

Collaborative Sensemaking Through Side-by-side Coaching: Examining In-the-Moment Discursive Reasoning Opportunities for Teachers and Coaches

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Abstract: Instructional coaching has emerged as a potential support to mathematics teacher learning, but little research has investigated the nature of coach-teacher interactions that support this learning. This paper presents an illustrative case of how a math coach and teacher collaboratively make sense of a lesson during side-by-side coaching. Findings indicate that the teacher-coach interactions included talk at three altitudes: within, across, and beyond moments of the lesson. Additionally, collaborative sensemaking happened briefly during the lesson, but was more extended at the end of the lesson. These findings show how side-by-side coaching can provide opportunities for collective sensemaking and point to its potential rhythms across a lesson.

Content-specific coaching can help teachers develop their practice in ways that better support student learning (Kraft, Blazar, & Hogan, 2018). Mathematics coaches can engage teachers in a variety of activities to promote their learning (Gibbons & Cobb, 2017). However, how these activities function interactionally to support teacher learning is the subject of ongoing investigation. This paper explores an innovative and effective model of coaching support, side-by-side coaching, which embeds coaching within teaching and seamlessly combines multiple coaching activities (Munson, 2018). Specifically, we examine how the coach and teacher jointly engage in making sense of their common experiences within a lesson, or collaborative sensemaking. In this exploratory study, we ask: What are the properties of collaborative sensemaking during side-by-side coaching?

Theoretical background

Pedagogical sensemaking as a form of teacher learning

A sociocultural perspective on learning positions learning as changes in participation within communities of practice (Lave & Wenger, 1991). This perspective highlights how social interactions constitute opportunities for learning, as well as evidence of learning over time. In this paper, we focus on pedagogical sensemaking as a form of teacher learning from a sociocultural perspective, and do so within the context of instructional coaching. Pedagogical sensemaking can be thought of broadly as the reasoning that teachers engage in to make sense of teaching and learning, which could involve interpretation, justification, explanation, or posing questions around teaching practice. Additionally, this sensemaking could focus on specific experiences or events, such as the events in a classroom lesson, or more generalized ideas about teaching and learning (Horn, Garner, Kane, & Brasel, 2017). Engaging in pedagogical sensemaking provides a conceptual infrastructure for supporting teacher learning from a sociocultural perspective.

Previous research on pedagogical sensemaking has examined both collaborative and non-collaborative contexts for teacher learning. Several researchers have examined the opportunities for teacher learning that exist during teachers' collaborative conversations among colleagues, such as a teacher workgroups or professional learning communities (Bannister, 2015; Horn & Kane, 2015; Louie, 2017). Despite taking place in a collaborative environment, this research finds that teachers' conversations are not necessarily collaborative, and instead, can sometimes be more monologic in nature (e.g., Horn et al., 2017). Alternatively, researchers have also examined how teachers use pedagogical sensemaking as individuals with respect to their experiences teaching, such as how teachers make sense of and implement educational reforms, and how teachers analyze classroom experiences and videos of them (Dyer & Sherin, 2016; Santagata, Yeh, & Mercado, 2018). This body of research highlights the important role that pedagogical sensemaking plays in supporting teacher learning, and begins to develop some guiding principles for how this happens. However, little research has examined the role of pedagogical sensemaking in a coaching context, which is another collaborative environment aimed at supporting teachers to use everyday pedagogical experiences for learning.

Pedagogical sensemaking in instructional coaching contexts

Coaching is an increasingly prevalent form of job-embedded professional development in schools, in which instructional coaches support teachers in developing their capacity to engage in the practices of their profession. This study focuses on a coaching model that embeds a coach directly in the classroom community to work in joint activity with the teacher as they teach. We conceptualize this model, *side-by-side coaching*, as involving the coach moving throughout the classroom side-by-side with the teacher to engage together in the practices which the teacher aims to learn, develop, or refine. The teacher and coach move fluidly between acts of teaching with students and moments of professional discourse that would narrate and inform practice, as well as pre-briefing and debriefing the lesson immediately before and after. Co-participation in the work of teaching creates opportunities for (1) the coach to model practice, (2) the teacher to engage in practice and receive immediate feedback from the coach, (3) shared reflection on moments of instruction, (4) the coach and teacher to discuss instructional decisions in the moment, and (5) for immediate support for the teacher in emergent problems of practice. These specific activities that could be involved in side-by-side coaching also contain ample opportunities to collaboratively participate in pedagogical sensemaking. In particular, side-by-side coaching can support teachers to engage in *collaborative sensemaking*, and its structure supports several key features of productive pedagogical sensemaking identified in previous literature.

Previous literature on pedagogical sensemaking has identified that access to pedagogical experiences, and focusing attention on relevant aspects of them, is important (Louie, 2017; Sherin, Jacobs, & Philipp, 2011). In contexts outside of classroom experiences, access is provided through sharing experiences narratively (e.g. Horn, 2010) or through classroom artifacts such as student work or classroom video (Kazemi & Franke, 2004). Side-by-side coaching provides different access to classroom experiences because the teacher and coach simultaneously share experiences in the classroom, although each may have different perspectives or viewpoints about what happens. Additionally, the coach and teacher can play a role in what the other thinks about and pays attention to both in the moment and afterward. This close proximity to the experience and act of teaching make side-by-side coaching unique in comparison to other contexts that support pedagogical sensemaking.

Supporting *collaborative* sensemaking requires that participants make their thinking public to one another for joint consideration (van Es & Sherin, 2008). Collaborative contexts that support pedagogical sensemaking also note the importance of allowing colleagues to share and consider multiple interpretations or different ways of making sense of the same (or similar) events (Lord, 1994), and to take up and build on one another's ideas. In particular, connecting pedagogical sensemaking to future action is theorized to be particularly important in supporting teacher learning (Horn et al., 2017). In side-by-side coaching, the coach and the teachers have flexibility about when and where to share their thinking with one another, including during the actual lesson, or before and after instruction take place. Further, because the coach and teacher are jointly responsible for making subsequent instructional decisions during the lesson, side-by-side coaching pushes the coach and teacher to collaboratively decide on instructional next steps.

Finally, research on pedagogical sensemaking highlights the importance of creating time and space to deeply consider pedagogical sensemaking (Horn et al., 2017). In many cases, this deep engagement necessitates time outside of a classroom environment. In side-by-side coaching, there is a possibility for immediate engagement of pedagogical sensemaking, but it is not yet known whether these opportunities are sufficient for deep engagement. This paper contributes to the literature on pedagogical sensemaking by examining how it can unfold during side-by-side coaching interactions. This exploratory study aims to characterize the kinds of sensemaking used by the teacher and coach in discourse as they engage in joint teaching activity to support teacher learning.

Method

Study context and data sources

The data for the present analysis were taken from a larger study of how side-by-side coaching supported elementary mathematics teachers to learn to confer with their students during collaborative inquiry-based group work (Munson, 2018). Three elementary teachers from the same public, urban elementary school in California participated in side-by-side coaching. Teachers volunteered to take part in the study, and the first author served as the coach. The broad goals of the side-by-side coaching were to support teachers in uncovering, noticing, and interpreting student thinking, and building discursive tools for responding to that thinking in the moment.

The coaching period of this study was four weeks long for each teacher. In each week, the teacher and coach engaged in two days (lessons) of side-by-side coaching. Each teacher participated in 7-8 side-by-side coaching sessions during the coaching period of the study.

During side-by-side coaching, the teacher was responsible for planning and leading instruction, including launching the day's work with students and facilitating closing discussions. The coach and teacher began each

session by pre-briefing, typically for 5-10 minutes, to discuss the teacher's plan and goals for the lesson. During collaborative group work, when conferring occurred, the teacher and coach moved together throughout the classroom talking with students about their work. The teacher and coach talked between conferring interactions with students, and at times, they would pause interaction with students to talk about what was occurring as it happened. The teacher and coach typically concluded the side-by-side coaching session by debriefing what had occurred.

All side-by-side coaching sessions were video recorded, using a fixed camera positioned high and in one corner of the classroom. A total of 23 side-by-side coaching sessions were collected across the three teacher participants. Lessons were typically 60 minutes in length but varied from 45 to 90 minutes.

Analysis

This exploratory analysis examined the data qualitatively to identify emergent patterns of collaborative sensemaking between teachers and the coach during side-by-side coaching. Through repeated viewing of the video corpus and the creation of content logs, initial patterns of teach-coach interactions were identified (Engle, Conant, & Greeno, 2007). In this initial phase of data analysis, we noted the teacher-coach speech varied in how closely tied to immediate events it was, that teacher-coach talk occurred throughout the lesson but was densest near the end of the lesson, and variation in topics and duration of discussion of each topic. Based on these patterns, a single illustrative case (Yin, 2014) was selected for deeper analysis. The case selected was from the classroom of the fourth-grade teacher leader and took place on the second day of coaching, in the first week of the four-week coaching period.

The focal video (duration = 60 minutes) was analyzed by creating minute-by-minute content logs of all interactions between the teacher, her students, and/or the coach. Because the study is concerned specifically with the way that the teacher and coach collaborate for sensemaking during instruction, analysis then focused instances of teacher-coach talk. All teacher-coach talk was coded based on the emergent patterns from the initial video viewing to indicate the altitude of the talk (see Table 1). If a single talk turn moved between altitudes, it was segmented such that each segment received one altitude code.

Table 1: Codes for the altitude of teacher-coach talk, with definitions

Altitude	Definition	Example
Within moments	Utterance focused on the current moment of instruction or interaction or event(s) that immediately preceded the coach-teacher interaction.	Coach: They [students] had figured out that 6 [six-packs] was 36 and 7 [six-packs] was 42. And then the next one also had to be 42. And they had said, 'We don't need to actually figure it out until we're at least over 100.'
Across moments	Utterance focused on connections between specific moments or events, including the current moment, moments previously occurring in the lesson, or those in the past.	Teacher: In those moments like [points to tables in the room where the teacher and coach had interacted with students], I wanted to interject.
Beyond moments	Utterance draws generalizations about practice, student thinking, mathematics, or learning. May discuss ways of framing future understanding or decision-making.	Teacher: I'm definitely realizing that before I thought that it was more like, in-and-out type of conferences where it was, like, probe them with a question, get them going, and then leave. But it seems like it's more productive to sit for a longer period of time.

Talks turn segments were then analyzed in sequence to determine boundaries by topic. The focal video includes a density of teacher-coach talk in one 10-minute portion; in this portion, topics were defined for each string of related talk turn segments. Patterns in the rhythm, speaker, altitude, and topics of teacher-coach talk are discussed in the findings.

Findings

During the focal side-by-side coaching session, we identified three rhythms to the collaborative sensemaking the coach and teacher engaged in through discourse. We found that, with regard to coach-teacher talk, there were rhythms in the altitude, rhythms across the lesson, and rhythms within the topics. Together these rhythms illustrate the ways that the coach and teacher collaborated to make sense of teaching and learning within a lesson.

Rhythm within altitude of teacher-coach talk

As the coach and teacher talked during the lesson, we found that they engaged in three levels, or altitudes, of talk (see Figure 1). The teacher and coach often spoke about specific moments of teaching and learning which they had co-witnessed during the lesson, an altitude of talk that we refer to as *within the moment*. In these utterances, which were closely anchored to the local experience, the teacher or coach might site specific details they observed, pose questions about what they had witnessed or engaged in instructionally, or propose interpretations or explanations of these events. Less frequently, the teacher and coach spoke *across moments*, in which they connected multiple moments that one or both had observed. These connections could highlight similarities or contrasts which sharpened sensemaking across cases. Finally, the teacher and coach often spoke *beyond moments*, attempting to generalize about student thinking, mathematics, learning, or practice. These instances were implicitly, and sometimes explicitly, connected to the specifics of the shared teaching experience within the side-by-side coaching. However, these utterances described larger patterns that could provide a framework for responding to similar moments in the future. Both the teacher and the coach engaged in all three altitudes of talk, indicating that these types of talk served both participants in collaborative making sense of their shared experience.

Rhythm within topics

The strings of utterances could be clustered by topic, which ranged multiple dimensions of teaching and learning. Across the lesson, the teacher and coach discussed a total of nine separate topics. The coach and teacher used their discussions to make sense of student thinking, strategy development, the teacher's own professional learning, and pedagogy. The broad categories, however, do not fully capture the nuanced topics discussed, which sometimes straddled these boundaries (see Figure 2). For instance, in minutes 56 - 58, the coach and teacher discussed the utility and purpose of sustained eliciting when conferring with students and during this topic they touched on the role of eliciting in formative assessment, how eliciting supported students in articulating thinking, and the pedagogical investment of time this discursive work demands. Even in these sustained topic strings, the teacher and coach typically talked for 1 - 2 minutes, and in these relatively brief spans, their discussions covered interrelated aspects of teaching and learning mathematics.

When talk was sustained for more than a few seconds, these topics typically include multiple levels of talk (note the topics discussed in the final 10 minutes of Figure 1), with *within the moment* talk the most consistently represented. During sustained talk, both the coach and teacher engaged in talk about the topic. This is to say, that these instances were not simply one participant reflecting aloud or making their own thinking public. Successive talk turns by both participants shaped and negotiated the meaning of the topic, both with the moment of shared experience and in ways that extended beyond that moment.

Rhythm across the lesson

While the coach and teacher took time out during and between interactions with students to talk, these interactions were brief and typically stayed at one altitude of talk (see Figure 1). During the first 33 minutes of collaborative group work, the teacher and coach engage in three extended interactions with students about their thinking and had four teacher-coach interactions. Three of these teacher-coach interactions stayed at a single altitude, and two of these only included one talk turn. The coach and teacher did talk both within and beyond the moment, addressing immediate instructional issues that emerged and generalizations that might be drawn from these moments. For instance, in minute 23, the coach paused an interaction with students to notice aloud to the teacher that the students were struggling to keep track of the various quantities involved in their mathematical task. Separately, in minutes 31 - 32, the coach and teacher discuss the general pattern the teacher observed in the coach's interaction with students, which she saw as moving between asking questions about the mathematics and the story context for the day's task.

Teacher-coach interactions across the lesson often (6 out of 9 instances) began with one participant offering aloud something that they had noticed during the shared experience of teaching. However, how these instances of noticing aloud functioned as tools for collaborative sensemaking differed across the lesson. In the heart of the lesson (minutes 16 - 50), three of the four brief teacher-coach interactions either started with or was entirely characterized by the speaker noticing aloud something from the interactions with students immediately prior. For instance, in minute 26, the teacher begins an interaction with the coach by saying about the way conferring was structured, "So, I'm noticing that it's a lot of revisiting the story and retelling, and not just retelling but revisiting to find the problem." During this period of the lesson, these noticing aloud utterances functioned to focus attention on a specific feature the pair had co-witnessed, but they generated little if any uptake for conversation.

However, in the final 10 minutes of the lesson, the noticing aloud moments function differently, generating extended exchanges of sensemaking that weave between multiple levels of talk. What is noticed aloud

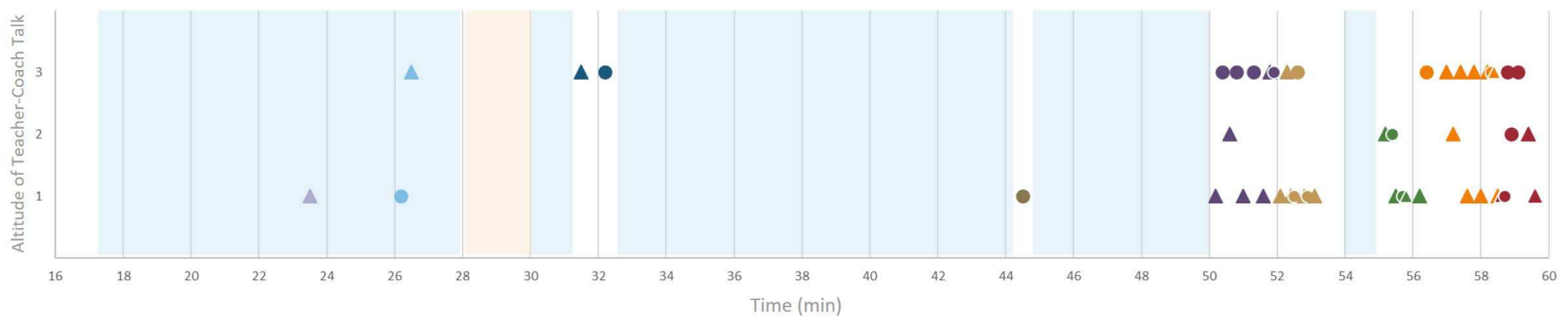


Figure 1. The rhythm of teacher-coach and teaching talk after the launch of the lesson, with time (min) running along the x-axis. Blue shading indicates conferring interactions with students, while the orange shading indicates an episode in which the teacher made a whole class announcement. The scatter plot represents utterances between the teacher (circles) and coach (triangles). Color denotes each new topic of discussion. The position of each utterance indicates the altitude of talk: Within the moment (1), Across moments (2), or Beyond moments (3).

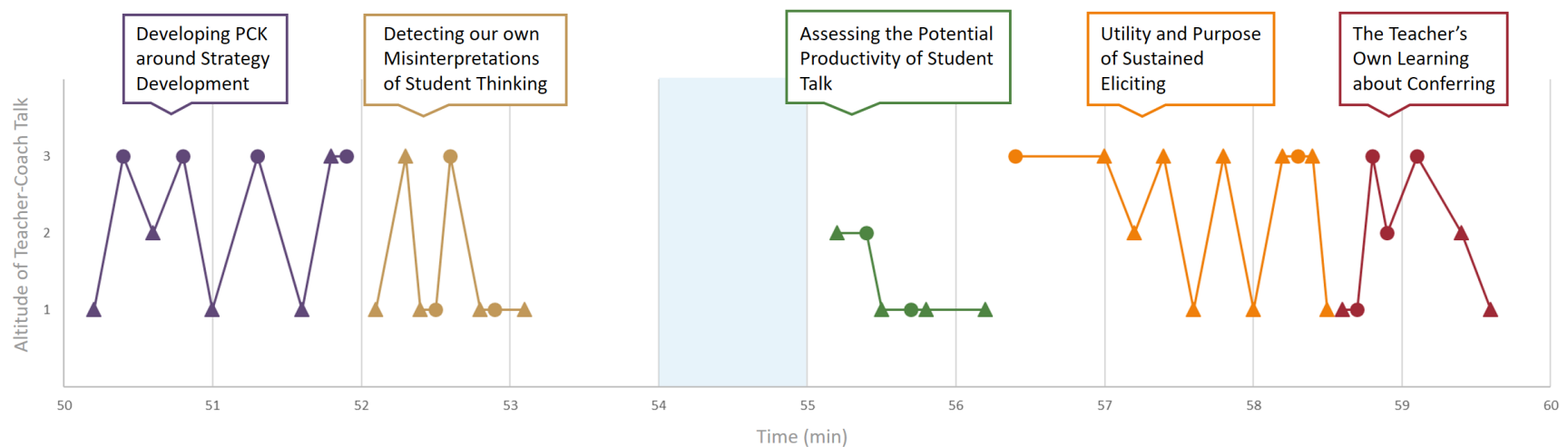


Figure 2. Detail of the final 10 minutes of the lesson, in which the bulk of teacher-coach talk occurred. The topic of each series of utterances is denoted above the graph. The notation system is identical to Figure 1, with the exception that utterances within the same topic are connected with lines of the same color to show sequence.

in these later interactions typically occurred much earlier in the lesson; the coach and teacher used noticing a detail, event, or exchange aloud as a way to orient the listener to a particular moment about which more conversation or reflection was warranted. In the following section, we offer a vignette from the end of the lesson that illustrates how these rhythms took form in the teacher-coach talk about a single topic.

Collaborative sensemaking in action: Vignette of detecting our own misinterpretations of student thinking

The following vignette comes from the dense teacher-coach talk period in the final 10 minutes of the lesson (shown in gold in Figure 2). The task the class was working on involved trying to figure out how many six-pack of water would be needed to fill a vending machine that could hold 156 bottles. Prior to this interaction, the coach and teacher had conferred with three separate collaborating groups of students.

In the second conferring interaction (minutes 32 – 44), the students had launched the conversation by saying they were confused. The coach elicited student thinking and they discussed the approach the students had taken that involved modeling the inside of the vending machine using rows and columns, an array-based strategy the class had explored in a previous unit. The students said that they didn't know how many rows and columns to make, and the coach asked if they could draw a picture to represent what was happening in the story. The students said no, which triggered the coach to ask more eliciting questions about their work so far. These questions revealed that the students already had a well-developed approach to the task and they were confused about a discrete part of their strategy.

The coach and teacher had talked to another partnership about their thinking (minutes 44 – 50) and then discussed the developmental trajectory of strategies for representing multiplication (minutes 50 – 52), before circling back to discussing this interaction.

In a mere 50 seconds, the coach and teacher each talk across multiple altitudes about detecting their own misinterpretations of student thinking (see Table 2). The coach begins by noticing aloud that she had asked the group in the second conferring interaction to generate ideas about how to represent the mathematics in the vending machine story and the students said no (lines 1 – 3). This move draws the coach and teacher's shared attention to a particular interactional moment nearly 20 minutes earlier in which the coach's move failed to produce idea generation, and the coach goes on to frame this generally as an instance of an attempt to nudge being rejected by the students (lines 4 – 5). This move from *within the moment* to *beyond moments* situates this event as a case of a larger phenomenon. The coach then describes how she interprets this type of phenomenon, as an indication that the interaction is on the wrong path (lines 7, 9, and 11) and how to respond, by going back (line 13).

Table 2: Transcript of Topic #2 discussed in the final 10 minutes of the lesson, in which both the coach and teacher talk across multiple altitudes making sense of a challenging interactional moment with students

	Transcript	Altitude of Utterance
1	Coach: So, one thing I wanted to point out about this group over here, is	Within the Moment
2	that, I pulled them back to the story and I asked them if there	
3	was a way to represent it, and they just said no.	
4	Coach: So, I think of this as, like, I'm trying to nudge you and you just	Beyond Moments
5	rejected me.	
6	[Teacher laughter]	
7	Coach: Which is, which is, which is fine because it tells me –	
8	Teacher: – Yeah –	
9	Coach: We're not on the right path –	
10	Teacher: - Yeah –	
11	Coach: I was on the wrong path.	
12	Teacher: Yeah, yeah, yeah.	
13	Coach: So we go back,	Within the Moment
14	Coach: - in this case we didn't go back to the story, we went back to the	
15	student work.	
16	Teacher: Right, yeah, I noticed that, too, where it was, like, the blank -	Within the Moment
17	Teacher: I think that's, like, the point where I'm like, when there's that	Beyond Moments
18	blank stare, it's like, What is it? But it makes sense that it would	
19	be the question isn't going in the right direction, and it's like	
20	revi- Yeah, that was really interesting.	

21	Coach: It's not that we need to draw a new picture. It's that we need to	Within the Moment
22	make sense of what was on the paper. And I had misinterpreted	
23	that -	
24	Teacher: Yeah, totally. Me, too.	Within the Moment
25	Coach: - as the spirals like you had drawn for the food vending machine.	Within the Moment
26	And so I had- And that was, like, an incorrect assumption and I	
27	needed to go back and question myself.	

The coach then toggles back to the particular moment, saying that in this context she steered the interaction back to the student work rather than the mathematical task or story (lines 14 – 15). The teacher joins in at the same *within the moment* altitude, saying that she had noticed a cue from the students that the coach's question wasn't getting uptake, a blank stare (line 16). Then it is the teacher who moves the conversation up to generalize about the challenges she faces when she receives a blank stare from students and how this conversation is supporting her in making sense of those instances (lines 17 – 20).

The coach then shifts the conversation back down to anchor it within the moment by saying that in this instance the students didn't need a new picture, as the coach had suggested, but rather the coach needed to elicit more about the work they already had on their paper (lines 21 – 22). She identifies this as her own misinterpretation of the students' thinking (lines 22 – 23), which the teacher acknowledges she shared (line 24). The coach stays with this misinterpretation, describing what she noticed in the student work that triggered the misinterpretation and reiterating that she was the one who needed to interrogate her assumptions (lines 25 – 27).

This interaction bounces between within the moment and beyond moment utterances by both the teacher and the coach. Instead of talking about the moment and then generalizing or simply making general statements, the teacher and coach weave between making sense of the instance and placing it in a larger context of instances like it (e.g., receiving a blank stare, being confused about student work, making misinterpretations). In this example of teacher-coach collaborative sensemaking, neither participant strays far from the concrete details of the interaction with students they had just experienced together, while they use that experience to consider the implications of it on making sense of student thinking more broadly.

Conclusion and implications

The teacher's and coach's sensemaking during side-by-side coaching was collaborative in nature. The coach-teacher talk allowed both parties to make their thinking public to one another, an important aspect of collaborative sensemaking. At the end of the lesson, when collaborative sensemaking was dense, the teacher-coach discourse involved turns of talk from both the coach and the teacher for each of the topics discussed, and the vignette showed how the coach and the teacher took up each other's ideas as the conversation progressed. One key distinction between the teacher-coach interactions in the heart of the lesson and those at the end may simply be that there was far more shared experience to discuss after an extend experience side-by-side. During this time, the coach and teacher could recall particularly salient instances and begin to connect them. Note that utterances across moments do not emerge until the final 10 minutes, which is to say after there have been many moments that could be connected or contrasted. One interpretation of this rhythm is that collaborative sensemaking during side-by-side coaching is fed by the shared experience of teaching with children. These findings point to the importance of debrief or after-lesson conversations between the teacher and the coach in a side-by-side coaching format in order to collaboratively make sense of the lesson.

The findings also show that side-by-side coaching can provide opportunities for deep sensemaking that connects specific classroom experiences with one another and with more general pedagogical ideas. These connections are considered especially important for collaborative teacher learning (e.g., Horn, 2010; Horn et al., 2017) and have been documented among teachers that are consistently responsive to student thinking and teachers who are developing responsive teaching practices (Dyer & Sherin, 2016). Five distinct topics were discussed within the final 10 minutes, each involving contributions at different altitudes, suggesting that the coach and teacher were able to connect specific experiences from the classroom either together or to more general ideas about pedagogy. Debriefing in side-by-side coaching may be an especially important venue for teacher learning, supporting deep conversations in a relatively short period of time after substantive shared classroom experiences.

The results of this paper suggest future lines of inquiry into teacher learning and coaching. As an exploratory study, the findings are constrained by examining one illustrative example. Future work could examine additional side-by-side coaching data from the same teacher and data from additional elementary math teachers could be examined to determine whether the patterns with respect to the rhythms in altitude and topics across a side-by-side coaching lesson are consistent. This analysis could also detect differences in the engagement during

side-by-side coaching based on different types of classroom lessons or different teachers and determine if the promising nature of dense collaborative sensemaking at the end of the lesson proves consistently fertile ground.

More generally, this study showed that the collaborative sensemaking at the end of shared experiences was particularly dense. One potential design principle worthy of additional research is the function and utility of coupling shared experiences of pedagogy with substantive opportunities to debrief. Future research into the design of professional learning could investigate this principle in different coaching models for variation in the types of shared experiences and structures for debrief. Additionally, design research could examine how to adapt this principle for other professional learning contexts, such as collaborative teacher workgroups or mediated field experiences for novice teachers. Finally, additional research could examine the role of the coach to identify facilitation practices that support collaborative sensemaking.

Few studies offer analyses of how coaches can work effectively with individual teachers to promote learning (Gibbons & Cobb, 2017). This paper begins to fill this gap by documenting the teacher-coach interactions during side-by-side coaching. In particular, the findings that show how in-the-moment interactions during the lessons can serve as a foundation for later deep sensemaking at the end of or after the conclusion of a lesson. Rather than indicating that the in-the-moment interactions during side-by-side coaching are prime locations for teacher learning, the findings suggest that the in-the-moment and post-lesson interactions work together to support teacher learning around classroom experiences.

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