

Leveraging Coach-Facilitated Professional Development to Create Collaborative Teacher Networks for Enhancing Professional Practice

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Job-embedded professional development (PD) models like lesson study (LS) provide opportunities for teachers to observe how students respond to a mathematics task and develop collective professional learning (Suh and Seshaiyer 2014). Additionally, effective mathematics PD should be related and responsive to school and teaching contexts, connected to content and standards, enhance pedagogical practices and content knowledge to further student learning, include extended time and significant contact hours with focus on classroom implementation; including on-going support of peers and experts to create and support communities of practice (Garet et al. 2001; Smith, Stein, and Silver 1999). Research indicates that teachers change their underlying beliefs about teaching approaches only after they see their students succeed (Guskey 2002). More specifically, Guskey’s model of teacher change describes a sequence of outcomes resulting from professional development that begins with changes in teachers’ classroom practices, such as, implementing new instructional approaches and/or using new curricular materials. When teachers employ a new instructional strategy or curriculum and succeed in helping students learn, teachers’ attitudes and beliefs change with the evidence of improvements in student learning. In addition, professional development of teachers is “an experientially based learning process for teachers” (Guskey, 2002, p. 387) where teachers need to receive regular feedback on the effects of their efforts so that they can sustain their new practices and receive continued support.

Successful implementation of instructional reform is challenged by critical issues in schools, such as building capacity, making time, developing leadership, ensuring equity, building a professional culture, garnering support and scaling up (Loucks-Horsley et al. 2003). Promising studies point to the nature and quality of teachers’ professional relations as a key contributor to sustaining instructional reform (Gersten, Chard, and Baker 2000). Professional learning is sustained when teachers’ interactions provide the type of knowledge, feedback, and social support that enables teachers to deepen their knowledge and practice. A longitudinal study (Coburn et al. 2012) examined how teacher social networks impacted the ability to sustain new instructional strategies within district reform after the mathematics initiative supports were removed. Findings indicated that teacher social networks combined

with strong ties, high-depth interaction, and high expertise enabled teachers to maintain the pedagogical approach.

Our study explores how a coach-facilitated LS PD model promoted the development of teacher social networks by providing access to knowledge, feedback, and social supports that deepened coaches' and teachers' understanding and enactment of ambitious teaching reform-oriented practices. The following research questions guided our study: (1) How did specific mathematics coaching practices and professional activities provide unique opportunities for teachers to enact important instructional practices and deepen their content knowledge? and (2) How did the coach-facilitated LS model appear to support the development of teacher social networks?

■ The Method for Our Study

Participants and Procedures

This study included seventy-seven elementary and middle grades mathematics teachers (grades 5–9) and twelve mathematics coaches (K–8) recruited from four suburban and two rural school districts, all within one hour of a major eastern city. The suburban districts have diverse student populations that are predominantly students of color, and one of the two rural districts has a majority of students who qualify for free or reduced lunch. Some of our participants were recruited as a team of teachers with a school-based coach or district math leader. University-based facilitators, including faculty and members of the PD design and facilitation team, also attended the LS host lessons to support the coaches and to further the groups' thinking about content and pedagogy.

Teachers and coaches met for the algebraic thinking and problem-solving summer institute and then conducted LS during the academic year. As PD designers and implementers of the PD institute, we felt the need to adapt the follow-up LS model (Lewis 2002) to meet the needs of teachers and overcome constraints within districts, while staying true to the implementation portion of immersing teachers in collaborative planning, teaching, observing, debriefing, and reflecting both individually and collectively. We referred to our modified version as a “coach-facilitated” LS structure, which had two optional structures for the second iteration of the research lesson. In the first option (see fig. 7.1, option 5a), the coach was able to observe and provide feedback to each teacher during the “re-teach,” and the coaches and teachers then come together as a whole group to present their professional learning at the LS symposium. In the second option (see fig. 7.1, option 5b), during the “re-teach” the participating teachers taught and videotaped the second iteration of the lesson and reflected collectively using Edthena, an online, video-based coaching tool that allowed teachers and coaches to view and mark episodes and to reflect on lessons by making comments and asking questions. We created these optional structures in the second iteration of the lesson because we encountered challenges in scheduling additional professional days (released time) for our participating coaches. Although we recognized that there were some trade-offs, we noticed very quickly that the coach-facilitated LS structure provided differentiated PD for our coaches and a chance to build relationships among participants who served as coaches and who served as peer coaches in addition to LS participants.

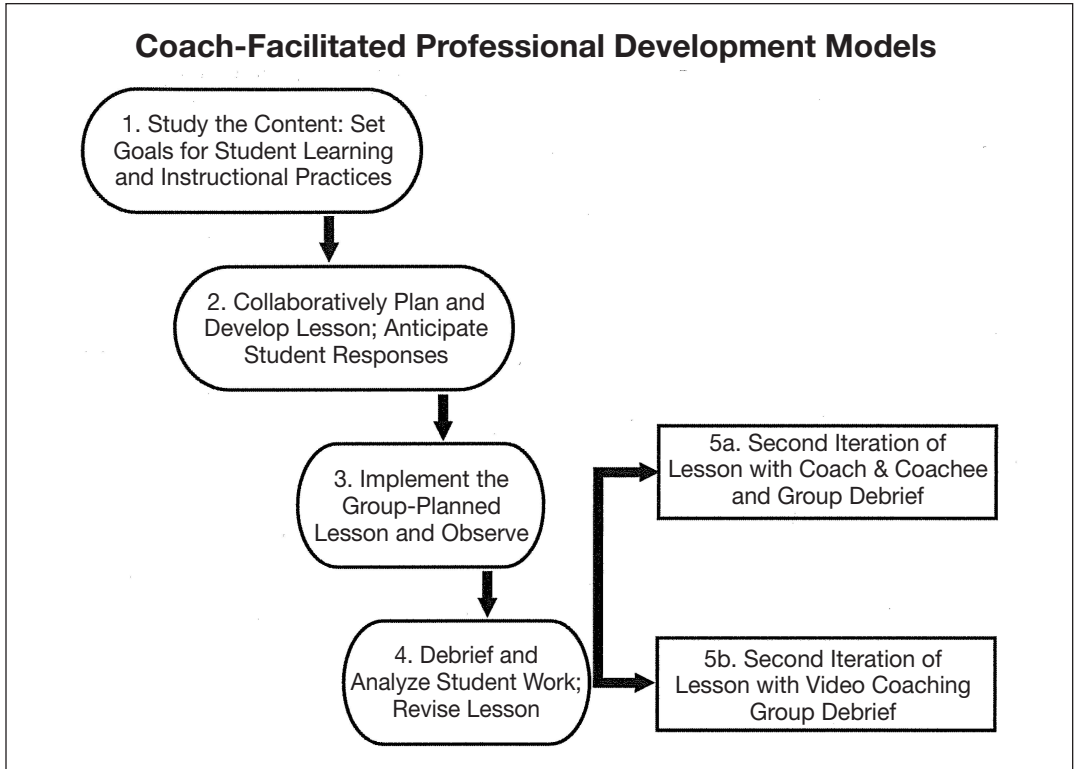


Fig. 7.1. Coach-facilitated LS (modified from Lesson Study Cycle [Lewis 2002])

Data Sources and Analysis

The data sources included video clips from the research lessons, including teaching and lesson debriefs, student work, teacher reflections, and researchers' memos. In addition, we captured the coaches' and teachers' exchanges for the second lesson iteration through Edthena. Finally, we administered a survey to the participants inquiring about the nature of the coach-facilitated LS PD experience. We systematically analyzed the data using Dedoose, a web-based application for developing initial codes and used the method of axial coding to find categories that drew emerging themes (Miles and Huberman 1994). Each of these data sources contributed to compiling a comprehensive picture of teachers' and coaches' learning experiences.

■ Results

For the first research question, we analyzed the specific coaching practices and professional activities implemented in the PD (such as the coach-facilitated LS and the use of Edthena video coaching) to assess the impact of these practices on teacher professional growth, as evidenced by the professional artifacts such as collaborative lesson plan, reflections, observations of teaching, and collective debrief.

Differentiating PD for Coaches and Teachers to Support Professional Growth

Through differentiated PD for coaches during the content-focused institute, we wanted coaches to concentrate more on their role as facilitators who could support teachers as they implemented problem-based learning and examined student thinking during the follow-up LS. During the institute, we brought the coaches together each day to work on mathematics problems prior to the teacher groups' experience with them so that we could anticipate the strategies and misconceptions we wanted to address with the school-based teacher teams. During these coaching sessions, we used the Five Practices (Smith and Stein 2011) to help teachers anticipate how students might approach the problem and determine what struggles students might have. The conversations were vertical in nature, as the grade band experience of the coaches was K–12. Providing coaches with this time to think collaboratively appeared to develop their content and leadership skills in facilitating teachers' engagement with the mathematics and teachers' practices in implementing the tasks in their own classrooms. This preparation provided an opportunity that allowed the coaches to assume the role of the experts and be seen as knowledgeable others.

The Coach as the “Knowledgeable Other”

As we moved into the follow-up LS, the coaches served not only as facilitators but also as knowledgeable others who pushed the mathematics forward to help teachers think more critically and deeply about the content. In this section, we share a case study of four teachers and their mathematics coach engaged in a modified coach-facilitated LS that took place as part of a larger PD project. Of the four teachers, Julie was a veteran teacher of twenty years while the others were in their first three years of teaching: Val was a seventh-grade mathematics teacher with three years of experience, Dylan was a first-year sixth-grade mathematics teacher career-switcher, and Sloan was a fifth-grade multi-subject teacher with two years of experience. This team was facilitated by Nancy, the district coach who also participated in the PD project. The team selected the lesson titled “Tiling Garden Beds” (fig. 7.2; Driscoll 1999) and collaborated to create their lesson plan.

TILING THE GARDEN

The Manassas Park Garden Club is collecting handmade tiles from different art classes to put around their school garden. They will not start planting until all tiles have been collected. While they wait, the garden club is trying to predict what the garden will look like. The size of their garden will depend on how many tiles they receive.

Here are three sizes of gardens framed with a single row of tiles. The white squares represent the tiles and the dark squares represent the possible garden:

Stage 1 Stage 2 Stage 3

Answer the following questions using pictures, words, tables, graphs, and/or symbols.

1. Draw Stage 4. How many white tiles are there?
2. How many white tiles at Stage 10? Stage 50?
3. How would you find the number of white tiles for any stage?

Fig. 7.2. The Tiling Problem (Driscoll 1999)

The PD organizers provided a lesson plan template modeled after *5 Practices for Orchestrating Productive Mathematics Discussions* by Smith and Stein (2011). Teachers spent their time working through and analyzing the problem to try to anticipate all possible strategies that their students might use (e.g., guess and check, drawing, making and chart, writing and algebraic expression) as well as crafting questions that they felt would guide students without reducing the cognitive demand of the task (e.g., Are you following the pattern? Can you test your rule against any stage? What remains the same in each stage?). Once the lesson was complete (see this book's page at NCTM's More4U site for the complete lesson plan for Tiling the Garden), the teachers (including the host), the coach, and the university facilitator met to debrief the lesson. Using a coach-facilitated PD model was intended to provide a knowledgeable other to press teachers' content knowledge and pedagogy throughout the entire cycle.

When the host teacher implemented the Tiling the Garden lesson, his sixth-grade students were able to successfully extend the pattern by using the illustrations on the problem sheet and drawing subsequent stages if needed. Some of the student groups were able to describe the pattern in terms of a rule, while others struggled to generalize their observations. The host teacher and observing teachers used the questions from the lesson plan to guide students forward. The host teacher then had groups share different descriptions of the rule, written in algebraic form, and he simplified the expressions to show students that all rules were equivalent.

During the post-lesson debrief discussion, Sloan, the fifth-grade teacher, wondered about the connections her students would make from finding a pattern in a table to writing the algebraic equation. She stated, "I'm kind of worried that [my lesson is] going to go more like that one table that was having more trouble. . . . They were like so close . . . but they weren't able to transfer that into their equation." Later she elaborated, "I'm just worried that my kids will not be able to see what's changing." Val, the seventh-grade teacher, had a similar concern, "I'm scared because I don't think my kids are going to write equations." In responding to these concerns, Nancy helped

reassure the teachers that the vertical progression of algebraic standards moves from extending and recognizing patterns, to expressing patterns through verbal descriptions, and finally to symbolic representations using variables (National Governors Association Center for Best Practices and Council of Chief State School Officers [NGA Center and CCSSO] 2010). To support their students through this progression from different starting points, Nancy guided the teachers to create a collection of “pocket questions” (e. g., What pattern emerges when you analyze the numbers? Can you write a sentence that describes the relationship you found? Can you write a formula using your sentence?) as a way to advance student thinking.

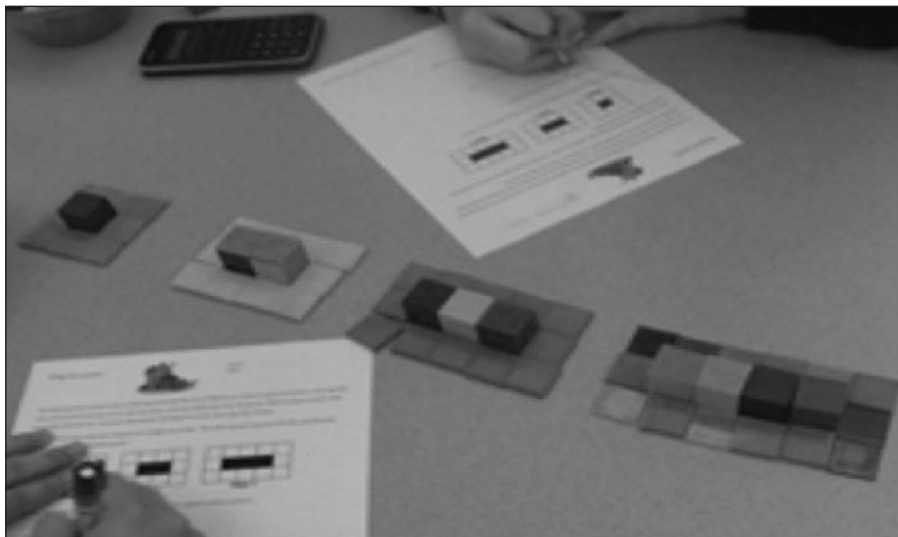


Fig. 7.3. Students' use of manipulatives to represent the Tiling pattern

Later in the debrief, Nancy and university facilitators led the teachers to discuss the use of manipulatives. This discussion helped Val to consider deeply the idea of using manipulatives, after seeing how the use of colored tiles supported students to verbalize and make sense of their different ways of seeing the growing pattern. Val had not previously used manipulatives with her middle school students. The coach shared in the post-interview that Val was encouraged to use manipulatives in her second iteration of the lesson because of the experience of observing the success of Dylan's students in using the concrete tool to explain and connect to their abstract and symbolic representations.

In summary, as the groups debriefed about the host teacher's lesson and their own implementation, the coach (Nancy) was able to push teachers toward the goals of thinking about learning progression with respect to algebra (e.g., moving from verbal descriptions to algebraic expressions) as well as pedagogical practices around facilitation of tasks (e.g., creating “pocket questions” and providing manipulatives).

Focusing on Teachers' Instructional Practice via a Video Coaching Tool

In most of our coach-facilitated LS groups, the first rendition of the lesson taught by the host teacher was observed by the entire team; however, it was not always possible for the second iteration of the lesson (taught in the other members' classrooms) to be observed by the team members and the coach. To enrich their collaborative professional practices, we asked each member of the LS team to videotape their second iteration of the lesson. The team then watched each other's lessons using Edthena and marked areas in the video clip that they considered strengths in each lesson (as described in the coach-facilitated LS model; see fig. 7.2, step 5b).

We examined one of the team's video coaching exchanges and found that the coach and the teachers had meaningful dialogue about the teaching episode. Due to their collective experience with the original lesson, they were very invested in providing feedback on the reteaching of the lesson. In the following video coaching excerpt from Edthena, the teacher and coach reflected on how her students thinking is enriched through the teacher's intervention and how students took ownership of mathematics instruction and persevered through the task:

00:36 – Coach: Great way to get them started [with individual work-time]—it makes sure all kids are engaged and thinking for themselves instead of relying on group members!

01:43 – Teacher: I was impressed with this [group]. They worked backwards pretty fast. I then challenged them to show me another way of getting the solution, and they were the first to start to work with the manipulatives.

Coach: That is awesome—great way to get them to think about it differently!

02:52 – Coach: This group had a student who was unable to get the right answer at first. Instead of just telling her the answer . . . they sat down and walked through the process. It was amazing to see the explanations and the moment the student understood the process and answer.

In the teacher's comments, it is clear that she values the first group's willingness to try something new to extend their thinking. The coach's comments highlight the importance of student agency and perseverance, encouraging the teacher to be aware of these opportunities. In her own reflection, the coach noted a change in teacher behavior through questioning and wait-time to encourage and support students to reach answers on their own. In addition, she noted a change in students' motivation as a result of this support: "students who have struggled and failed over and over were . . . engaged in the lesson and excited about figuring it out." The video coaching forum provided some time for teachers to revisit each other's lessons and the group experience led to a collective ownership of teaching practices. This excerpt shows teachers conversation about a peer's lesson:

00:59 – Teacher: The time allowed for group presentations needed to be expanded; not enough time to allow all groups to better explain thought process used to solve.

02:08 – Peer Teacher 1: The questions that were asked engaged the students' thought process and did not guide the students.

02:11 – Peer Teacher 2: Students comparing pictures and discussing their different approaches is a great way for them to see the problem slightly different and learn a new way of looking at something.

10:54 – Peer Teacher 3: Going around and checking all students work, giving them a chance to explain, guiding them without telling them [was a] great way to keep them going. I agree that time is always not enough but watching the videos has given me a broader insight of how students process information and also the use of oral [academic] language.

The shared experience of the lesson study and the exchange of feedback through the debrief and the video coaching appeared to contribute to the teachers’ collective knowledge.

Coach-Facilitated LS Supported the Development of Teacher Social Networks

For the second research question regarding how coach-facilitated LS model supported the development of teacher social networks, we identified several affordances of using the coach-facilitated PD model in the school-based PD design. In one of the survey questions, we asked, “How did working in a small school-based LS team help implement content and new strategies in teaching this lesson? Do you have a teacher or a coach from your own school in this course, if so, how did having a colleague enhance your learning?” Through participants’ responses, we found that teachers and specialists had developed different collaborative networks through the coach-facilitated school-based LS. The analysis of teachers’ responses to this question yielded four distinct types of teacher networks (see table 7.1). The first type of collaborative network mentioned as support was (1) the Coach and Teacher Networks, identified in thirteen out of forty-nine responses, which was expected since the coach facilitation was built into the fabric of the PD design. However, we were very pleased to see that there emerged other social networks: (2) Multi-district Teacher Networks with cross-grade “vertical” teacher networks and the same grade “horizontal” teacher networks mentioned in seventeen of forty-nine responses; (3) School-based Professional Learning Community (PLC) Teacher Networks mentioned in sixteen of forty-nine responses, and (4) Resource Specialists Networks mentioned in six of forty-nine responses. Two responses were coded for both supporting school-based PLC networks and developing the coaching network, and another two responses were coded for both supporting multi-district teacher network and coaching network.

Table 7.1
Development of collaborative teacher networks

Type of teacher network	Participants
Coach and Teacher Network	Teachers and coach within a school or district
Resource Specialists Network	Classroom and resource teachers within a school
Multi-District Teacher Network	Content teachers from multiple districts
School-based PLC Teacher Network	Teachers teams at same content and grade level

The Coach and Teacher Network: Trusting the Coach as the “Insider”

The coaches working with the university facilitator showed the collaborative nature of our efforts, and teachers saw their coaches endorsing our PD. With the prior relationships established with these teachers, the coach seemed to garner immediate trust, or “buy in” to our PD efforts. The coaches from eight districts participating in our project had a forum to discuss their own challenges as mathematics specialists and coaches in their districts. Inviting district leaders and administrators to attend the LS also validated the work the teachers were doing. In fact, one elementary teacher who did not have a school team formed a team with the teachers in their feeder middle school and their district math supervisor, and she shared how she felt supported in her professional learning.

The small school-based team was a very personal and effective way to enhance my teaching. Although I did not have a teacher or coach from my school, I was able to meet with the teachers and coach at our middle school as well as with the director of our division’s math department. All of the connections made me feel less isolated and more like I was part of a powerful teaching community.

Resource Specialists Network: Support for Teaching Diverse Student Populations

We formed LS teams as communities of practice where teams of general educators worked with teachers of English language learners (ELL) and special education teachers. In this way, we also saw what we called “collaborative coaching” where different participants shared their specialized professional expertise. The special education and ELL specialists shared their expertise on how the task would need modification to provide access for all students, and they helped generalists anticipate how learners might need extra support to navigate through the problem task. One teacher commented, “Having the ability to plan with an ELL teacher provides opportunities to discuss and understand some of the issues and misconceptions students deal with on a regular basis.” This exchange among professionals became one of the notable ways teachers recognized that all learners are capable of problem solving, as noted by this educator:

Prior to this PD, I was a teacher who focused on basic fact memorization and simple computation. I’ve always taught the inclusion class and I felt that the students I taught couldn’t handle or weren’t ready for real-life problem-solving activities. I have found this not to be true at all.

This collaborative mentoring through the community of practice allowed for teachers to go beyond “your kids” vs. “my kids” and rethink their beliefs about who can and cannot do mathematics.

Multi-District Teacher Network Formed from Vertical and Grade Level Teachers

The work with learning trajectories supported *vertical teaming* by teachers, for it allowed a “chance for teachers to discuss and plan their instruction based on how student learning progresses. An added strength of a learning trajectories approach is that it emphasizes why each teacher, at each grade level along the way, has a critical role to play in each student’s mathematical development” (Confrey 2012, p. 3). Some of our LS teams were vertical teams and others were grade level teams

from across districts. In this quote, teachers voice appreciation for new ideas they gained from teachers across multiple grade levels.

Working in a cross-grade level team enabled us to plan for success of students of all abilities. We were looking at extensions and remediation opportunities to provide all students an access point. It was very helpful to hear new strategies/ideas and see where students need to take the knowledge [for future grades].

School-Based PLC Networks Sustained Professional Learning with a “Carry-Over Effect”

The effect of the PD appeared to extend beyond the time and scope of our initiative. One coach noted a carry-over effect on her teachers’ interactions and focus on learning trajectories in their weekly PLC meetings.

The majority of their time [was] spent writing lesson plans together. . . . Now . . . the focus of their weekly meetings has shifted to evaluating student work [and] . . . revis[ing] the assignments given to students so that questions require higher order thinking which require students to engage in algebraic habits of mind.

Just as teachers appeared to begin to change their practice after seeing their students engaged in the mathematics learning, the coaches had a parallel experience watching their teachers take on the instructional practices that promoted student thinking through questioning during a problem-based lesson:

I’ve noticed a change in the teachers as well—instead of ‘is that right or wrong,’ they are looking for more than just a correct answer. . . . Just like the students are learning that . . . there are many ways to get to the same conclusion, the teachers are as well.

Coaches saw this willingness by their teachers to cross the boundary to reform-based teaching practices as an opportunity to support change for positive student outcomes aligned with new district initiatives:

Teachers not used to teaching using groups and more open-ended tasks saw the difference in how students reacted. If teachers can transfer this knowledge into building lessons from the current curriculum rather than thinking of the lessons they did as “special” we will be on the right track. I see many opportunities to be able to link the lesson study experiences with other site-based efforts.

For novice teachers, this also provided the teachers a jump-start in getting to know their support network. One new teacher commented on how she was able to build a resource base with a coach from her school and other colleagues:

I think having a small school-based team was a big help regarding planning and talking about the lessons. You could get instant feedback and compare results from classes with similar characteristics. Having colleagues and a coach all in that same school was a great support for checking in on progress.

In all, we found that the coach-facilitated PD model allowed for meaningful growth in the participating teachers’ content and pedagogical approach. Further, through well-planned and supported interactions, teachers were able to build helpful networks across grade levels, with their coaches, and across the learning needs of their students.

■ Conclusion

The opportunity for in-service teachers at multiple grade levels to collaboratively plan a learning task and to observe students respond to the task is not a common professional activity. Through our coach-facilitated lesson study PD model, we were able to leverage this professional learning opportunity to build collaborative teacher networks that empowered teachers, coaches, and specialists.

Having colleagues to participate with in this class enhanced our learning. We were able to share ideas and collaborate with ease, not just about assignments for this class, but also to support each other with other lessons as we each began to implement algebra rich tasks into our classrooms more frequently. We were also able to present at a school-based PD, and begin to show other teachers this teaching approach.

The coach-facilitated LS appeared to support the development of different teacher collaborative networks. Teachers with various expertise mutually contributed to and benefitted from the vertical articulation of algebraic concepts and professional dialogue and in essence provided a collaborative coaching environment. One of the most important takeaways for our PD design team is learning more deeply about how our coach-facilitated PD can provide the continued social support that is needed to sustain and support teachers' intellectual growth in content knowledge and the instructional shifts in their practice as they work to enhance student learning. We are encouraged by the outcomes from the coach-facilitated PD and LS model that helped develop social networks and supported teachers as they implemented the high leverage practices.

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