective in helping teach mathematics in bilingual classrooms (3 items)	0.63	[0.48, 0.79]
How this PD format was effective (5 items)	0.81	[0.73, 0.89]

Analysis of quantitative and qualitative data yielded two major findings. First, the teachers perceived the combined features of LSVC as effective for learning and development. Second, the major codes identified from the qualitative data showed that the hybrid model is effective because the design 1) is sustained and consistent, 2) is easily accessible to teachers due to the video sharing and video conferencing platforms, 3) offers teachers new perspectives of their teaching, 4) is collaborative in nature, 5) is grounded in relevant content, and, perhaps most importantly, 6) is distinctly different from their prior experiences with traditional Professional Development models.

LSVC is effective for teachers' perceived learning

Wilcoxon signed-rank test results revealed that participating teachers perceived the LSVC format as an effective model of PD, particularly in the following features: focus on specialized content, that of the integration of mathematics, language and literacy; in increasing the frequency of bilingual instructional behaviors; in developing their confidence in mentoring preservice teachers in those areas; and in increasing their knowledge level of bilingual instruction practices.

Teachers reported increased frequency of bilingual instructional behaviors in classes ($p < 0.001$, 95% CI: [-0.87, -0.37]) and collaboration practices ($p < 0.001$, 95% CI: [-0.87, -0.37]) after participating in the year-long PD workshops (Table 3). Teachers expanded on this topic qualitatively, sharing how their perspectives of student learning shifted through workshop discussions and written feedback during the virtual meeting. Katie wrote that LSVC equipped her for deeper reflection on student learning, noting an increase in the *"ability to reflect on your own teaching style, [to] look back [at the video] and see if your students are connecting with you, if they are fully engaged."* Many teachers noted that by watching their own videos, they saw their students from a new vantage point, facilitating future instructional adjustments. Teachers also reported an increase in their perceived confidence to model bilingual instructional practices to preservice and intern teachers ($p < 0.001$, 95% CI: [-0.50, -0.13]) (Table 4). Statistically significant differences in teachers' perceived knowledge ($p < 0.01$, 95% CI: [-0.47, -0.12]) were also supported by this sample (Table 5).

Table 5. Increase in Frequency of Bilingual Instructional Practices and Collaboration

Area of Increase	*p* value	95% Confidence Interval	Scale
Teaching bilingual literacy strategies	0.002	[-2.00, -1.00]	1-5
Providing bilingual students opportunities to write about mathematics	0.003	[-1.50, -0.00]	1-5
Explicitly teaching mathematics vocabulary to bilingual students	0.001	[-1.50, -0.50]	1-5
Providing bilingual students with opportunities to communicate mathematical ideas	0.013	[-1.00, -0.00]	1-5
Providing feedback to colleagues more	0.002	[-1.00, -0.00]	1-4
Receiving feedback from other teachers about their teaching	0.010	[-1.00, -0.00]	1-4

Table 6. Increase in Confidence to Mentor Preservice Teachers

Area of Increase	*p* value	95% Confidence Interval	Scale
Developing standards-based instruction in two languages	0.028	[-1.00, -0.00]	1-4
Selecting appropriate instructional materials and resources in both languages	0.010	[-1.00, -0.00]	1-4
Using positive classroom management and strategies for engaging students	0.006	[-1.00, -0.00]	1-4
Assessing and evaluating students' learning	0.029	[-1.00, -0.00]	1-4
Providing feedback to students about their learning	0.011	[-0.00, -0.00]	1-4
Relating curriculum to students' lives outside school	0.036	[-1.00, -0.00]	1-4
supporting the transfer of language and content knowledge across languages	0.000	[-1.00, -1.00]	1-4

Table 7. Improvement in Bilingual Knowledge

Area of Increase	*p* value	95% Confidence Interval	Scale
Theories of how people learn languages	0.011	[-1.00, -0.00]	1-4
Supporting English language development	0.004	[-1.00, -0.00]	1-4
Supporting Spanish language development	0.005	[-1.50, -1.00]	1-4
Collaborating with other teachers to support bilingual students' learning	0.023	[-1.00, -0.00]	1-4
Best practices for the assessment of bilingual students	0.000	[-1.50, -1.00]	1-4
School, district, and governmental policies, practices, and legislation that impact bilingual education	0.002	[-1.00, -0.00]	1-4
Differentiating instruction for Spanish and English-dominant students	0.123	[-1.50, -0.50]	1-4

Why was LSVC so effective for DLP teachers?

The analysis revealed that the LSVC model was effective for DLP teachers because it strategically combined elements of professional learning and professional development and was distinct from participants prior in-service PD experiences. Additionally, it enhanced their learning and improved their practices through a sustained, consistent, inherently collaborative structure, grounded in specialized content, encouraging participants to feel a part of the professional community, a dire need for DLP teachers that often feel isolated.

First, the design of LSVC is sustained and consistent over a year-long period, and potentially longer, if teachers continue to connect with their cohort. Further, the workshops and meetings had no geographic boundaries. Using video-recorded lessons and video conferencing, this hybrid design makes traditional lesson study convenient and accessible for teachers to conduct, which in turn enlarges the influence of lesson study by transcending geographical boundaries and time limitations. A major code emerging throughout the interview data was participants' favorable comparisons of their experience with LSVC to prior PD experiences. For example, Alysa (a pseudonym) shared that this was the first time she had a PD that offered the opportunity to plan a lesson together with other teachers, record herself teaching and reflect on it, noting,

> Usually, you go get a PD and then you come to your classroom and you're like OK...done. What do I do next? But this was kind of like, I got information, I went to my classroom, I reflected, I thought about okay, how am I gonna do this? … And then... I got feedback from one of my videos, I was like..."I didn't know I could take it even farther, and implement some of the things that [they mentioned]".

A second major code that emerged was participants' awareness of new perspectives of their teaching practice. Iris shared that for her, the opportunity for self-reflection was the most helpful feature of the PD, allowing her to consider "How I've been teaching and what it is that I'm doing and how I'm focusing on my students." Furthermore, she mentioned that features of LSVC should be applied to growth cycle models in schools for all teachers, because filming a video captures more vividly what a teacher needs to improve, as opposed to a written report. Julia asked her school to do LSVC with all teachers, arguing that technology makes it easier to observe colleagues with only minimal equipment and effort. Lila explained how the resources this PD provided her were useful, including the hybrid LSVC structure, the materials (video exemplars, idea sheets, etc.) as well as the opportunities she had to discuss with other teachers, in-person and online.

Additionally, the implemented model was inherently collaborative, helping teachers form their own professional community. This third finding was expressed throughout the various qualitative datum. For example, teachers in small group discussions discussed how they felt isolated from other DLP teachers and they appreciated any support from or communication with other teachers who understood the unique challenges of their specialized environment. In her interview, Julia explained that even in her DLP school, she simply did not have the opportunity to observe colleagues within the constraints of the school day:

> As a teacher, you know, we don't observe other teachers, we don't see other interaction, and then even five minutes of another classroom gives you like so many ideas, so many strategies, so many ways to do things.

One pre-survey open-ended question asked what features of PD work best for the teachers. 13 out of 34 teachers wrote about the importance of peer interaction and collaboration. Another question asked what motivated the teachers to participate in this PD. 10 teachers specifically mentioned the opportunity to work with other in-service or pre-service teachers. Madison expanded her elaboration to how the content was delivered and the structure of in-person sessions:

> I like the way you guided us… I liked how you got us all back together to watch each other's video and talk about it, and see how we could improve it, or how, good things and bad things, because we talked about everything, we gave constructive criticism.

The baseline survey indicated that 51% of the teachers believed working with colleagues is useful or very useful for improving their own teaching practices. In the final survey the majority of teachers reported an increase in frequency to collaborate with other teachers, through participating in this PD, including working with other teachers to develop lessons (n = 5), observing peers teaching (n = 11), providing feedback to other teachers about their teaching (n = 16) and receiving feedback from other teachers (n = 15).

Fourth, LSVC PD was grounded in content that teachers were interested in from the outset, expressed by participants in the surveys, recorded workshops, and during interviews. In an open-ended pre-participation survey question that asked teachers what motivated them to participate, six teachers wrote the PD content (the integration of math, literacy, and language) attracted them to participate. The way in which the specialized content was represented and delivered over the year was a feature of LSVC that the teachers believed to be effective. 19 teachers explicitly wrote about how the PD content combined theory with practice. The focused substance and delivery aligned with their preferences of effective PD formats. Alysa indicated that LSVC PD "reinforces what I was already doing" and "gave me new strategies to … implement it." She gave an example, explaining that:

> I had a hard time coming up with an idea of how to do it with kindergarteners... So I got to see [another participant's] video and then I was like, oh! I can do that with my class!

Developing workshop content relevant to what the specialized teachers find challenging to teach in their own classrooms makes this model of PD useful. Further, the compiled videos and lesson plans offered tangible resources for the teachers to access when needed. Alysa told us she watched all the videos and would like to see more because they offered *"great examples of … implementing the strategies."* The hybrid design of LSVC enabled teachers to see models of the content in action (theory tied to practice), to practice implementing strategies on their own, and to receive direct, specific feedback on the implementation of the PD content from a professional community who understands the specialized DLP teaching environment.

Discussion

In this paper, we investigated if the features of a hybrid in-person and virtual PD can enhance DLP teacher learning in terms of their knowledge level, bilingual instructional practices and their confidence to mentor preservice teachers in bilingual instructional practices (e.g., leverage EBs native language to access mathematical vocabulary; recognize the multiple forms of representing meaning in mathematics).

We asked if and how this strategically combined PD, LSVC, could enhance teacher learning in specialized contexts such as DLPs. Statistically significant results showed that overall, participating teachers felt that integrating mathematics, language and literacy was less difficult for them after participating in this hybrid PD structure, and reported an increase in: frequency of bilingual instructional behaviors in classes, confidence to mentor preservice teachers, and knowledge level regarding teaching mathematics in two languages. The perceived improvement in the above areas in bilingual classrooms are reflections of participants' growing understanding and skills of mathematical content delivery and facilitation of mathematical conversations for emerging bilinguals (EBs). Téllez and Mosqueda (2015) argued that this type of improvement is essential for EBs' learning, and through watching videos (one's own and others' lessons) and discussions with other teachers, DLP teachers developed deeper reflections on their teaching and learning.

The second part of our research question examined why this hybrid model was perceived effective in enhancing teacher learning. We found that first, LSVC was convenient, consistent, and sustained over a year. The hybrid design modifies traditional lesson study by adding an online component and the video club, making it more convenient and accessible for teachers to participate (e.g., Alles et al. 2019), transcending geographical boundaries and time limitations. Teachers, through discussions and interviews, said the recorded classroom videos were valuable resources for them in reflecting on their own teaching, allowing them to "steal" ideas and strategies for their own classrooms. Besides convenience, Darling-Hammond et al. (2017) listed sustainability as one of the seven characteristics of effective PDs, because effective PDs need time to be translated to effective practice in classrooms. Fishman et al. (2003) pointed out the significance of the mediums that are used to deliver PD, including face-to-face, video and/or audio, online or print, and different combinations of the above. Hybrid PD like LSVC could enhance teacher learning because they take into consideration the affordances of technology across geographic boundaries, to help teachers connect and see each other teaching and talk with each other, and at the same time center specialized content relevant to the teachers. The combination of lesson study and video club in this study created a "user-friendly" format of PD for teachers across different states to make full use of the resources at their convenience.

Additionally, this combination of PD features facilitates consistent and engaging collaboration, offering participating teachers opportunities to regularly interact with teachers beyond their school walls. Teachers reported that they enjoyed having partners from other schools, because they learned about other classrooms, state standards and instruction, as well as relating to personal stories told through in-person and virtual conversations. What brings about learning and change in practice is the interactions and exchange of ideas among teachers (Little, 2002; Wilson & Berne, 1999). The features of this hybrid PD established a structure where teachers deepened their learning by communicating and interacting with each other. Through the use of the video element and the lesson study framework, teachers not only watched themselves and others' teaching in action, but also discussed what they saw, a key step in creating a teacher professional learning community (van Es, 2012). The components of LSVC created a virtual space where teachers from two states conversed about their teaching practices and their students, building a sustainable network of support. The non-evaluative nature of the research team and other teachers made it possible for teachers to freely talk about their concerns and exchange ideas.

Strategically combining elements of traditional lesson study and video club, the hybrid LSVC approach centered the specialized needs of participants and the participants' own teaching. Centering specialized content relevant to the unique teaching experiences and contexts of the participating

teachers, is a crucial feature of LSVC that makes the hybrid approach perceived as effective to enhance teacher learning. Teachers' motivations for participation in this particular hybrid PD included the content of the PD, how the PD content was structured and executed, and the opportunity to practice what they learned. Darling-Hammond et al. (2017) note that focused PD content and active learning opportunities are two of the seven important key features of effective PDs. Simply put, when PD content is focused on what teachers teach in their classrooms, is in alignment with their curricula and school requirements, and provides the opportunity for teachers to study a particular element of pedagogy in a content area, there is usually a connection to the perceived effectiveness of teacher PDs (Darling-Hammond et al., 2017). The model in this study allowed teachers to interact beyond the walls of a single school or even district and helped teachers develop a substantive network relevant to their specialized needs in DLP schools while attending to the teachers' individual motivations for participating in the PD. This network would not be feasible without features from both Lesson Study and Video Club PD formats.

Findings from this study support current research in the key characteristics of effective teacher PD (e.g., Darling-Hammond & McLaughlin, 1995; Fishman et al., 2003; Wilson & Berne, 1998). In addition, findings from this study corroborate existing literature in that the video element is beneficial for teachers to view themselves and others' teaching in action and planning and reflecting on lessons in collaboration with peers gives teachers insight into their teaching and student learning (Fernandez & Yoshida, 2004; Takahashi, & Yoshida, 2004; van Es & Sherin, 2008; van Es 2012).

No existing research has studied strategically combining and modifying the two TPD approaches of professional learning and professional development to make it flexible for teachers in specialized contexts such as DLPs across multiple school districts in two states. Combining features of Lesson Study with Video Club provided a way for our participants to meet other DLP teachers working in various programs across states and districts through watching themselves and others' classroom videos, forming a professional community where they can ask questions, exchange ideas and seek help wherever and whenever they need to. The in-person and online structure provided flexible structures for DLP teachers to benefit from conversations with and observations of DLP colleagues, transcending geographical barriers.

Implications and Conclusions

This study found that connecting teachers through shared videos and flexibly structured, specialized content is a highly effective, transformational method of teacher professional learning and development. We are confident that variations of LSVC will work for other specialized groups of teachers, but only if the features we discovered are used (e.g., the use of teachers' own videos, semi-structured discourse and collaboration opportunities, focused content, and follow up and follow through over time with a diverse professional learning community). As with most professional disciplines, the work of teachers is now more specialized than ever. For example, the recent focus on academic language (AL) suggests that not only does each discipline have a specific discourse, but that students learn AL terms according to their developmental level. LSVC can be a productive vehicle for teachers to acquire such specializations, particularly if it situates teachers as active and agentive learners.

By exploring if combining features of LSVC can enhance teacher learning for those in specialized contexts such as DLPs, this study addresses the understudied question of how PD for specialized contexts might address teachers' unique challenges and needs. In the case of the present study, the absence of community among DLP teachers. Our results corroborate literature on the

characteristics of effective PDs and the benefits of video and lesson study (Takahashi & Yoshida, 2004; van Es & Sherin, 2008; van Es, 2012). Additionally, the hybrid format enabled teachers to notice student learning, in addition to their teaching practices, a finding consistent with existing literature (Tunney & van Es, 2016; van Es & Sherin, 2008).

Despite the evidence of success for LSVC, the study has several limitations. First, the small sample size prevented us from consistent use of parametric data analyses. Although we used established distribution-free methods, we lost statistical power when using rank or ordinal data analyses. Second, the teachers in our study did not participate in the TPD at the school level, as other TPD advocates have suggested (e.g., Darling-Hammond, & McLaughlin, 1995). We instead worked with teachers sharing similar teaching backgrounds and challenges over multiple schools/districts/states. Indeed, our study's findings call into question the claim that effective TPD must be a school-wide effort. Additionally, with both formats being effective in the PD literature, this study could be strengthened if we compared perceived effectiveness with participants focused on using only one feature (i.e. video club) or the other (i.e. lesson study), though teachers in this study specifically talked about the combination of both features working especially well for their learning.

Overall, we found quantitative and qualitative evidence that the strategic combination of Lesson Study with Video Club is perceived as an effective TPD model to enhance teacher learning for DLP teachers. The teachers reported an improvement in their knowledge, teaching practices, as well as opportunities to critically reflect on their instruction and student learning. Using recorded lessons and semi-structured protocols centered on specific content over sustained periods, this combination of features offers a feasible method for any network of specialized teachers, like those in DLP programs teaching mathematics, to form collaborative relationships that transcend geographical boundaries, enabling them to share recorded lessons, exchange ideas and participate in a sustained, rigorous and rewarding professional learning community.

For school administrators or district curriculum leaders considering using LSVC, it might be difficult to part with the traditional TPD of "bringing in the expert." But this time-honored strategy is largely what gave TPD such a negative reputation in the first place. In our study, each teacher's building principal was informed of their participation in the TPD and invited to attend, although none did. The perceived success of our LSVC, which eschews administrative, school-wide participation, suggests that teachers may prefer to study and improve their pedagogy without the hovering assistance of experts or administrative leadership. By planning and then teaching a lesson in their own classroom, and later analyzing the results privately, the teachers first learned *from their students*. Only after they studied what their students learned (or failed to learn) did they share their lesson with another teacher who shared a specific teaching context (in this case, a DLP, teaching mathematics, often in Spanish). It did not seem to matter if their LSVC partner worked at the same school or even in the same state. Creating a professional community where teachers can seek support and share classroom videos results in collaborative collegiate relationships transcending structural and geographical boundaries.

Experienced teachers know that their students provide the best measure of the quality of their instruction. Having outside instructional experts who are not familiar enough with the local and specialized contexts of teachers leading TPD is not likely to eclipse what professional teachers gain by carefully analyzing their own students' understandings. Our study has confirmed this finding, but we have also shown the importance of sharing and discussing actual instruction with another teacher who shares similar challenges. LSVC is a bridge that can connect teachers working in unique contexts who often express feelings of isolation, allowing teachers to share stories about their students and perhaps

provide a career-spanning professional community in which teachers do, in fact, observe other teachers.

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Declaration of interest statement

None of the authors have a competing interest.

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