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A Taxonomy of Instructional Learning Opportunities in Teachers' Workgroup Conversations

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Abstract

Many school-improvement efforts include time for teacher collaboration, with the assumption that teachers' collective work supports instructional improvement. However, not all collaboration equally supports learning that would support improvement. As a part of a 5-year study in two urban school districts, we collected video records of more than 100 mathematics teacher workgroup meetings in 16 different middle schools, selected as "best cases" of teacher collaboration. Building off of earlier discursive analyses of teachers' collegial learning, we developed a taxonomy to describe how conversational processes differentially support teachers' professional learning. We used the taxonomy to code our corpus, with each category signaling different learning opportunities. In this article, we present the taxonomy, illustrate the categories, and report the overall dearth of meetings with rich learning opportunities, even in this purposively sampled data set. This taxonomy provides a coding scheme for other researchers, as well as a map for workgroup facilitators aiming to deepen collaborative conversations.

Keywords

discourse analysis, inservice education, teacher learning, professional learning communities, conceptual change

Teacher collaboration is at the center of many school-improvement efforts. Because of the frequently observed concurrence of higher than expected student outcomes and strong teacher communities (McLaughlin & Talbert, 2001; Langer, 2000; Lee & Smith, 1996), designs to improve instruction often include provisions for teachers to work together. In addition, research on professional development points to evidence that site-based teacher teams bolster teachers' engagement with new instructional practices (Garet, Porter, Desimone, Birman, & Yoon, 2001; S. M. Wilson & Berne, 1999). With both teacher communities and professional development, the underlying assumption is that teacher collaboration enhances teachers' professional learning.

At the same time, we know that not all collaboration is equally effective at meeting this goal (Hargreaves, 1994), so understanding the underlying learning processes in teacher workgroups stands to strengthen these efforts. In literature that identifies the potential benefits of teacher collaboration, the details of learning often remain opaque. For this reason, we seek to uncover how different kinds of collegial conversations shape teachers' professional learning opportunities. Building off of earlier studies of teachers' learning in collegial conversations, we developed a taxonomy to describe how conversational processes differentially support teachers' professional learning opportunities; we then used the taxonomy to code a corpus of more than 100 hr of teacher workgroup meetings. This taxonomy accounts for key facets of learning opportunities—namely, how much teachers define, represent, explore, and work on instructional issues and engage in conversations that guide their future work—and can support others seeking to use teacher collaboration as a part of instructional improvement initiatives.

The Optimistic Premise of Teacher Community

In what Little (2003) called the "optimistic premise" of teacher community, teacher collaboration is widely presumed to contribute to instructional improvement and professional learning (DuFour & Fullan, 2012; Hord, 2004; Lieberman & Miller, 2008). To that end, teacher collaboration is a cornerstone of many instructional improvement projects; for example, the National Staff Development Council (n.d.), the largest nonprofit professional association

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for staff developers in the United States, included "learning communities" as one of their 12 professional standards for quality staff development. Numerous school systems—including those in New York City and Alberta, Canada—have mandated professional learning communities for teachers. Indeed, a recent report found that nearly all U.S. teachers reported collaboration as a regular part of their work: Teachers spend an average 2.7 hr a week working with colleagues (MetLife Foundation, 2009).

The optimism around teacher collaboration has its roots in research, which has repeatedly found correlations between schools with strong teacher communities and higher than expected student achievement (Goddard, Goddard, & Tschannen-Moran, 2007; Louis & Marks, 1998; McLaughlin & Talbert, 2001; Ronfeldt, Farmer, McQueen, & Grissom, 2015). Analysts trace this relationship to many possible sources. Strong professional communities foster trust and support teachers' risk taking as they develop new instructional practices (Bryk & Schneider, 2002; Bryk, Sebring, Allensworth, Luppescu, & Easton, 2010), provide forums for teachers to share expertise and resources (Lampert, Boerst, & Graziani, 2011; McLaughlin & Talbert, 2001), enhance professional development (Garet et al., 2001; S. M. Wilson & Berne, 1999), and support teachers' sensemaking around policy mandates (Coburn, 2001; Horn, Kane, & Wilson, 2015). Despite the consensus around positive outcomes from teacher collaboration, a critical gap remains in the literature. In a review of research on professional learning communities, Vescio, Ross, and Adams (2008) found positive effects on student achievement when teacher collaboration was accompanied by "structured work that was highly focused on student learning" (p. 15). Although this is promising, the tools available to guide workgroups in this way often fall short of their purpose. For instance, protocols aiming to focus teachers on student learning do not necessarily lead to meaningful teacher learning, particularly absent strong facilitation (Andrews-Larson, Wilson, & Larbi-Cherif, in press; Little & Curry, 2009; Kane, under review). In other words, the tools typically available to teachers and schools to support positive collaboration often fall short. We need to move beyond an analysis of tools toward an examination of the interactions that animate meetings, with or without these tools. In other words, we need to understand how various types of discussions differentially support teachers' professional learning.

Conceptual Framework: Teachers' Professional Learning Opportunities

To build our framework, we draw on prior work that attends to teachers' learning opportunities in workgroup conversations. From a sociocultural perspective, learning involves changes in participation in a community of practice (Lave & Wenger, 1991), highlighting the social resources for—and social consequences of—people's learning. In this light, we investigate teachers' learning in workgroup meetings by analyzing *learning opportunities* that arise in these interactions, with a particular focus on opportunities that stand to transform instructional practice. We see learning opportunities at two levels in these interactions. Educators can change their participation in the immediate setting of the workgroup, as they shift their pedagogical reasoning through their conversation. Also, they can change their future participation as classroom teachers, as they reimagine possibilities for practice.

Keeping these two fields for changing participation in mind, we identify how activities and environments stand to support new forms of practice and understanding (Greeno & Gresalfi, 2008). Our emphasis on *opportunities* foregrounds the group processes over the particular impact on individuals. In our data, we operationalize learning opportunities by looking for how meetings (a) provide teachers with conceptual resources to interpret teaching issues and (b) mobilize them for future work (Horn & Kane, 2015; Horn, Kane, & Wilson, 2015). In other words, through an analysis of conversational content and processes, we identify what teaching concepts are communicated and their implications for teachers' future action.

Developing Conceptual Resources

To begin our analysis of learning opportunities, we examine concepts developed in teacher workgroup meetings. In the popular imagination, teachers are thought of as *doers* more than as *thinkers*, with greater emphasis in policy, organization, and professional education on the *doing* of active instruction than on the *thinking* that underlies the planning or debriefing of lessons. For this reason, teachers' learning is typically framed around activities and actions rather than concept development; nonetheless, we find concept development to be a generative lens for thinking about teachers' workgroup learning. Drawing on Vygotsky's (1934/1986) notion of concept development, we view teachers' understanding as arising through an interplay between formal (or *scientific*) concepts and lived (or *spontaneous*) concepts (Kane, 2015; Smagorinsky, Cook, & Johnson, 2003). Formal concepts are generalizable *abstractions about* the world. Lived concepts, however, arise from *experiences in* the world. For teachers to develop robust pedagogical concepts, the two must work in concert: Without generalizable abstractions (formal concepts), teachers are limited in making meaning from experience. However, the reverse is also true: Without experiences in the world (lived concepts), generalizations about teaching become hollow and meaningless, lacking any experiential anchors. Thus, pedagogical concepts develop when teachers link generalizable abstractions about students, teaching, or content to specific details of their work.

We operationalize these ideas about pedagogical concept development in our data by noting the extent to which formal and lived concepts come together in workgroup meetings. For concepts to come together, two things need to happen

interactionally. First, both formal and lived concepts need to surface. Second, these concepts need to be brought into dialogue. When meetings primarily center on participants' broadcasting of classroom events in the form of *replays* (Horn, 2005, 2010) or demonstrating instructional techniques in the form of *rehearsals* (Horn, 2005, 2010), teachers emphasize lived concepts. Obversely, when meetings primarily center on abstract theories—or even maxims such as "Don't smile before Christmas"—they emphasize formal concepts, principles that are divorced from the lived details of teaching. In both cases, if other participants' contributions bring the general and the particular together—by surfacing the formal dimensions of lived concepts or illustrating lived examples of formal concepts—teachers' meetings can provide richer learning opportunities.

Mobilizing for Future Work

In addition to looking at how pedagogical concepts develop, we further specify learning opportunities by examining how workgroup meetings mobilize participants for future work. This is the second field for teachers' changing participation as they discuss and (re)imagine their subsequent action. In fact, teacher workgroup meetings more consistently center on this dimension of learning opportunities than they do on pedagogical concept development. Teachers' limited non-instructional time compels workgroups to prioritize planning future lessons during meetings, making this a dominant topic. Even during this common task, however, teachers' interactions convey concepts about teaching to varying degrees. Accounting for the two dimensions of learning opportunities, we see the richest learning opportunities happen in conversations where teachers develop pedagogical concepts and link these to their future work (Hall & Horn, 2012).

Research Design and Methods

Research Context

Our analysis of teachers' learning opportunities in workgroup meetings took place in the context of a larger project investigating instructional improvement in middle-school mathematics in urban school districts. Starting in 2007, the Middle-School Mathematics and the Institutional Setting of Teaching (MIST) project investigated large-scale support of mathematics teachers' development of ambitious and equitable instruction. *Ambitious instruction* refers to teaching that supports students' understanding of important mathematical ideas, as reflected in documents rooted in research (e.g., Hiebert & Grouws, 2007; Lampert, 2001; Stein, Remillard, & Smith, 2007) and directed at practice (e.g., the National Council of Teachers of Mathematics' [NCTM] *Principles and Standards for School Mathematics* [2000]). *Equitable* underscores the need for instructional adaptations to ensure that all students have access to these non-standard forms of instruction (Jackson & Cobb, 2010; J. Wilson, Nazemi, & Jackson, in preparation). Given that ambitious and equitable mathematics teaching is not typical in U.S. schools, this set a high bar for teachers' instructional change in the MIST project.

Originally, the research team identified four urban school districts investing in viable strategies to meet this goal. Starting in 2011, we narrowed our focus from four to two school districts, partnering with Districts B and D[1] because of their investments in high-quality mathematics curriculum and intensive teacher professional development. We followed each district's instructional improvement strategies from the district office to schools and classrooms. To document this work and to understand change over time, we collected a variety of qualitative and quantitative data, including measures of instructional expertise. Both Districts B and D included teacher collaboration as a part of their instructional improvement strategies, giving us fruitful sites to investigate the role of these interactions in teachers' professional learning.

Selecting Focal Teacher Workgroups

Following the best-case logic of the larger study, we sought out well-functioning workgroups, using an internal sampling technique (Bogdan & Biklen, 1992). That is, we asked key informants in the districts to nominate teacher teams who collaborated well. We interviewed participants to further refine our selection, because local ideas of successful collaboration may not align with our own. For example, teachers might be known to "work well together" because they provide each other with emotional support without delving into the details of teaching in ways that would open up professional learning opportunities as outlined in our conceptual framework. We originally intended to develop eight longitudinal cases of teacher workgroups (four in each district) over the 4-year study. However, due to high turnover within schools and grade levels, teacher workgroups did not remain stable across academic years; we therefore engaged in case selection anew each year. We ended up tracing 24 teacher workgroups at 16 different schools,[2] a theoretically purposive sample, with well-functioning groups overrepresented, that provided a window on how collaboration might contribute to teachers' learning and instructional improvement (Yin, 2009).

Capturing Workgroup Interactions in Context

Data collection aimed to support analyses of how teacher workgroup meetings provided learning opportunities that contribute to instructional improvement. Our data collection had two goals: (a) to examine the interactional processes that

shaped meaning making in teachers' meetings, while (b) sufficiently capturing the broader school and district contexts that also shaped those meanings. To serve the first goal, we sampled three to four meetings from each focal workgroup every academic year from 2011-2015, for a total of 111 meetings. The meetings typically lasted between 45 and 60 min. For each meeting, videographers recorded notes about the context and participants in the particular meeting. In site visits and interviews, members of the research team sought to understand the workgroups' typical meeting activities and conversational foci to aid in any generalizations about interactions in the recorded meetings. To serve the second goal, we drew heavily on data from the larger project to understand participants' roles, expertise, instructional practice, and workplace experiences. These include annual structured interviews with teachers, school leaders, and district personnel; video recordings of teachers' instruction, coded for accomplishment in ambitious mathematics instruction (Boston & Wolf, 2006); measures of mathematical knowledge for teaching (Hill, Ball, & Schilling, 2008); annual surveys of teachers, school leaders, and other school staff; and annual profiles of each focal school's approach to instructional improvement in mathematics based on aggregated data and site visits.

Data Analysis: Categorizing Workgroup Learning Opportunities

Phase 1: Inductive Analysis of Prior Work

The goal of our taxonomy was to provide a "reliable gloss" about the nature of teachers' learning opportunities across our corpus of teacher meetings. Because interactional details are crucial to teachers' meaning making, we developed our initial categories from previously analyzed meetings.

Several prior studies on teachers' conversational learning informed this analysis (Hall & Horn, 2012; Horn, 2005, 2007, 2010; Horn & Kane, 2015; Horn & Little, 2010; Kane, under review). All of these projects centered on case studies of secondary teacher workgroups in the United States, mainly in urban public schools. Although the particulars of the research designs varied, the studies shared a common methodology. Using tools from sociolinguistics (Hymes, 1974) and discourse analysis (Goffman, 1974), these studies examined video and audio records of teachers' talk to understand how meanings—the grist of pedagogical concepts—get constructed through interaction.

To build a provisional taxonomy of learning opportunities in teacher meetings, we used open coding (Charmaz, 2006) to characterize the conversational processes in these earlier studies to arrive at provisional categories for analyzing our corpus. As a part of this process, we developed a set of interpretive questions to imagine what an engaged newcomer might be able to learn about mathematics teaching from participation in the meetings. Our interpretive questions were as follows:

1. Emically, what seemed to be the *thrust* of the meeting?
   a. What *activities* were suggested?
   b. What actually happened?
   c. What *problem framings* (Goffman, 1974) did participants use, and how are they taken up?
   d. What was treated as a *valued contribution*?
2. What was the facilitator pressing for?
   a. How was the facilitator's press taken up by teachers?
3. If there is dialogical talk, what is it focused on (e.g., instruction, mathematical thinking, student experience)?

Using these questions as a guide, we identified six kinds of meetings that characterized teachers' differential learning opportunities. We invoked the "engaged newcomer" heuristic frequently as we refined our codes and sharpened our decision rules (see in Table 1 in the "Findings" section of this article).

Phase 2: Excluding Data-Use Meetings

As we began applying the taxonomy categories from Phase 1 to our data corpus, it became apparent that meetings in which teachers discussed standardized test data had a distinctive character and provided qualitatively different learning opportunities. Although we have examined these meetings elsewhere (Garner & Horn, 2016; Horn et al., 2015), we excluded them from this analysis. Because data use was a regular activity in both districts, this left us with 77 of 111 meetings (69.4%).

Phase 3: Refining the Categories

In this phase of focused coding (Charmaz, 2006), we sought to capture the remaining data incisively and completely, still open to the possibility that the meetings in the corpus might include conversational processes that did not emerge in the inductive coding of prior analyses. Because we were coding at the meeting level (and not, for example, at the episode level), our coding represented the dominant form of talk in the meeting, with the decision to code at the higher category if talk was evenly split between two categories. As we double-coded a cross-section of the 77 meetings, our research team negotiated these decision rules, discussing ambiguous cases and modifying the categories (Corbin & Strauss, 2014). After a few rounds of double coding and consensus building about decision rules, our interrater agreement exceeded 85%. Then, meetings were single-coded, with any puzzling examples brought back to the group to reach consensus and refine our decision rules (Corbin & Strauss, 2014).

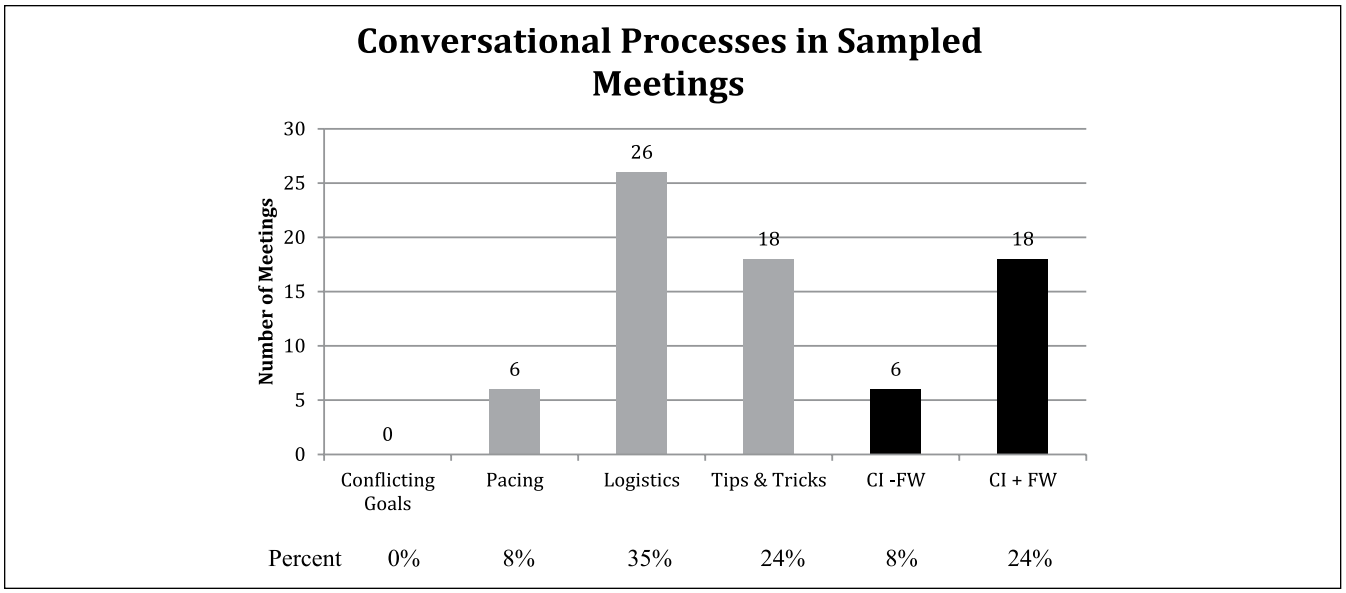

Figure 1. Distribution of meetings by conversational type.
Note. CI − FW refers to the category-collective interpretation separate from future work and CI + FW refers to the category-collective interpretation linked to future work.

Table 1. A Taxonomy of Learning Opportunities in Teachers' Meetings.

Category	Concepts developed	Mobilization for future work	Nature of discourse
Conflicting goals	No teaching concepts explicitly developed	No consensus about future instruction	Monological
Pacing	No teaching concepts explicitly developed	Pace of future instruction coordinated	
Logistics	No teaching concepts explicitly developed	Pace and topics of future instruction coordinated	
Tips and tricks	No teaching concepts explicitly developed	Instructional talk or activities for future instruction coordinated	
Collective interpretation, separate from future work	Analysis of instruction supports concept development	Analysis of instruction *not* linked to future work	Dialogical
Collective interpretation, linked to future work	Analysis of instruction supports concept development	Analysis of instruction linked to future work	

Note. Each category describes a meeting's prevailing conversational processes. The list is organized from the most limited learning opportunities to the richest, with the thick line separating the meetings that do not explicitly develop teaching concepts from those that do. Examples of each category are presented in subsequent sections.

Findings

A Taxonomy of Learning Opportunities in Teachers' Meetings

The following categories of conversational processes accounted for every meeting, except the data-use meetings: conflicting goals, pacing, logistics, tips and tricks, collective interpretation separate from future work, and collective interpretation linked to future work (see Figure 1). We present the categories in ascending order of professional learning opportunities. That is, we classified workgroup meetings based on (a) the extent to which pedagogical concepts developed and (b) how they mobilized teachers for future work. Note that these categories are agnostic about the underlying instructional vision; the pedagogical concepts developed may or may not support the districts' goals of ambitious instruction. Indeed, more often than not, they reflected traditional forms of instruction, providing empirical grounds to temper widespread optimism around teacher community as a simple solution to instructional change projects.

As we looked at the meetings coded in each category, we saw that the different conversational types supported different kinds of inquiry into teaching. In particular, the most common type of workgroup meetings were *pacing* and *logistics* (40%), meetings that focused primarily on *when* topics would be taught. Logistics meetings also took into

consideration *what* was to be taught and related that to pacing decisions. Overall, the question of *when* remained crucial in most workgroup meetings across categories, which makes sense given the intense pace of the work of teaching. As a counterpoint, we found that deeper considerations of *why* instructional decisions were made—the *collective interpretation*, *separate* and *collective interpretation*, *linked* categories—remained somewhat less common (35%), even in this purposive sample of successful workgroups. Fewer than half of the workgroups (10 of 24) had at least one sampled meeting that involved *collective interpretation*, with only one workgroup having all of their sampled meetings in the collective interpretation categories. This is not surprising, as teachers' typical discourse, reflecting widespread professional norms of privacy and autonomy (Little, 1990), seldom goes into the *why* of pedagogical concepts. The collective interpretation meetings thus signaled unusual professional norms, which supported different learning opportunities. *Collective interpretation separate from future work* meetings involved some analysis of teaching, where the analysis remained disconnected from subsequent plans. *Collective interpretation*, *linked to future work*, in contrast, explicitly connected the jointly developed concepts of collective interpretation of teaching to future instruction. In a sample that overrepresented well-functioning collaborative groups, the relative paucity of meetings involving *why* instructional decisions get made is itself a finding of this study. Related to our sample, we also note that in our coded meetings, there were no instances of *conflicting goals*. However, such meetings arise in other studies of teacher workgroups (e.g., Horn & Little, 2010), so it is necessary as a theoretical category.

Conversational Type and Teachers' Learning Opportunities

In this section, we illustrate five of the six categories with data excerpts to illustrate how they provided differential learning opportunities for participants. In our illustrations, we articulate the underlying coding logic, explicating the extent to which concepts for teaching are explicitly developed as well as how teachers mobilize for future work. We also invoke our engaged novice heuristic to help readers understand its application to the data excerpts.

Although there are six categories in the taxonomy, we first present four categories marked by monological exchanges that we have come to describe as *low depth meetings*, signaling the limited opportunities for teachers' professional learning. Then, we present the two categories marked by dialogical exchanges that we call *high-depth meetings* to indicate the greater opportunities for professional learning.

Low depth meetings

Pacing and logistics. We group together the first two categories, *pacing* and *logistics*, because these meetings have in common that teachers focus on organization without getting into details of instructional content or activities. In pacing and logistics meetings, teachers typically establish where they are in the curriculum and which lessons they will "do" next. Often framing conversations in a short time horizon (e.g., "last week," "tomorrow"), they frequently refer to lessons by textbook number, avoiding details such as teaching approach, important ideas, or key indicators of student understanding.

We distinguished pacing from logistics, however, because the former meetings were strikingly devoid of content—so much so, that an engaged newcomer would have no access to the topics discussed, thus dampening the opportunities for professional learning. (Note that we have marked transcript line numbers with P and L to signal the meeting code as *pacing* and *logistics*, respectively.) We illustrate a pacing meeting with an exchange among three seventh-grade teachers (Charmaine, Gary, and Devon) at Riverview Middle School from December 12, 2012, where they coordinated the pace of their instruction without mentioning content:

P1 Charmaine: So where are we now?

P2 Gary: Okay. We're going to do 2.2 and 2.3 tomorrow, still—

P3 Charmaine: Okay.

P4 Gary: So we can assess on Friday.

P5 Charmaine: Will we all be ready to start Module 3—

P6 Gary: I want to start 3—

P7 Charmaine: I mean Module 4. It's 4, isn't it?

P8 Gary: Yeah, but it's, uh, it's Investigation 3.1

P9 Charmaine: Yes, that's it right here, Module 4.

Concepts developed. Invoking the engaged newcomer heuristic, we see an outsider would not know what content is being discussed here. This excerpt reflects the prevalent discourse of the meeting, where the teachers only signaled their pace through chapter and module numbers ("2.2" and "Module 3"); there was very little conversation about the actual mathematics being taught. Although future work is coordinated, there is little opportunity for participants to develop concepts about teaching. If any of the participants have questions about how to best teach Section 2.1, it does not come out in this meeting. In this way, no explicit pedagogical concepts are developed.

Mobilization for future work. In this conversation, the teachers coordinate the pace of future instruction. In Turn

P2, Gary announced that they will "do 2.2 and 2.3 tomorrow," followed soon after by a determination to "assess on Friday." As is common in both pacing and logistics meetings, the details of the activities remain undiscussed.

Logistics meetings expand teachers' learning opportunities slightly over mere pacing meetings, because content is coordinated by name. When naming actual topics for instruction, teachers continue to omit the details of their instructional plans, although they do occasionally discuss rationale for their choices. In our sample, for instance, we have explanations of why to teach one topic before another or reasons to spend different amounts of time on different lessons. In the following excerpt from the seventh-grade workgroup at Creekside Middle School on March 20, 2012, Nadine, the department chair, sat at the front of the room and projected different documents to organize a logistics meeting with six other teachers. The school's math coach, Tiffany, and the principal, Mr. Russell, joined them.

L1 Nadine: Okay. We are starting, square roots was at the beginning of this 6 weeks. I don't know how many of you are actually there. We're going to get there at the end of this week since I was absent before Spring Break we're finishing up with surface area and volume. So, do we wanna do like Monday just a little lesson on squares and square roots since we're kinda getting to that point or do we wanna continue with more surface area practice?

L2 Tiffany: What is, do you have that Scope and Sequence the next 6 weeks? Tha-, or it's on the curriculum framework (*talking over one another*)

L3 Holly: The first seven days were supposed to be the volume and surface area (*talking over one another*)

L4 Tiffany: I just want to see kind of where we are.

L5 Amber: Well, I know that we probably won't get to square roots until after testing next week because we're, we're still on volume.

Concepts developed. This exchange reflects the dominant discourse of the 40-min meeting. The teachers coordinated different mathematical topics—surface area, volume, squares, and square roots—with their teaching and testing schedule. Again, no pedagogical concepts were explicitly developed. In Turn L1, Nadine posed a question about whether to do a "little lesson on squares and square roots." When Coach Tiffany replied by appealing to the curriculum framework (Turn L2), a lived concept emerged that *the curricular framework should guide pacing decisions*. Because concept development comes about through the interplay of lived and spontaneous concepts, the statement comes across as normative, without, for example, conversational openings to understand how to use a pacing guide. The pedagogical concepts in this discussion remained rooted in lived experiences of pacing and testing, without much interface with formal concepts—abstract principles that might guide their work.

Mobilization for future work. As with the pacing meeting, the teachers focused primarily on future work. By naming the topics, however, the meeting provided slightly richer learning opportunities. For instance, as this conversation unfolded and the teachers realized how far behind they were according to the pacing guide, Coach Tiffany later suggested that they "spiral in [...] surface area and volume and move on." This solution to the teaching problem of being off the pacing guide brought in a formal concept of "spiraling"—which here meant revisiting prior topics while moving forward in the curriculum—as a response to their experienced dilemma of being "off pace." With the exception of the brief discussion of probability, however, the specific instructional strategies for future work—how, exactly, would one spiral in surface area and volume?—were left unspoken in this meeting.

Tips and tricks. In *tips and tricks* meetings, teachers focus on monological exhibition of ways to do things. In our data, these often consisted of teachers sharing instructional explanations, mnemonics, or uses of representations, with little feedback or discussion on the contributions. In some of the tips and tricks meetings in our sample, meetings were dominated by one teacher or coach who offered instructional strategies to others in the workgroup, whereas other meetings involved a round-robin sharing out. In one workgroup with a long history of collaboration, we saw tips and tricks meetings centered on collective memory, signaled by phrases, "like that time when . . . " or the naming of particular lessons. Invoking our imagined engaged newcomer, tips and tricks meetings offer greater learning opportunities than pacing or logistics meetings because representations of practice (Little, 2003) and related details of instruction are made visible, providing access to richer lived concepts. The overall monological nature of the talk, however, means that the concepts remain underdeveloped.

For instance, in this December 14, 2012, meeting with the seventh-grade workgroup at Riverview, teachers Charmaine, Gary, and Devon were preparing for an upcoming investigation. The teachers practiced how to introduce the lesson, although there was very little commentary or feedback from the others.

T1 Charmaine: Ok, so we're on Investigation 3.

T2 Devon: Yes ma'am

T3 Charmaine: Comparing and scaling rates. [*8 s pause*]. You want to be the teacher?

T4 Devon: Alright. Um, so the way I always start off these investigations, um, I'll stand up in front of the class [*stands, moves to face Charmaine and Gary*]. And I will say, "Okay, your partner right now is your shoulder partner, the person right next to you. You and your partner are going to take turns reading sentences. So for instance, in this first section, I would say [*reading from curricular materials*] 'Stores, catalogues, and websites often use rates in their ads.' And then I'd turn to [Charmaine] who'd be my shoulder partner, and she'd read the next sentence, which would be—so then she would read, 'The ads sometimes give the cost for several items.' So you're going to take turns with your partner reading through this until you reach the bottom. When you reach the bottom, raise your hand up [*raises hand*] so I know that you're done." And so that would be how I would start the section off, that way everyone's reading, and I'd also have a signal as to when they're done. [*Sits*]

T5 Gary: Okay, and, um [*4 s pause*]. I'm just trying to think of an effective way to, uh—and I've used the same method for, like reading page 33, the introduction. But [*3 s pause*]. Okay. Now, when I've done my problems, I've done it like this: I've said something—in fact I'm going to stay here if you don't mind.

Gary then went on to practice his introduction. Commentary from the others remained at the level of clarification ("Do you use the Smart Board?") or affirmation ("Good idea").

Concept development. Tips and tricks meetings provide richer representations of teaching, as in Devon's demonstration of how he intended to start his students off in the investigation (Turn T4). In this way, teachers have access to lived concepts—in this case, the concept of *starting off investigations.* Devon's description made it easier for other teachers to learn from his practice. In addition, Devon provided a formal concept for his instructional decision, offering the rationale "that way everyone's reading, and I'd also have a signal as to when they're done." As Gary rehearsed his introduction, the Riverview teachers had another example of the lived concept *starting off* investigations. Although Devon and Gary offered primarily lived concepts with some formal concepts brought in, the monological nature of the meeting limited the other participants' opportunities to engage with these ideas and develop these pedagogical concepts.

Mobilization for future work. As with the pacing and logistics meetings, tips and tricks meetings focus primarily on future work. The teachers, in this instance, primarily use their workgroup time to rehearse instructional talk, perhaps getting a chance to refine their presentation and pick up some new ideas and practices from their colleagues. Teachers may have a better idea of how to introduce this particular lesson, but without formalizing concepts about the features of strong instruction, they are not positioned to apply such principles in other scenarios.

High-depth meetings. In 35% of our coded meetings, teachers' conversations focused on collective interpretation of teaching—the format that most supported pedagogical concept development, what we came to refer to as *high-depth meetings*. These meetings are marked by dialogic discourse, exchanges among multiple participants that put formal and lived concepts in contact with each other. Typically, these richer conversations occurred as teachers investigated problems of practice: interpreting student work, debriefing a disappointing lesson, or trouble shooting challenges with struggling students. In most cases, workgroups linked the concepts developed through their discussions to their future plans (*collective interpretation linked to future work*), but not always. The missed opportunity to link rich conversations to subsequent instruction happened in two of the seven collective interpretation meetings, when rich debriefings of professional development sessions were followed by pacing or logistics talk.

Despite our purposive sampling for best-case workgroups, we captured collective interpretation in fewer than half of the groups (10 of the 24 workgroups sampled, with two of those 10 workgroups only ever engaging in one collective interpretation meeting). By looking at distribution as well as frequency and given our purposive sampling for strong collaboration, this suggests that collective interpretation is relatively rare in teachers' workgroup meetings.

For reasons of space, we explain the difference between the two collective interpretation meeting categories through a single example from Magnolia Middle School's sixth-grade team on February 19, 2013. Magnolia stood out in our data because all three of its sampled meetings were coded *collective interpretation*. Two accomplished mathematics educators, Coach Lindsay and Assistant Principal Gerard Donovan, facilitated the meetings. The two leaders and four sixth-grade teachers attended the meeting excerpted below. Lindsay and Mr. Donovan asked two of the teachers, Shonda and Deanna, to bring in work samples from students whose mathematical understanding was on the edge of mastery. They discussed the work samples to determine whether they demonstrated students' understanding of unit rate, a topic they had been teaching. Through a collective interpretation meeting, we claim that the participants' talk developed the pedagogical concept, *students' work demonstrates their understandings.* In the following

conversation, the workgroup discussed Deanna's student, Tommy, and his work sample. We present the conversation in episodes to show how collective interpretation unfolds over time in support of concept development. Deanna began by describing how Tommy's work indicated his understanding of unit rate.

Collective interpretation separate from future work

Episode 1: Diagnosing issues.

C1 Deanna: I think, okay, he got the table, like filling in the table, finding the unit rate, doing that, but then, when he had to apply it and figure out how much money for 7 hours, it was supposed to be $35, and he put $3.50.

C2 Gerard: Okay. So now, let's go back and look at the standard.

C3 Deanna: Or $3.05.

C4 Gerard: Okay. So, when we look at the standard, what did the standard require us to do?

C5 Deanna: He cannot apply, well, he found the unit rate, but I just think he's having issues with the, well, if he did seven times five, he should've got 35. So, I don't know why he's getting three point, where he's getting the decimal from.

In Turn C1, Deanna looked at Tommy's work and tried to figure out why he got $3.50 instead of $35. Over a few exchanges with Gerard, by Turn C5, Deanna articulated several questions about the sample ("he found the unit, but I just think he's having issues with . . . " "I don't know . . . where he's getting the decimal from"). Gerard's question—and indeed the whole activity—centered on linking the formal concept of *students' work demonstrates their understanding* to lived concepts in the form of student work samples. The framing of the activity was thus geared toward interpretation and, in turn, pedagogical concept development.

Episode 2: Clarifying.

C6 Lindsay: So, what was, what was—

C7 Deanna: He may've

C8 Lindsay: —it supposed to be? 35 cents?

C9 Deanna: Seven times five, 35 dollars.

C10 Lindsay: 35 dollars.

Collective interpretation meetings require that workgroups establish and maintain a shared understanding of ideas under discussion. For this reason, clarifying interludes such as this are quite common. In this brief exchange, Lindsay, the instructional coach, checked in about the correct method for solving the problem. Without knowing how the problem should have been solved, the group could not make sense of Tommy's mathematical understanding. Lindsay's questions prompted Deanna to specify what the correct answer should be, a critical part of the lived concept upon which the overarching concept of *students' work demonstrates their understandings* could develop.

Episode 3: Offering another perspective.

C11 Shonda: But sometimes they get confused on the calculator. You know, and he may've inadvertently put the zero, because you know sometimes you can set the mode or whatever?

C12 Deanna: Yeah?

C13 Shonda: Maybe he inadvertently did that.

This episode is also typical in collective interpretation meetings, where it is common for different participants to offer different interpretations of the same lived concept: It is emblematic of the dialogic nature of these meetings. In this instance, as Deanna struggled to interpret Tommy's work and what it meant about his understanding of unit rate, Shonda offered another interpretation, presumably rooted in her lived experience. She suggested in Turns C11 and C13 that Tommy's work may not have reflected his understanding of the math as much as it reflected his calculator skills.

Episode 4: Refining what it means to understand.

C14 Deanna: I mean, I think for the most part, he has the concept, but

C15 Lindsay: Well, but it sounds like he has the concept of, or he has the procedure for how to find

C16 Deanna: The procedure.

C17 Lindsay: unit rate.

C18 Deanna: Yeah.

C19 Lindsay: I'm not sure

C20 Deanna: He knows what that

C21 Lindsay: Did it—

C22 Deanna: He can't

Revisions of prior claims and refinements of understanding are also emblematic of collective interpretation (Horn, 2010); these are the changes of participation that signal professional learning. In this episode, Lindsay's probing refined Deanna's understanding of what it meant to have a conceptual understanding of unit rate. We see that in Turn C14, Deanna declared, "for the most part, [Tommy] has the concept," offering her interpretation on this case of *students' work demonstrates their understandings*. Lindsay followed up (Turn C15) by distinguishing between having the *mathematical concept* and having the *procedure*, which led Deanna to revise her original assessment. Here, Deanna stated that Tommy more likely had "the procedure," presumably meaning that he knew the steps for doing the problems but did not understand why he was doing them. Lindsay's contribution—a formal concept of *procedure versus mathematical concept*—refined Deanna's interpretation of Tommy's work and her understanding of what it means that *students' work demonstrates their understandings*. In turns C17 to C22, which unfolded rapidly, Deanna and Lindsay arrived together at uncertainty around whether Tommy understood the key idea of unit rate. Indeed, these conceptual refinements make collective interpretation meetings the richest in professional learning opportunities.

In the subsequent discussion, Deanna wrapped up by saying, "I'm gonna say now. It says how much money he will earn in 7 hours and he put $3. And if he looks at the table, he should be able to figure out that's not right." In this concluding statement, Deanna linked the formal concept (students' mathematical understanding) with the lived concept (Tommy's incorrect work). Through the dialogue with Lindsay, Gerard, and Shonda, she had opportunities to better develop her pedagogical concept of *students' work demonstrates their understandings*, as her co-participants alerted her to potential sources of error (e.g., calculator entry) and pressed her to distinguish between procedural and conceptual understanding. In the end, Deanna identified evidence in Tommy's work that signaled the fragility of his mathematical understanding ("If he looked at the table, he should be able to figure out that's not right").

In a small number of the collective interpretation meetings in our corpus (seven out of 27), the rich discussions ended at this point. That is, workgroup participants co-developed pedagogical concepts, such as *students' work demonstrates their understandings*, but did not link these concepts to future work, proceeding with their planning in the same vein as the *pacing, logistics*, or *tips and tricks* meetings, with no clear referents to the previous collective interpretation discussion. We coded these meetings as *collective interpretation separate from future work*.

However, in the remaining 20 of the 27 collective interpretation meetings, the co-developed concepts became a basis for subsequent action. In the next section, we illustrate *collective interpretation linked to future work* by fast forwarding to the end of the same workgroup meeting. We show how the Magnolia teachers leveraged their interpretation of Tommy's (and other students') understanding to plan their next instructional steps.

Collective interpretation linked to future work. In the interlude between discussing Tommy's work and planning how to address students' misunderstandings in subsequent instruction, the teachers identified several other sources of confusion. In addition to discussing students' understanding of the content, they noted that students may have guessed, made errors in extending the pattern in the table, or understood unit rate as additive (rather than multiplicative). All of these specific examples of student *mis*understandings came out of the collective interpretation of how *students' work demonstrates their understandings.*

Episode 5: Figuring out how to teach and address the misunderstandings.

C23 Lindsay: Okay. So, what, then, the question is, what're we gonna ask them to get them back on track

C24 Shonda: I had, so, when we went over it, I said, "What you should've done was made your own table. When you showed your work, you should've made your own table and did your one, two, three, four, five, six, seven," and then, once they did that, when we went over this, they understood that, "Okay, it's going up by," I forget however many it was. Was it 10 or five?

C25 Deanna: They're times-ing, yeah.

C26 Lindsay: The, the

C27 Shonda: And their, their interpretation, "Well, it went up by however so many. And the three was out of order."

C28 Lindsay: Right.

C29 Shonda: So then, once they saw that they make their own table, then, they were able to correct the graph

In Turn C23, Lindsay initiated the workgroup's conversation around future work by asking what the teachers could do to address students' misunderstandings ("what're we gonna ask them to get back on track"). Shonda responded

with a replay of her own instruction (Horn, 2005, 2010), providing classroom talk directing students to construct a table to help them understand the pattern in the linear growth problems. After completing the replay in Turn C27, Shonda concluded with a description of how this activity addressed their shared concern about students seeing the underlying pattern and noticing how to correct their graphs (Turn C29). This replay provided a lived concept of *students' work demonstrates their understandings*, with an emphasis on how Shonda directed students to construct tables to highlight a particular pattern critical to supporting their understanding.

Note the difference between this replay and the replays and rehearsals (Horn, 2005, 2010) characteristic of *tips and tricks* meetings, as when Devon shared how he started his class on investigations (Turn T4: "I'll stand up in front of the class . . . and I will say, 'Okay, your partner right now is your shoulder partner, the person right next to you'"). In contrast to *tips and tricks* replays or rehearsals, which are typically monological, Shonda's replay was embedded in a dialogic conversation about students' work demonstrating their understanding: In this way, the broader conversational context became the grounds linking the lived concept the replay represented with the formal concept under examination, thereby providing a richer learning opportunity for workgroup participants. Because they had already established a shared understanding of the kinds of difficulties students had with the unit rate problems and how these manifest in their work samples, the replay provided a lived concept linked to a well-honed collectively interpreted pedagogical concept. The group then further defined their future work, adding more depth to the learning opportunities of the meeting.

Episode 6: Refining the strategy.

C30 Lindsay: And I, I think that that's a nice strategy for them to see the multiplicative relationship, but I don't know if that really helps them interpret the context. Because I think that, I think that what that still, I think that what that's still focusing on is that you have to have the numbers in order to figure out what's happening, and really what we want them to focus on the unit, the unit rate, and the relationship between 10 and 2.

C31 Deanna: Right.

C32 Lindsay: So, I think the next step would be to draw their attention to, "What is the relationship between money and time?" And if I know money, but I don't know time, then how can I use that relationship to figure out one or the other? Because in real life, you're not gonna have an ordinal table.

Lindsay responded by validating Shonda's suggestion to have students build a table to catch their own confusions in the graph, labeling it with the formal concept as a "nice strategy for them to see the multiplicative relationship" (Turn C30). In the same sentence, she also raised the concern that it might not help students interpret the context, a key concern across the Magnolia teachers' previous conversations. Lindsay further elaborated her reason for emphasizing students' learning to interpret the context: "we want them to focus on the unit . . . rate and the relationship between 10 and 2." She supported this formal concept with a lived concept in the form of a replay, suggesting that the teachers draw students' attention to the relationship between time and money (Turn C32). By stating a sequence of questions directly importable to the classroom, Lindsay's contribution specified the actions the teachers could take to help students interpret the context, a critical part for their developing mathematical understandings. In this way, Lindsay explicitly linked the workgroups' pedagogical concept to teachers' future work. Once again, these rehearsals differ markedly than those used in *tips and tricks* meetings, because these images of classroom dialogue are rooted in deeper conceptual ground.

Discussion and Conclusion

In this study, we presented a taxonomy for classifying teacher workgroup meetings according to the professional learning opportunities made available through the dominant forms of talk. These categories effectively and comprehensively coded a large corpus of middle school mathematics teacher workgroup meetings, modulo the data-use meetings. Comprehensively coding a set of workgroup meetings sheds new light on learning opportunities in teacher communities. First, we found that, despite our purposive best-case selection, meetings with the richest learning opportunities—the collective interpretation meetings—remained relatively rare. We suspect this is because professional norms of privacy and autonomy—coupled with the urgent need to specify future lessons—press teachers to focus on planning, as in logistics and pacing meetings (40% of the coded meetings).

Given our partner districts' goals for instructional improvement, the dearth of collective interpretation in our sampled meetings is an important finding. The districts invested in teacher workgroups to help teachers develop ambitious mathematics instruction. This change in instructional practice requires that teachers *rethink* their teaching, rather than merely extend their existing practices. Collective interpretation meetings support this kind of rethinking more than the other meeting types. Furthermore, collective interpretation is required for a close consideration of students and their thinking, which is a cornerstone of ambitious and equitable instruction.

Yet, we reiterate that our coding scheme remains agnostic about the underlying visions of teaching in these conversations. Although 35% of the meetings in our sample entailed the

collective interpretation that supports concept development, they may or may not reflect the values of ambitious and equitable instruction. While the meeting we drew on to illustrate the high-depth categories generally took an asset view of student learning, this taxonomy does not preclude concept development around deficit views of students. We do not have any such meetings in our sample, but we certainly have examples of collective interpretation meetings that support ideas not aligned with ambitious and equitable mathematics instruction, such as a meeting where the teachers develop ideas about proceduralizing an otherwise rich mathematical task.

The relative paucity and general concentration of collective interpretation meetings also may be due to limited instructional expertise in many of the workgroups. Previous research has shown that professional learning opportunities in workgroups reflect an *accumulated advantage phenomenon* (Horn & Kane, 2015), with more accomplished teachers finding more to discuss and consider about problems of practice, thus inviting a sustained focus on collective interpretation. In general, findings from the MIST project point to the importance of instructional expertise as a resource for teacher learning activities (e.g., Gibbons & Cobb, in press; Sun, Wilhelm, Larson, & Frank, 2014; Wilhelm, Chen, Smith, & Frank, 2016), so it stands to reason that teacher workgroups would be similarly influenced. We anticipate that the presence of expertise would center the high-depth conversations around concepts reflective of ambitious instruction, as was the case at Magnolia Middle School.

The taxonomy can serve both theoretical and practical purposes. As an analytic tool, researchers can use it to understand the nature of teachers' collaborative meetings and their potential to contribute to conceptual change. As a practical tool, educators and instructional coaches can monitor their own facilitation to press for collective interpretation in workgroups designed to support teachers' instructional improvement.

There are three primary limitations of this analysis. First, as a reliable gloss of the learning opportunities in the teacher workgroup meetings, many of the conversational details are not accounted for in this coding scheme—including details that would suggest whether what teachers were learning would be viewed as desirable by teacher educators or school leaders. In this way, our take on learning remains agnostic about *what* is being learned. Future work can bring the qualities of what is being learned into sharper focus.

Second, workgroup meetings centering on teachers' use of standardized test data did not fit within this coding scheme. Many of those data-use meetings did not involve discussions on instruction or student thinking, instead focusing on interpreting score reports and planning instructional interventions. Given their growing presence in teachers' workplaces, we plan to grapple with these omitted data-use meetings next.

Finally, this taxonomy was inductively developed through a long-term program of research looking at secondary mathematics teachers' workgroup conversations. It seems likely that other workgroup configurations—different content strands, grade levels, or foci such as equity and inclusion—might lead to different taxonomy categories. Future work should extend these ideas to account for teachers' work more broadly to help the field develop robust understandings of the possibilities and limitations of teachers' workgroup learning.

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Notes

1. All names are pseudonyms.
2. We selected three to four workgroups per district per year. Because of high turnover among teachers and instructional leaders, very few of these workgroups stayed intact for longitudinal study, leading us to select new groups every year.

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