

TRACING TAKE-UP ACROSS PRACTICE-BASED PROFESSIONAL DEVELOPMENT AND COLLABORATIVE LESSON DESIGN

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*This study explored how two professional development approaches to reforming math instruction with different mechanisms for fostering change might have valuable synergies when used in tandem to support **take-up**, i.e., teachers' acceptance, adoption, and incorporation of ideas into practice. This investigation of Practice-Based Professional Development and Collaborative Lesson Design found that take-up was a recursive process that occurred across both PD types as teachers iteratively moved between building and deploying knowledge. Both overarching and practice-specific struggles occurred during enactment, triggering shifts back to knowledge building. Struggles associated with learning to facilitate productive struggle included making sense of student thinking, identifying and providing appropriate scaffolds without lowering the cognitive demand, and helping students move from intuitive to mathematical arguments.*

Keywords: Professional development, Teacher knowledge, Instructional vision

Introduction

Decades of research suggest that aligning math instruction with how children learn math involves prioritizing student sense-making and instructional activities that require mathematical reasoning and productive struggle (Stigler & Hiebert, 1999; Boaler, 2016). Research-based reform of math instruction therefore involves changing the way teachers teach, shifting from an “I do, we do, you do” model to responsive engagement with students and their ideas, as well as changing the types of learning activities that are used in classrooms, shifting from repetitive practice and closed questions to rich, worthwhile math tasks. The challenge lies in finding an approach to professional development (PD) that addresses changes to the “how” of teaching (teachers’ instructional practices) as well as to the “what” of teaching (the lesson plans and instructional activities teachers use in their classrooms).

Objectives

This study explored how two PD approaches to reforming math instruction with different mechanisms for fostering change might have valuable synergies when used in tandem to support the translation of a reform-oriented vision of math instruction into practice. While ample research has focused on opportunities for learning that occur within communities of practice like those present in these PDs, I have focused specifically on individual teacher *take-up*, i.e., teachers' acceptance, adoption, and incorporation of ideas into practice, in an effort to address a gap in existing research spotlighted by Lefstein et al. (2020). This investigation of Practice-Based Professional Development (PBPD) and Collaborative Lesson Design (CLD) was aimed at helping to conceptualize and identify instances of *take-up* and was guided by the following research questions:

1. How do individual teachers demonstrate take-up of ideas?
2. What connections are there between individual teacher take-up of responsive teaching practices in PBPD and take-up that occurs in CLD?

Theoretical Framework

Teaching is a complex art that involves not only what the teacher is doing but also what the students are asked to do--- interweaving of instruction and curriculum. Professional development (PD) that addresses changing one without changing the other can create “problems of enactment,” i.e., teachers who want to teach in a new way but lack either the curriculum resources or the teaching skills to enact this new vision (Kennedy, 1999). Ineffective PD drains precious resources of time and money while fostering little change in classrooms, so endeavoring to better understand how take-up of ideas from PD occurs is a worthwhile avenue of investigation.

Collaborative Lesson Design (CLD) focuses on changing teaching by improving the planning process and lesson plans teachers use to enact lessons. In this professional development model, researchers and teachers work together within a community of practice and within a local context to co-create and continually revise lesson plans based on reform priorities (Hiebert & Morris, 2012). It is assumed that the lesson design cycle, which consists of planning, enactment, reflection, and revision, is a high-leverage opportunity for teacher learning and that the use of CLD could surface core teaching practices and give teachers the opportunity to become skilled in these practices through induction and refinement in their own classroom context. The challenges that arise when using the CLD model, however, include the possibility that without any training in a new set of pedagogical skills, teachers may face the “problem of enactment” described by Kennedy (1999), i.e., vision change without the necessary skills to enact the new vision, making teachers unable to execute the lesson plans as the creators intend.

Practice-Based Professional Development (PBPD), by contrast, focuses on changing teaching through pedagogical training in enacting core teaching practices, i.e., specific instructional skills including launching problems and facilitating discussions (Grossman, 2018). This model assumes that pedagogies of enactment, including representation, decomposition, and approximation, (Grossman et al., 2009) are high-leverage opportunities for teacher learning and that practices such as discussion facilitation are applicable in any classroom setting. Further, PBPD also assumes that learning core practices provides an opportunity for teachers to rethink their lesson design for their particular context. Challenges arise, however, in the transfer of pedagogical skills to specific educational contexts, and a parallel “problem of enactment” may occur if vision change occurs without the necessary resources to enact it (e.g., if a teacher, equipped with facilitation skills for high quality math tasks finds herself working with a curriculum devoid of those tasks). In the absence of a supportive community of practice and reform-oriented teaching materials, teachers may struggle to put their teaching practices to use as practice-based educators intend.

Research on professional learning communities and generative discourse has proliferated over the past two decades (Lefstein et al., 2020). Often, the focus of this research is on opportunities for learning and there is an implicit leap of faith involved in connecting what occurs in these communities with individual learning and particularly with what occurs in individual teachers’ classrooms. Situative theory, which attends to “how various settings for teachers’ learning give rise to different kinds of knowing” (Putnam & Borko, 2000, p. 6), provided a theoretical foundation for this case study research. I examined evidence of take-up in PBPD and CLD settings in order to ascertain whether and how these opportunities for learning impacted individual teachers’ classroom practices.

Context

The Responsive Math Teaching (RMT) Project a research-practice partnership between university researchers and 13 schools within a large under-resourced urban school district, engages K-8 teachers and instructional coaches in three years of professional development focused on utilizing worthwhile math tasks as a vehicle for responsive teaching and for fostering student productive struggle (Responsive Math Teaching Project, 2021a). Since this is a departure from traditional teaching practices, participants spend Year 1 experiencing responsive math teaching as *learners* in monthly Math Circle PDs before moving on to focusing on how to teach responsively in Year 2. Prior to the pandemic, Year 2 professional development primarily utilized practice-based approaches supplemented with individual coaching to help participants shift their math instruction to align with the RMT instructional model (Responsive Math Teaching Project, 2021b), which emphasizes reform priorities that include student sense-making, use of low floor/high ceiling tasks, and teachers acting as facilitators of both productive struggle and rich, responsive discussions. In response to the move to virtual instruction and requests from participants for curriculum support to supplement PD focused on responsive teaching, the RMT Project began incorporating CLD in the fall of 2020. Although the RMT Instructional Model includes seven components, this study focused on four: 1) Launching a Task, 2) Facilitating Productive Struggle, 3) Making Student Thinking Visible, and 4) Connecting to a Mathematical Goal. These are the four practices that were represented, decomposed, and approximated most often during RMT PBPD and the four components of lesson planning emphasized most consistently during the CLD sessions involving planning, reflection, and revision of lessons.

Methods

Participants

RMT professional development offered to Year 2 participants consisted of six 5-week cycles that included one practice-based professional development (PBPD) session and two collaborative, cross-school, grade-specific lesson design (CLD) sessions: a planning session followed by a reflection/revision session. I utilized a comparative case study approach, purposefully selecting 14 participants who attended PD sessions most consistently. These participants represented classroom teachers and math leads (grades 1-8) from 10 different schools. All participants taught primarily in a virtual environment with some hybrid instruction integrated at the end of the year. Some participants were recommended for RMT PD by their principals and others were simply volunteers. In this paper, I focus on one case from the study, chosen because it is both illustrative of the overall study findings and because the focal participant was the “best case” (Patton, 1987) in the sense that she was strictly a classroom teacher and not a math coach, was not at a school that received supplemental coaching from RMT researchers or RMT-trained school personnel, and attended all PBPD and CLD sessions.

Data Collection

Data collected and reviewed included videotapes, audio transcripts, and chat transcripts of PBPD and CLD sessions; observational field notes; participant journals; participant responses to feedback forms for each cycle; and participants’ artifacts of practice in the form of video and audio recordings and student work samples. For each of the 14 study participants, data from all of the aforementioned sources were compiled chronologically on a spreadsheet, wherein color coding was used to differentiate between PBPD, CLD Planning, and CLD Reflection session data. Direct quotes from comments made in PD sessions and from journal and chat entries were captured verbatim and parenthetical descriptions were added to contextualize each quote,

including journal prompts, facilitator questions that prompted the comment or summaries of the preceding discussion. During the data collection and compilation process, analytic memos were written for each PD session summarizing observations about both individual and group take-up.

Data Analysis

A pilot study focusing on Cycle 1 data for five teachers was conducted in fall 2020 to create and test data analysis tools. I used the practice grain size and terminology established by the Core Practice Consortium (Grossman, 2018, pp. 186-189) to develop a list of *aspects*, component parts of larger practices, and *approaches*, actions taken by teachers when enacting an aspect of a practice, using both emergent approaches and approaches included in RMT coaching materials. This list was reviewed and further refined with input from three RMT research team members. Although the full list is too extensive to include here, the aspects and approaches for Facilitating Productive Struggle (FPS) are shown below in Figure 1.

Practice	Aspects	Approaches
Facilitating productive struggle (FPS)	Supporting learner thinking without lowering the cognitive demand	<ul style="list-style-type: none"> • Relaunching the task with students who can't get started • Using models, diagrams, or acting out to help a student get unstuck • Using questioning and/or annotation to help a student make sense of their own thinking • Determining how much support/scaffolding is just enough • Pointing out an approach that has helped another student or group get started • Providing "just in time" tools or supplies • Coaching mathematical participation by suggesting a "what would happen if" scenario • Coaching mathematical participation by asking a student to convince others
	Providing opportunities for collaboration	<ul style="list-style-type: none"> • Providing opportunities for students to work in pairs or small groups • Scaffolding collaboration by orienting students toward each other • Strategically pairing students with similar or complementary strategies
	Monitoring student work	<ul style="list-style-type: none"> • Monitoring group work for progress and group dynamics • Keeping track of strategies being used • Looking for / capitalizing on opportunities to assign competence • Finding ways to observe student work in progress in a virtual setting

Figure 1: Aspects and Approaches for Facilitating Productive Struggle

Inductive data analysis during the pilot study also resulted in the identification of 9 emergent *take-up manifestations*, i.e., ways in which participants demonstrated take-up, shown in Figure 2

below. Kazemi & Hubbard (2008) drew on Cook & Brown's (1999) earlier work to distinguish between "knowledge that is possessed and knowing that is deployed in action" (p. 429), a distinction I used to sequence the manifestations in order of the level of action they entailed, moving from knowledge building to knowledge deployment during enactment and finally to sustained integration into classroom practice.

Noticing	Expressing awareness of a practice aspect. May occur with or without identifying the pedagogical reasoning behind the practice aspect.
Agreeing	Affirming another's comment about a practice aspect.
Asking	Asking a question or expressing confusion about a practice aspect.
Suggesting	Recommending a way to incorporate or improve upon a practice aspect. May occur with or without advocacy.
Prioritizing	Expressing a belief that a practice aspect is important.
Raising a concern	Noting a lag between one's vision of a practice aspect and one's ability to enact it.
Enacting	Executing a practice aspect. May be evident in a teacher's description of a lesson or in lesson video or audiotape artifacts.
Critiquing	Making critical comments about one's own execution of a practice aspect or giving critical feedback to others, including suggestions for improvement.
Sustaining	Integrating a practice aspect into regular classroom instruction beyond the task-based lessons enacted as part of the CLD professional development.

Figure 2: Manifestations of Take-Up (shown from early to late stage by gray coloration)

Working chronologically, data for each participant was coded inductively on two levels (Miles, Huberman, & Saldana, 1994): first for practice aspect using the list of approaches in Figure 1 and then for manifestations of take-up. For example, a participant journal comment might have been coded for FPS aspect "Supporting learner thinking" based on the presence of the approach "Using a model to help a student get unstuck" and for take-up manifestation "noticing." This coding made it possible to trace the development of each practice aspect chronologically over the course of the year in order to identify *threads*, i.e., progressions from low level to higher level take-up. Using a mapping process borrowed from expansive learning research (Bal, Afacan, & Cakir, 2018) to visually display these chronological threads also surfaced the presence of *struggles*, i.e., recurrent dilemmas that hampered take-up progress across one or more cycles.

Summary memos were written for each participant for each of the four focal practices. These memos were compared to exit interviews for triangulation purposes. Data was also validated via member reflection sessions in order to engage participants as collaborative partners and to ensure that their perspectives were accurately represented (Creswell & Poth, 2018). Dialogic engagement with strategically selected thought partners was used on 4 occasions to refine study

design and to perform validity checks on data analysis processes and findings (Ravitch & Carl, 2016).

Results

While a number of additional findings emerged from this data analysis, here I will focus on two: 1) Take-up is a recursive, iterative process during which teachers cycle between knowledge building and knowledge deployment in action; 2) Two different types of struggles emerged that triggered a shift from knowing in action back into the realm of knowledge building: *overarching struggles* and *aspect-specific struggles*. Four types of overarching struggles spanning multiple practices were observed: *vision preceding skills*, *skill development with incomplete vision buy-in*, *belief that a practice cannot be enacted with particular content or with a particular group*, and *difficulties enacting practices virtually*. In addition to overarching struggles, other struggles emerged that were unique to specific practice aspects. Here, I focus on struggles that emerged from the FPS aspect “Support learner thinking without lowering the cognitive demand.” These struggles included *difficulty making sense of student thinking different from one’s own solution strategy*, *difficulty identifying and providing appropriate scaffolds in real time without lowering the cognitive demand*, and *difficulty helping students move from intuitive to mathematical arguments*. To illustrate these findings, I will focus on Melanie, a fifth and sixth grade math teacher whose case is representative of the larger group.

Demonstrations of take-up over time

Tracing take-up threads across PD sessions enabled me to construct narrative accounts of how take-up occurs, often progressing from low level take-up evident in noticing and agreeing remarks to higher level take-up evident in enactment and critiquing over the course of a single PD cycle or across multiple PD cycles as shown in Figure 3 below.

Tracing Take-Up for Melanie	
PBPD	Take-up of FPS aspect <i>support learner thinking without lowering the cognitive demand</i> first occurs when Melanie agrees with a comment about the difficulty of responding to a student strategy that you don’t understand when the student hasn’t articulated it well.
CLD	This practice aspect resurfaces in the next CLD planning session, when Melanie prioritizes finding ways to support students who can’t find an entry point to start the task, noting, “ <i>This is going to be the bulk for me. I’ll have 20% of my class who will be able to navigate this task, who will be interested or intrigued. But then I do fear for the children who are just like, ‘I don’t know what to do.’</i> ” Melanie continues to pursue this topic by asking the group how to best provide support. When Melanie returns to the CLD reflection session, she recounts enacting this practice aspect with a student in her classroom and critiques her enactment because she feels that she funneled the student to her own solution strategy instead of trying to follow the student’s thinking.
PBPD	Melanie continues to focus on this FPS aspect, which surfaces again in a subsequent PBPD as noticing that FPS involves providing stepping stones that are enough but not too much of a stretch for the student. During the same PBPD, Melanie analyzes the RMT Instructional Model and notices that to support learners appropriately, “ <i>you need enough scaffolds.. You need to know your learners and have scaffolds so that the struggle is productive. It’s not just straight struggle.</i> ” Melanie’s noticing continues as she analyzes a video of a teacher executing FPS and is able to pick out effective support moves that the

	teacher used. She also suggests another scaffold that the teacher in the video could have used.
CLD	<p>In the next CLD planning session, Melanie suggests a scaffold for the task and also prioritizes “<i>helping a student get unstuck without doing it for them</i>,” noting that the scaffold should only be used if a student were struggling and should not be given to the whole class just in case. After enacting the planned lesson, Melanie critiques her enactment specifically in terms of how much support she provided to the students and raises a concern about the balance she is striking in her class between supporting students and doing the work for them. She notes,</p> <p><i>I don't feel like my kids take risks anymore. When I say work on it..they just sit there and wait knowing that I'm going to pop over to my whiteboard and sort of draw something, and you know, help them out, and I actually think that they're right. So, I'm coming to this conclusion: I'm taking on too much of the load.</i></p> <p>When Melanie shares a video clip of her lesson, she asks whether she had responded to a student question by giving too much assistance. As the group discusses her video, Melanie agrees with an alternative talk move suggested by the group. Moving beyond agreement, Melanie prioritizes supporting students by making an FPS “talk moves wall” behind her computer screen with post-it reminders of questions to ask that she can refer to during her instruction. Melanie later completes a feedback form on which she describes using questions from the RMT FPS framework to support students in explaining their thinking during her regular, daily instruction, a sustained effort to integrate this practice aspect into her teaching.</p>

Figure 3: Example of a Narrative Constructed from Take-Up Tracing

Melanie's narrative above highlights a common overarching struggle I have termed *vision preceding skills*. Here, her competence enacting FPS lagged behind her vision of what FPS should look like, prompting iterative returns to knowledge building. Melanie's narrative also exemplifies *difficulty making sense of student thinking different from one's own solution strategy* which surfaced as funneling a student towards Melanie's own solution path rather than helping her make progress on her own. Also evident in Melanie's narrative was *difficulty identifying and providing appropriate scaffolds in real time without lowering the cognitive demand*. Struggle points in Melanie's narrative and the resulting shifts into forms of take-up associated with knowledge building are visually displayed in Figure 4 below.

As evident in Figure 4, struggles often surfaced during enactment and reflection, prompting a renewed effort to build knowledge in order to refine skills. Narratives such as Melanie's examined across multiple cycles made clear that take-up is not simply a linear progression from low level to high level but rather an iterative process across both PD contexts in which noticing, asking questions, and suggesting remain essential in fostering enacting and critiquing and ultimately in the honing of teaching practices.

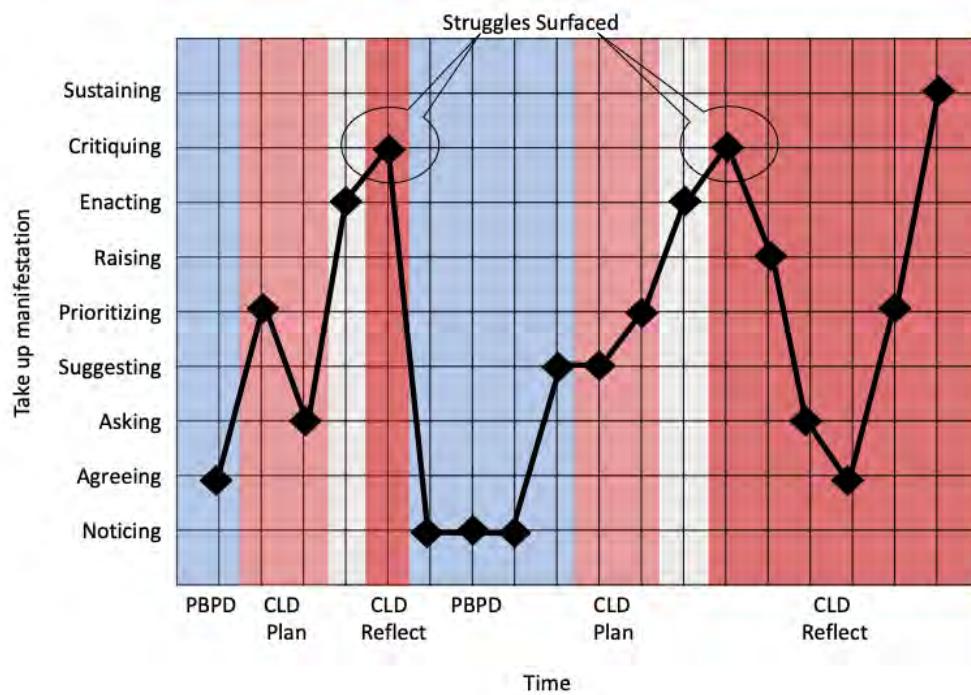


Figure 4. Melanie's Take-Up of FPS Aspect "Supporting Learner Thinking"

Discussion

Both take-up threads and their mapping made evident synergies between CLD and PBPD by highlighting instances when one form of PD provided opportunities for increased take-up of practice aspects originally taken up in the other. In early cycles, PBPD sessions focused on representation and decomposition of practices and most often fostered knowledge-building forms of take-up, including noticing, agreeing, and asking. Early on, suggesting, prioritizing, enacting and critiquing were primarily evident in CLD. CLD provided an early and consistent impetus to move beyond knowledge building and into knowledge deployment—beyond learning into experimentation, as 8th Grade teacher Leann noted, *"If we didn't need to do it for this [CLD Reflection Session], I might've not pushed myself to get it in."* As the year progressed, however, and PBPD incorporated rehearsal and reflection on video artifacts, the types of take-up became more varied across both forms of PD. As learners focused their attention on specific practice aspects and specific struggles that emerged when enacting the practices, both PBPD and CLD sessions showed an uptick in the number of take-up manifestations across participants.

In my effort to focus on individual take-up, by no means did I intend to downplay the critical role played by the communities of practice formed within and across both types of PD. Discourse in each setting was not only generative but also fostered collective take-up in ways that were beyond the focus of this study. Instead, my intention was to shed some light on how participation in these communities impacted individual teachers' classroom instruction, a path less trodden in the field (Lefstein et al., 2020). Understanding how group and individual take-up intersect, with an eye towards classroom impact, remains an area in need of further investigation.

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