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Understanding Data Use Practice among Teachers: The Contribution of Micro-Process Studies

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Despite the growing volume of research on data use systems or data use activities in which teachers engage, micro-process studies—investigations of what teachers and others actually do under the broad banner of "data use" or "evidence-based decision making"—remain substantially underdeveloped. Starting with a review of the extant research on teachers' data use practice in workplace and professional development contexts, this article argues for a more conceptually robust, methodologically sophisticated, and extensive program of micro-process research on data use that also anticipates the ways in which local practice both instantiates and constructs institutional and organizational structures, processes, and logics.

Widespread appeals to "data-based decision making" and "performance metrics" now echo across multiple human service fields, among them public health, medicine, social work, and education. In education, such appeals have propelled the invention of new data systems, organizational routines, and professional roles and have been the impetus for a growing wave of practitioner-oriented guides, conferences, and professional development offerings. Efforts to organize collective discussion of student learning data and to consider other metrics of school improvement grew rapidly during the advent of whole-school reform or restructuring initiatives in the 1990s and intensified with the rise of test-based accountability during the past decade. In the earlier period, which coincided with interest in performance-based assessment, evidence of student learning took many forms, including student portfolios and exhibitions. In recent years, teachers have been invited or required to engage with one another, with administrators, and with a variety of others (instructional coaches, consultants, parents) to review and interpret data derived from standardized

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tests, interim or benchmark assessments, and administrative records charting attendance, graduation, dropout, and other metrics.

These appeals to data-based decision making have also spawned a body of writing that characterizes data use systems and provides summary descriptions of the kinds of activities in which teachers engage or the tools they are expected to use (e.g., the volumes edited by Mandinach and Honey [2008] and Moss [2007]). Yet little of this writing affords a window into the actual practices teachers employ as they collectively examine and interpret student data or the ways in which the contexts of data use come to occupy a central or peripheral part of teachers' ongoing work life. Although numerous studies purport to be about data use practice, they rely almost exclusively on survey data and interview accounts to characterize those practices (e.g., Anderegg 2007). Investigations of what teachers and others actually do under the broad banners of data use, evidence-based decision making, or evidence-based practice remain relatively underdeveloped.[1]

This article posits that studies of data use practice—what I term micro-process studies—stand to make a much-needed contribution to a program of research on data use and school improvement. The article's central argument is that micro-process studies expose aspects of practice that otherwise remain opaque, and further, that these dynamics of practice are likely to prove salient in accounting for the evolving nature and consequences of "data use" in schools and districts. Following a brief depiction of the micro-process perspective, I assess the contributions of a small body of extant research, suggesting that this research supplies a useful foundation for an expanded program of research centered on practice. However, the available research also suffers from certain conceptual and methodological limitations. Conceptually, the research would benefit by more systematically exploiting theoretical frameworks that have guided studies of work processes in domains outside education; these include frames derived from organizational analysis, social network analysis, and interpretivist traditions in sociology (Barley 2008; Engestrom and Middleton 1998; Hallett and Ventresca 2006; Spillane 2012, in this issue). Methodologically, the research on data use practice in schools and districts suffers from an overreliance on ex situ accounts of practice (largely derived from interviews) and a relative paucity of high-quality observational analyses of the sort that have long characterized classroom-based research (e.g., Jurow 2004; Mehan 1979) and workplace studies in other fields (Engestrom and Middleton 1998; Hutchins 1995). This article thus argues for a more conceptually robust, meth-

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odologically sophisticated, and extensive program of micro-process research on data use that also accounts for the ways in which local practice both instantiates and constructs more macro-level organizational and institutional structures, processes, and logics.[2]

A Micro-Process Perspective and the Study of Workplace Practice

In their essay titled "Bringing Work Back In," Barley and Kunda (2001) criticize "contemporary organization theory's tendency to distance itself from a detailed understanding of work and how it may be changing" (79). The disciplinary divide between organizational theory and the sociology of work is consequential, they argue, because we are in a period in which work has transformed, with a shift from manufacturing to a service-dominated economy, from stable jobs to contingent employment, and from predigital to digital technologies. A central insight of this work is that the micro-level study of work processes and relationships is a crucial means for grasping macro-level developments and for shaping the ways in which we theorize about work and its transformations. It is not certain how much or in what precise respects the work of teaching is changing in the ways identified by Barley and Kunda, but one of those ways is most certainly the expectation that teachers engage publicly, collectively, and "accountably" with evidence of student achievement and attainment. It is in this shifting policy context that micro-process studies might supply a more complete understanding of what it means to work as a teacher in today's schools.

For purposes of this article, I emphasize certain conceptual and methodological entailments of the micro-process perspective. Conceptually, a micro-process attends systematically to the ways in which interaction is meaningfully situated, shaped by and constitutive of organizational structures, norms, and resources (the context of particular schools or districts, for example) as well as broader institutional and societal structures, processes, and logics (common arrangements for and ideas about education). In their essay "Micro-Process Foundations of Institutionalism," Powell and Colyvas (2008) characterize social interaction in terms of complementary dynamics by which institutional logics are "pulled down" into micro-level practices and on-the-ground practices may "build up" over time into broader institutional patterns (see also Douglas [1986] on this point). In this view, "practice" is not solely apparent in or enacted through the moment-by-moment interactions among individuals but is also embodied in routines, in categories and classification systems, in scripts and roles, and in tools and artifacts that exist independent of particular actors and interactions. Cook and Brown (1999) employ the example of the physician-patient medical interview to define practice as actions embedded

in, interpretable through, and constitutive of a shared system of meaning. They write:

> For our purposes, then, we intend the term "practice" to refer to *the coordinated activities of individuals and groups in doing their "real work" as it is informed by a particular organizational or group context.* In this sense, we wish to distinguish practice from both behavior and action. Doing of any sort we call "behavior," while "action" we see as behavior imbued with meaning. By "practice," then, we refer to action informed by meaning drawn from a particular group context. In the simplest case, if Vance's knee jerks, that is behavior. When Vance raps his knee with a physician's hammer to check his reflexes, it is behavior that has meaning, and thus is what we call action. If his physician raps his knee as part of an exam, it is practice. This is because the meaning of her action comes from the organized contexts of her training and ongoing work in medicine (where it can draw on, contribute to, and be evaluated in the work of others in her field). (Cook and Brown 1999, 386–87)

Methodologically, a micro-process orientation requires close attention to patterns of on-the-ground interaction. Although interviews, surveys, and self-report logs and diaries supply ex situ accounts of practice and point usefully to salient dimensions of interaction and context, it seems unlikely that a robust understanding of practice can be achieved absent the strategic use of methods that capture the detail, nuance, and patterning of social interaction.

The medical field has proven a particularly rich environment for micro-analytic studies, demonstrating the utility of a range of methods for tracing the contours of practice and for showing how variable aspects of practice matter with regard to outcomes of interest. For example, Mishler's (1984) seminal analysis of discourse in the context of the medical interview (an established routine for generating and acting on information) revealed how the physician's systematic focus on biomedical evaluation and treatment generally worked to silence or suppress the patient's efforts to introduce "lifeworld" circumstances, concerns, or emotions. More specifically, an interview structure that privileged short answers to a physician's questions about symptoms tended to silence, constrain, or interrupt longer patient narratives that might have served as a resource in medical diagnosis and treatment. Studies of physician-patient communication have proliferated in the years since Mishler first published *The Discourse of Medicine* and have been credited with stimulating changes in medical practice and in the preparation of physicians (Heritage and Maynard 2006). Micro-process studies in the medical field have similarly proved fruitful in illuminating the dynamics that enable or impede complex changes in workplace practice and relationships (e.g., Kellogg 2009).

Examples derived from medicine, while plentiful, supply just one precedent

for micro-process studies that deepen understanding of ongoing work processes, dynamics of organizational change, and trajectories of learning. Indeed, the published scholarship spans a wide range of fields and work contexts, from scientific laboratories (Latour and Woolgar 1986) to ocean-going ships and airplane cockpits (Hutchins 1995; Hutchins and Klausen 1998). Edited volumes compile empirical examples from multiple work domains and trace conceptual and methodological developments (Drew and Heritage 1992; Engestrom and Middleton 1998; Luff et al. 2000). In all the available examples, investigators delve into the ways that the members of an organization create shared meaning and activity through interaction, employing methods of observation that capture what individuals do with one another and with the relevant tools and objects of a field.

Micro-Process Precedents in Education

In the field of education, classroom-based studies of teaching and learning offer the most well-developed precedent for micro-process studies and the most compelling testimony to their utility. Macbeth (2003, 239) terms naturalistic inquiry the "central innovation of classroom studies in the last 30 years," extending to studies of classroom socialization, cross-cultural interactions and processes of inclusion and exclusion, and studies of teaching and learning in discrete curricular domains.

Mehan's (1979) influential year-long study of a primary-grade classroom was among the first to undertake the systematic analysis of a corpus of classroom video. Mehan's study is perhaps best known for its detailed exposition of the common three-turn "I-R-E" (Initiate-Reply-Evaluate) mode of teacher-student interaction. One might argue that this prevailing pattern might also have been readily uncovered by less labor-intensive process methods, such as the 10-category Flanders Interaction Analysis System (Flanders 1960). However, what Mehan's analysis demonstrated—and that the Flanders scheme could not—was the subtlety, consistency, collective skill, and tacit understandings with which teachers and students together constituted the social and intellectual fabric of classroom life.[3] In the book's title, *Learning Lessons*, Mehan signals the way in which the exchanges between teacher and students become the occasion of learning, not only the substance of some curricular subject but also learning how to "do" the work of a lesson itself. Further, as Macbeth (2003) demonstrates with an elaborated example of an IRE sequence in a fourth-grade mathematics lesson, the simple tallying of IRE exchanges could not begin to capture the complex way in which particular turns function in combination, in sequence, over time, to create the academic and social terrain of the classroom.

The current generation of video-based classroom studies has focused particularly on teaching and learning processes in discrete subject domains, bringing to life the "instructional triangle" and helping to flesh out what it means for teachers and children to engage in depth with subject-specific concepts, skills, and epistemologies. Lampert (2001), in a volume titled *Teaching Problems and the Problems of Teaching*, relies on a year-long body of video and related artifacts (her own lesson designs, post-lesson journal notes) to convey how the multiple goals she holds for her students—helping them to become independent and courageous thinkers, contributors to a group, and mathematically adept—play out through her pedagogical choice to teach with particular kinds of mathematical problems (those that embody key concepts, enable multiple solution paths, invite children's imagination, and expose their reasoning). In another example, Jurow (2004) examines the video-recorded mathematical reasoning of middle school students as they develop practices of mathematical generalization through their participation in an eight-week population-modeling project. Although the ability to detect and describe general patterns is considered fundamental to mathematics, Jurow explains, "seeing mathematical patterns is not, however, a transparent activity; it requires figuring out what is important to pay attention to and what to ignore in and across situations and how to use mathematical forms, such as graphs, to identify relevant mathematical phenomena. . . . Because generalizing is a central mathematical practice, documenting how students learn to describe how something always behaves will help us understand how students enter into the specialized disciplinary discourse of mathematics" (280).

Jurow's analysis rests on a view of mathematical abstraction (generalization), not as "moving away" from the concrete but as rooted in and a product of local social practice: "Such a view attends to how social interactions, tools, personal history, and the environment shape the creation and recognition of similarity across situations" (281). To grasp the ways in which particular classroom tasks and instruction enable student learning, then, requires close attention to students' discourse, gesture, and use of mathematical tools and representations. The resulting analysis allows Jurow to trace the trajectory of student understanding as students begin to link and compare situations and to offer conjectures about the behavior of the population (guppies); it also reveals the affordances and limitations of the curriculum—an extended simulation—in ways that would not likely be apparent otherwise (e.g., the ways in which a worksheet query may inadvertently shift the ground from an effort to determine a "sensible" model based in observation and evidence to an effort to identify a "right answer").

Micro-process investigations of classroom interaction have substantially advanced our understanding of how these formal environments shape learning, social relationships, and identities, as well as the ways in which they represent

(and sometimes interrupt) widely shared conceptions of what constitutes teaching and schooling. By comparison, the field offers fewer micro-process studies of teachers' professional interaction in schools. A few studies of school workplace interaction have begun to uncover the ways in which interaction in collaborative groups promotes or constrains teacher learning, instructional innovation, and peer support among teachers. In one example, Horn and Little (2010) analyzed over 50 hours of recorded interaction among members of two self-defined "collaborative" groups of teachers, detailing how characteristic conversational routines in each group functioned to open up or close off in-depth conversation about problems of practice. However, such close examinations of situated interaction prove relatively small in number, especially in relation to the quite large volume of interview- and survey-based studies of the school workplace. The marked scarcity of such micro-process studies of teachers' interactions characterizes the research on data use as well.

Research on Data Use Practice among Teachers

Guided by a conception of micro-process studies anchored in situated interaction, and informed by the empirical precedents established in education and in other fields, I sought empirical work that focused on teacher-to-teacher interaction or teachers' interactions with relevant others (administrators, instructional coaches, consultants, parents) that would reasonably fall into the category of "data use." In doing so, I concentrated on workplace settings outside the classroom, excluding studies of teachers' within-classroom practices of formative assessment.

I further emphasized studies for which the observation and recording of data use activity was a central component of the research design and published analysis. In this context, observational records would preserve what people say and do with each other, with the data artifacts at hand (samples of student work, graphs, tables, and other visual representations) and whatever other tools (protocols, accessible databases) they have readily available. In some respects, this preference for observational records results in an overemphasis on occasions of face-to-face contact. To the degree that such face-to-face interactions depend on the participants' prior or subsequent construction, retrieval, selection, or representation of data, the activity boundaries of data use practice stretch beyond the structured occasion of face-to-face interaction; in turn, the study of practice may require observational methods that extend beyond the relatively straightforward recording of face-to-face meetings. Admitting that caveat, I deemed the recorded observation of face-to-face interaction a key criterion in the search.

Finally, my search privileged studies of data use practice during a period

roughly spanning the late 1980s to the current moment—a period that encompasses the growing standards movement and its evolution into test-based accountability systems. Teachers' engagement in systematic inquiry and evidence-based decision making has a long history, dating in the United States at least to the 1920s (Hollingsworth 1994). However, the rhetoric and practices associated with educational data use and evidence-based practice have evolved in particular ways over the past two decades, harnessed first to locally driven whole-school reform initiatives and then increasingly to the accountability agendas formulated by states and by federal legislation.

Although attention to data use is burgeoning and practice-oriented guides have proliferated (e.g., Boudett et al. 2005), a search for published research yielded only a small number of studies encompassing an analysis of observed data use practice. In a recently published review, Young and Kim (2010) sought research that would illuminate the use of data at school and district levels. They reported that "use of data is fast becoming a central tenet of many school- or district-level theories of change" (16) but that relatively little research focuses on the ongoing, formative uses of data in schools and districts. The search conducted for this article confirms the earlier Young and Kim (2010) result: the field is sparse, especially in light of the escalating level of reported practice and by comparison with the rich legacy of micro-process classroom studies. More typically, claims regarding teachers' data use practices rest on interview- or survey-based reports. Few studies of school- or district-based data use report an analysis of observational findings even when observations have been part of a larger study design and may have been systematically coded (Young 2006). In effect, a strict application of the search criteria defined above produces a very small number of studies for which data use practice constitutes the central focus.

In the discussion that follows, I review five studies in which teachers' data use practice constitutes the primary focus and in which analysis is derived mainly or at least prominently from systematic and sustained observation. I then introduce two examples of recent work in more formal professional development contexts that, while not conceived by the researchers as studies of "data use," do establish a useful precedent for the close examination of teachers' interactions around issues and artifacts of student learning and help point to the kinds of advances we might make through the more systematic pursuit of micro-process investigations.

At issue throughout is what these studies offer that cannot readily be tapped by less labor-intensive interview and survey methods. In some respects, and not surprisingly, findings from the available observational studies echo those derived from less labor-intensive interview- and survey-based studies. They underscore the role that leadership plays in framing and guiding data use activity; they reveal differences in the perspectives, capacities, and motivations

that participants bring to the enterprise; and they demonstrate that various kinds of expertise matter, together with relational trust and professional norms conducive to in-depth consideration of school and classroom practice.

However, through the display and analysis of interaction, the micro-process studies also expose patterned and consequential aspects of data use practice that elude the blunter instruments of interview and survey. Four such aspects emerge in the first set of studies profiled below. First, the studies (to varying degrees) expose the interpretive work actually being done on organized occasions of "data use" and the relative attention and weight given to the available data as a legitimate source of evidence and as a guide to action. As Coburn et al. (2009, 1118) argue, "evidence does not independently inform decision making because it is always mediated by interpretation," making the work of evidence-based decision making fundamentally a process of interpretation, argumentation, and persuasion. Second, the studies provide concrete instantiations of leadership or facilitation—for example, the moves by which leaders frame and focus conversation (or not)—while also showing how the sense making that transpires around data is both collectively co-constructed and constrained by the available expertise in the group. Third, the studies trace the actual use of tools and processes designed to aid the examination and interpretation of data, uncovering unexpected adaptations and dilemmas. For example, structured discussion protocols and processes help to focus discussion and facilitate broad participation, but they also lend themselves to ritualized enactment, privileging form over substance. Finally, the studies convey some of the normative character of data use interactions, including norms for challenge and critique and norms regarding talk about students and their families. Prevailing norms of interaction and interpretation function to promote or inhibit in-depth discussion.

Four papers published in the edited volume *Professional Learning Conversations: Challenges in Using Evidence for Improvement* (Earl and Timperley 2008) present findings from observational studies of school-based processes for examining, interpreting, and acting on student data. Together, the papers take up a set of organizing questions: What is the nature of "evidence-informed conversations" and how do they constitute an opportunity or catalyst for improvement? What conditions enable or impede them? To what extent do these conditions and conversations distinguish improving from stagnating or declining schools? The settings represented by the papers span the broad range of likely data use contexts, encompassing a voluntarily organized "critical friends group" in an urban high school in the United States, locally mandated primary-grade meetings convened to review assessment data in Canada, a network-based event involving school- and district-based teams from 32 districts in the United States, and data review meetings in schools engaged in a national reading improvement initiative in New Zealand.

Earl's (2008) paper in the volume, "Leadership for Evidence-Informed Conversations," presents multiple excerpts from a single videotaped conversation in which a principal, a district reading consultant, and a group of teachers in grades 1–4 examine evidence of students' progress in reading in grades 1–3. The conversational excerpts represent part of a larger archive of research data from a 13-district study in Ontario, Canada. As the title conveys, the paper's analytic focus is on leadership, more specifically on the moves made by the principal to frame the discussion and to sustain a focus on the data in hand: a set of charts showing reading assessment data disaggregated by grade and gender and a "data wall" arrayed to display information about each student's pre-reading skills (e.g., letter identification) and growth across grades on a literacy continuum, together with notations regarding the various interventions for each student.

By focusing primarily on a succession of the leader's moves, the paper reveals a dilemma identified in other studies of data use—the tendency of teachers to turn away from the data in hand even when it is closely linked to the curriculum in use and to talk in more general terms about instruction or noninstructional factors in student performance, such as parental expectations (see Little et al. 2003). The principal is shown having to work consistently and with some difficulty to sustain a focus on the data and on interpretations and implications that could be anchored specifically in those data. Having launched the discussion by asking teachers to examine a set of reading assessment charts and identify patterns ("I have compiled the data that you gave me into charts. What patterns do you think are meaningful? Look at the information. What is your initial interpretation?"), she acts in four subsequent instances to redirect teachers' talk back to the data from what have developed into teacher conversations about teaching strategies (twice) or about parents as a factor in children's reading progress (twice). In doing so, she moves from her initial open invitation ("What patterns do you think are meaningful?") to successively more specific queries: "Are there any other patterns that you find? How do you feel about how the grade 1 students are doing?" and then "I want to go back to the data. You know what is really interesting to me. Look at this plum colour. These are the students who are not at benchmark. " And finally, "Let's look at the data wall for grade 1. Would you take us through each child and tell us about them."

Earl's strategic choice to summarize much of the teacher talk (rather than supplying the full transcript) obscures some of the specific features of teacher interaction that motivate the principal's moves; it also makes it difficult to gauge the effects of the principal's moves on teacher discourse, although there is some indication in the excerpted talk that teachers remain more focused and attend more concretely to evidence of student progress when orienting

to the individualized records on the data wall than when asked to consider the assessment results charted by grade level.

The issue of sustained and specific focus on evidence and its implications for facilitation arise as well in Timperley's (2008) paper "Evidence-Informed Conversations Making a Difference to Student Achievement." The author draws on "evidence-based conversations" to help explain the differential record of improvement among seven schools seeking improvement in reading scores as part of a national initiative in New Zealand. All of the schools had participated in the same program of professional development, the schools were comparable in student population demographics and prior records of student achievement, and classroom observations showed teachers to be able to implement the recommended approach to early literacy instruction. Timperley attributes the variation in improvement outcomes to systematic differences in practices of data review in the higher-achieving and lower-achieving schools. In the two schools showing evidence of improvement and higher achievement profiles, teachers met more often to examine student performance on reading and writing assessments, and they joined that analysis to a discussion of what teaching practices might enhance or inhibit student gains. Of the schools showing little improvement, Timperley says: "Rather than basing these conversations on information about student progress, they focused mostly on teaching practice" (70).

To bring the reported differences more fully to light, Timperley provides excerpts from three conversations, two from improving schools and a third from a school with persistent low achievement. The conversations and conversational settings are shown to vary in several respects. First, the schools differed with regard to the clarity of purpose attached to reviews and interpretation of data. In the improving schools and in demonstrably generative conversations, leaders clearly defined and reinforced a purpose, thus presumably making it easier to decide how the available data might constitute evidence or information to guide action. In lower-achieving or stagnating schools, the purpose(s) for reviewing data tended to remain vague or ambiguous, perhaps with the assumption that the meanings following from data are self-evident. Timperley sums up a recurrent theme regarding weak data conversations by identifying the problem of the "activity trap": "Less effective conversations became stuck in activity traps in which examining data and having conversations was seen as a good thing to do with only a vaguely defined purpose for doing so" (69).

Timperley's case study schools also varied with regard to the sheer presence of relevant data and the attention focused on those data during scheduled meetings; in improving schools, teachers engaged in discussions of data that were germane to their shared efforts to boost literacy achievement, while in lower-performing schools, programmatic descriptions of instructional tasks and

curricular priorities substituted for student data as the basis for teacher talk. In addition, the conversations reflected quite different norms of professional interaction, with little latitude for challenge or critique evident in the lower-performing schools. Characterizing one conversation about writing instruction in a lower-performing school, Timperley reports: "All descriptions were treated as equally effective in the sense that no negative evaluative comments or suggestions for improvement were made" (76).

Finally, schools differed with regard to an underlying professional ethos, including teachers' disposition to value evidence of student progress or difficulties and to offer or seek instructional help from colleagues. Teachers in the most improved school openly expressed uncertainty and sought help from others in the group. In one such conversation, a teacher reported her struggle to calibrate instruction appropriately on the basis of the available data on students, resulting in an offer of classroom-based help (Literacy leader: "So you are asking for help?" Teacher: "Yes." Literacy leader: "Do you want someone to observe you . . . or do you want to observe somebody [teaching], or do you want someone to look at the reading strategies in the whole process? . . . Be thinking team about the kind of help that we may be able to offer"). Reporting on other sources of self-report data in the same school, Timperley reports: "All the teachers reported that they sought the assistance of their colleagues in a variety of ways between meetings" (72). In contrast, and consistent with weak norms of professional interaction, teachers in the lowest-performing school deferred consistently to their colleagues' individual autonomy, accepting without question individuals' interpretations of evidence or their instructional choices.

The interpretive resources supplied by teacher expertise and by the use of conversation-structuring tools constitute a focus for a third paper in the volume. Little and Curry (2008), in the paper titled "Structuring Talk about Teaching and Learning: The Use of Evidence in Protocol-Based Conversation," excerpt stretches of talk from a single 40-minute videotaped conversation that typified practices of examining student work within a multi-disciplinary, multi-role group in a comprehensive high school—one of multiple conversations recorded among this group over a two-year period. The group's monthly "critical friends group" (CFG) meetings served as the occasion for examining evidence of student learning and teaching practice as collected, selected, and presented by individuals for collective consideration. The regularly scheduled meetings and the device of a protocol-guided conversation together constituted what Spillane (2012, in this issue) terms an "organizational routine" and thus strategically appropriate for an investigation of data use practice.

Analysis focuses on the enactment of a protocol—procedural steps and guidelines—to structure talk about two student essays selected by a teacher to represent

cases of student difficulties or struggles. The protocol guidelines, reproduced in the paper, specify five phases of conversation together with suggested time allocation and guidance for roles and type of intended participation (e.g., the group is asked to devote 10 minutes to each of three activities: "describing the student work" while refraining from judgment, "interpreting the work," and considering "implications for classroom practice"). However, the authors find that "like many other conversations we observed, this one does not reflect strict adherence to the written protocol, either with regard to the substantive focus of talk in particular phases or with regard to the suggested time allocations or participation guidelines. Participants redefine the various protocol phases, most prominently with regard to when and how judgments are rendered regarding the quality of the student work, and whether or how to introduce additional evidence of the teacher's instruction" (33). By parsing the conversation as it unfolds, Little and Curry show how the participants take up the student essays both as evidence of student understanding (judging that they may not have understood the task of writing a persuasive essay) and as grounds for making inferences about the teacher's instruction and offering instructional advice.

The teachers sustain a focus on the student work for one-third of the allocated time, although in considering instructional implications, "the participants move away from the student evidence to produce a generic typology of instructional remedies" (36). By preserving the sequential order and excerpting substantial text from the lengthy (840-line) transcript, the authors demonstrate that the conversation "demonstrably yielded insights into teaching and learning" (38) but also argue that it displays certain aspects of protocol-based conversation that were also evident in the study's larger data set (Little et al. 2003): the tendency of participants to privilege form and procedure over substance, resulting in superficial examination of the evidence at hand (akin to the "activity traps" that Timperley identifies); the potential conflict between openness to broad participation and/or multiple points of view and the need for the kind of focus that could inform instructional choices; and, finally, the tendency for the apparent ease and accessibility of protocol formats to mask the conditions and resources needed for their effective use, including facilitation skill and teaching expertise in particular subject domains. In this instance, the ability of the participants to engage fully in an analysis of student work depended on their understanding (or lack of understanding) of the genre of the persuasive essay.

The tendency to privilege form over substance in data-based discussions also arises as an issue in the Lasky et al. (2008) paper "Learning to Think and Talk from Evidence: Developing System-Wide Capacity for Learning Conversations." The authors draw on data from a longitudinal, mixed-method experimental design study with 32 high-poverty urban and rural schools across four states. They focus conceptually on structures, tools, and norms that they

posit will provide "foundational conditions that can scaffold the learning towards more sophisticated use of data envisaged by those advocating more evidence-informed systems" (98). The authors analyze conversations that transpire as part of a network-based professional development event involving school-based teams and structured by elements of the "data wise process" (Boudett et al. 2005). The overall claim of the paper is a familiar one, underscoring the difficulty of collective, systematic data use, especially in early stages: "The conversations show that during the early stages of learning from data, participants tended to focus on procedures or processes rather than on the meaning of the actual data" (99). The conversation excerpts show a consistent pattern: facilitator/leader prompts that were insufficient to establish purpose or to focus attention on data, teachers' inattention or superficial attention to the actual data in hand, and facilitator questions that were largely procedural rather than substantive.

The restricted length of the individual papers in the Earl and Timperley (2008) volume and the device of focusing on single conversations prove to be important constraints on understanding the patterned nature of teachers' interactions and the contexts in which they unfold. One potentially fruitful alternative resides in the growing number of doctoral dissertations focused on data use practice. In one example of a dissertation rooted in extensive observation, Barrett (2009) investigates teachers' collective practices of inquiry and data use in the context of a reform initiative she terms TLM (Teacher Leadership Model). The TLM combines a "small learning community" (SLC) structure with a substantive emphasis on rigorous and coherent curriculum and instruction, facilitative leadership, and a data-driven system of accountability. Over an 18-month period, Barrett conducted more than 50 observations of four SLC groups during common planning time meetings. She asks: "What kinds of professional conversations emerge? What are teachers focusing on, and what appears to drive the focus of teachers' work? Does this vary across SLCs, or over time?" (23).

In her observations, Barrett "attempted to capture direct quotations from participants whenever possible" (57–58) but did not construct an audiotaped or videotaped record of teacher interaction. The absence of such a record presents a serious limitation for a micro-process analysis, for which the sheer volume of observations offers partial compensation. Barrett's coding of the field notes results in a set of overall findings that underscore the importance of looking more closely at situated interaction. For example, she finds teachers more likely to speak up in meetings when they are engaged in what they consider "kid talk," but she also characterizes the talk about students as frequently superficial, laden with stereotypes, and focused on explanations for student failure that reside outside the control of the teacher. The presence of a facilitator and the availability of tools for displaying and reviewing data

appeared to offer limited purchase on the tenor and direction of the discourse and especially on what appear to be deeply ingrained ways of classifying students according to perceived effort, motivation, and ability. Barrett's excerpted fieldnote entries, while necessarily incomplete as a record of interaction, point consistently to a set of complex, patterned, and consequential practices that are likely to have parallels in many school settings and that would benefit from closer scrutiny.

In each of the studies summarized above, teachers consider a range of student data (primarily test results and curriculum-related assessments but also student work samples) as part of school-level or district-level initiatives linked specifically to accountability demands and local school improvement initiatives. However, the emphasis on generating and interpreting evidence of student learning also pervades contemporary professional development. It seems unlikely that the investigators associated with professional development studies conceive of their research as focused on "data use." However, the kinds of interactions captured and analyzed in these professional development contexts offer insight into the issues and dynamics likely to surface in workplace settings, including issues related to teachers' expertise, dispositions toward various kinds of evidence, norms of interaction and interpretation, and the role of leadership.

A growing number of professional development programs employ the examination of student work samples or other evidence of student learning as a means of deepening teachers' knowledge for teaching in specific subject domains—most often mathematics, but also in science, literacy, and history. Some programs focus specifically on practices of formative assessment in those domains, affording them particular relevance to studies of data use in other settings. Increasingly, studies linked to such professional development programs rely on audiotaped and videotaped records to trace the often-nuanced trajectory of teacher learning and its relationship to teachers' encounters with evidence of various kinds.

I posit that this body of research proves a useful precedent for micro-process studies of data use in three ways. First, the professional development settings represented in this body of research may plausibly be seen as "safe" settings for struggling over the meaning of evidence and thus as settings likely to reveal the uncertainties that teachers experience and the ideas and beliefs they bring to the interpretation of data in other contexts. When conducted in ways that invite collective and in-depth sense making, intensive professional development exposes teachers' taken-for-granted assumptions about teaching and learning and the interpretive frameworks they employ as they take up samples of student work, consider the results of student assessments, or view video clips of students in classrooms. These "safe" settings may differ appreciably from the settings organized by accountability demands, but the dialogue that populates them nonetheless offers purchase on the entailments of learning from evidence.

For example, Kazemi and Franke (2004) traced the development of discourse among 11 elementary teachers over a one-year period as the teachers examined their students' responses to mathematical tasks and activities. The teachers began with collective scrutiny of student work samples created in response to agreed-upon mathematical tasks. Teachers' inferences from these written records of student work—inferences about what students "must have been thinking"—were challenged when the teachers started more systematically to elicit students' verbal explanations of what they had done and how they were thinking and to report those classroom conversations alongside the work that students produced. Teachers' understanding of mathematics teaching and learning deepened, and their classroom practices shifted, when they attended to the details of student thinking and problem-solving practice as those were revealed in a combination of student work samples and narrative accounts of classroom interaction.

The second precedent established by the professional development studies is their growing reliance on audiotaped and videotaped records of unfolding interaction. The conversations captured by these methods achieve a degree of specificity and depth unlikely to be captured in observation protocols or field note summaries alone, and even more unlikely to be represented well in post hoc interview accounts. In the Kazemi and Franke (2004) study summarized above, for example, the audio taped record of teacher discourse made it possible to (*a*) uncover the gradual shift in teachers' orientation to the specifics of student thinking; (*b*) link that shift to the change in the nature of classroom evidence considered by the teachers; (*c*) trace the contributions of individual teachers to the group's deliberations; and (*d*) identify how facilitators' specific moves and interventions furthered teachers' development. With the aid of complete transcripts, the authors were able to construct summary tables displaying the change in teachers' perspectives and interactions over time, thus supplying a warrant for their claims that would not have otherwise been possible.

Third, professional development studies also help to illuminate the contribution of particular tools and activities and of specific facilitator or leader moves in maintaining a focus on evidence of student learning, and in helping to shape the discussion as teachers turn to assessing, interpreting, and responding to the evidence in hand, factors also identified as salient in interview-based studies of data use in schools (Young and Kim 2010). Although the analytic focus on facilitation tools and practices is relatively new in the professional development literature (Borko 2004; Elliott et al. 2009), it gains significance in light of the established importance of leadership and facilitation in research on school-based data use activity (Coburn and Turner 2012, in this issue). For example, Falk (forthcoming) analyzed video records of eight three-hour sessions of professional development activity in which teachers

examined samples of student work in elementary grades science. He found that the depth of teachers' discussion about student understanding varied with the kinds of evidence provided to the teachers and the tasks defined by the facilitator. Open-ended analysis of a small sample of student work yielded more detailed attention to student reasoning and understanding, while the shift to specific criteria for judging "proficiency" within whole-class sets of student work led teachers to focus on the correctness or incorrectness of student responses with little attention to evidence of the reasoning behind the response. Falk argues that these two facilitated approaches to teachers' collective assessment of student work—approaches that one might readily envision in school-based activity as well—represent quite different opportunities for teachers to deepen their understanding of student learning and to craft an instructional response.

The combination of workplace-based studies and professional development research offers glimpses into the insights to be gained by joining micro-process studies to some of the larger-scale survey- and interview-based research that has so far dominated the field. To date, the corpus of observational research remains quite meager, paling beside the far more extensive body of classroom-based research. With expectations for data use practice escalating in schools and districts, the time is ripe to deepen and broaden the reach of micro-process investigation.

Expanding the Contributions of Micro-Process Studies in Research on Data Use

This article has its origins in the observation that the rhetoric of "data-driven decision making" and "evidence-based practice" has gained widespread purchase among education leaders and policy makers but has generated little research that investigates how this rational discourse plays out in the system of everyday practice that makes up schooling. To date, investigators have done relatively little to take advantage of a long history of interaction analysis in education (Erickson 2004) or to exploit conceptual and empirical work that sits at the disciplinary intersection of institutional, organizational, and interpretive traditions in the social sciences (Barley 2008; Hallett and Ventresca 2006). Individual studies attend in varying degree to participation structures and processes, content specificity and depth, organizational routines and contexts, norms of interaction, and facilitation practices, but the overall body of research lacks the kind of comprehensive scope or agenda that would enable multiple case studies to contribute to a more cumulative understanding of data use practice as both a local development and a broadly institutional phenomenon in education.

To define such a comprehensive research agenda for micro-process studies

is well beyond the scope of this article, but I propose two broad metaphorical starting points that I consider consistent with the emphasis on situated interaction introduced earlier. The first entails a strategy of "zooming in" for a deeper understanding of the practices and perspectives in play in specific moments (events, activities) as teachers and others assign various meanings to data, make inferences from data, create explanations for observed patterns, and imagine useful responses to the patterns they detect. A second starting point takes the form of "zooming out" to locate those specific interactions in the structure and fabric of organizational life—for example, by tracing the emergence of new organizational routines and the ways they juxtapose, modify, transform, or displace established ways of working.

The metaphors of "zooming in" and "zooming out" are not meant to convey analysis at different structural levels (individual and organizational, for example) or to invite a distinction between micro-and macro-level phenomena. Rather, they allow for a characterization of practice that is both constituted in and through interaction and made meaningful within the web of activity and relationships that make up life in a given institutional domain. The medical interviews studied by Mishler (1984) can be viewed as strategic sites for the study of medical practice not merely because they entail interaction between physicians and patients but because the medical interview has evolved as a central routine for organizing that interaction. The talk that unfolds in a medical interview, whatever its particularities on any specific occasion, is likely to be recognizable to both parties as being consistent with broadly taken-for-granted notions about physicians and patients and more specifically about the occasion of a medical interview.

In pursuing the "zooming in" strategy for the study of data use in schools, one might ask several questions. As teachers engage in the examination and interpretation of available data, what interpretive or explanatory frameworks are in evidence, and what courses of action do they tend to promote or inhibit? In what ways do verbal and nonverbal actions convey professional norms of interaction that are conducive (or not) to in-depth discussion anchored to data—for example, norms regarding the questioning of existing instructional practice? How are data representations (graphs, tables, charts, narratives, work samples) actually examined, invoked, critiqued, or ignored, by whom, and with respect to what kinds of unfolding argument? Similarly, how are various participation protocols or interpretive tools taken up and enacted, and with what apparent consequence for the depth of discussion? In what ways do designated leaders (administrators, coaches, consultants, lead teachers) frame purposes, tasks, the context, and the process?

To illustrate the possibilities, I elaborate briefly on the first of these questions. It is in the work of interpretation that data come to be treated as trustworthy, meaningful, and useful (or not) and that data are marshaled as evidence to

advance and justify (or contest) a particular course of action (Coburn et al. 2009). Inevitably, that interpretive work—such as assigning relevance to particular data points, patterns, or trends—relies on the worldviews that teachers and other participants bring to the task. Coburn (2006) illuminates such interpretive sense making by tracing in detail the successive ways in which teachers in an elementary school successively framed and reframed the problem of reading performance and their stance toward state-level reading policy over the course of a school year. In doing so, she demonstrates the analytic power of combining sense making theory and framing theory to account for the dynamic and iterative interplay of the local and the institutional in the course of policy implementation.

Teachers' worldviews are also reflected in taken-for-granted ways of characterizing or classifying students that are manifest in the interpretation of data and in consideration of appropriate courses of action. Bowker and Star (1999, 5) argue that the pervasive, taken-for-granted use of categories and classifications is fundamentally constitutive of the social order, but they observe that "few have looked at the creation and maintenance of complex classifications as a kind of work practice." Within education, Horn (2007) found that differences in the curricular and instructional decisions made by two groups of mathematics teachers could be attributed at least in part to the inclination of one group to challenge conventional notions of "fast kids" and "slow kids." In the data use studies profiled above, teachers' classificatory talk pervades the excerpted conversations and suggests the power of shared categories to frame interpretation of data and shape instructional responses. Such classificatory talk and inscriptions receive scant analytic attention in the published work to date but would constitute one productive window into data use practice and the ways in which such practice intersects established ways of thinking and acting.

"Zooming in" questions lend themselves well to conceptual and methodological tools of interaction analysis applied to discrete occasions of interaction, such as the meetings or events on which the extant micro-process studies focus. Still at issue are where those occasions reside and the significance they assume amid the welter of daily or weekly activity in which teachers engage. In what ways are particular kinds of data and particular occasions of collective data use proving integral or peripheral to the work that teachers now do?

By also "zooming out," micro-process studies enable us to trace changing patterns of data creation, access, and use as part of teachers' daily work. The events, activities, and interactions now associated with "data use" reside in a larger landscape of work practice, encompassing the long-established ways in which teachers routinely generate, interpret, and act on information: taking and reporting attendance, grading student work, producing periodic report cards, or talking with colleagues or parents in the language of success and

failure. For decades, daily school attendance served as the most pervasive single data point: it was collected by teachers each morning or each class period, recorded on individual students but joined to a system of organizational monitoring and reporting. Report cards, generated by teachers on the basis of their individual assessment of students' academic progress and behavior, served as the measure of student performance and a primary vehicle for teachers' communication with parents. To gauge the prospects that shifting logics and practices of "data use" will gain purchase in teachers' thinking and practice both in and out of the classroom will require attention to this larger terrain of work practice and to the fabric of workplace relationships (Little 2007).

In "zooming out," we might ask the following: What part do occasions of data use play in the daily and weekly routines that organize the work of teaching? How are teachers positioned in the set of relationships and practices that broadly constitute "data use" in a school or school system?

Recent developments in social science research aid the investigation of such questions in two ways. The first is a conceptual orientation toward organizational routines (Feldman and Pentland 2003) as a source of both stability (the structural or "ostensive" features of the routine) and change (the enacted, "performative" aspect of the routine). Sherer and Spillane (2011) employ the case of the "five-week assessment" in a single case study school to demonstrate the analytic affordances of focusing on organizational routines to explore shifts in data use practice (see also Spillane 2012, in this issue). By employing the routine as the unit of analysis, Sherer and Spillane overcome the limitations of focusing solely on discrete events, locating them within the broader landscape of activity and relationships within the school. Their analysis describes the evolution of a new way of working—the "five-week assessment"—that they credit with transforming teachers' work both inside the classroom and with one another and that they find evident in a range of formal and informal interactions.

Second, research on the "zooming out" questions stands to benefit from the theoretical, methodological, and practical advances represented by social network theory and by methods of social network analysis. Dimensions of social positioning and social relationship—including relationships of power, authority, and relational trust—have long been embedded in research on educational change (Bryk et al. 2010; Louis and Kruse 1995). However, the recent embrace of social network theory has enabled more systematic attention to the web of relationships, both formal and informal, through which the meaning of any change comes to be interpreted and enacted, facilitated, or impeded (for a recent compilation, see Daly [2010]). For example, Stoelinga (2008) employed network analysis to examine how informal teacher leaders

(literacy coaches) were positioned in relationship to the school's formal leadership structure and to teachers in three schools; the resulting network maps show quite different density of ties and place the designated teacher leaders in quite different positions to pursue a change agenda. Joining network mapping to the analysis of organizational routines and of discursive practices in observed interaction would afford a substantially deeper grasp of situated data use practice.

Teachers' work is transforming as the kinds of available data multiply and expectations for their use begin to shift. Consistent with broad images of "zooming in" and "zooming out," an expanded conception of micro-process research will entail close parsing of interaction and situating that interaction within proximal organizational contexts and in relation to a more broadly institutionalized (and evolving) system of meanings, identities, relationships, and structural arrangements.

Notes

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1. Although it is not uncommon to see the terms "data' and "evidence" used interchangeably, Phillips (2007) and others usefully note that data do not speak for themselves and attain the status of evidence only when interpreted by someone and employed in the making of an argument. As Phillips puts it (390), "To put it in a nutshell, evidence is made, not found."

2. In employing the terminology of "micro-process studies," I acknowledge the danger of reifying the longstanding micro-macro divide in sociological thought, thereby suggesting analysis is reserved to the lowest levels in a hierarchical system or is inattentive to larger social structures. My intent here, following several contributors to neoinstitutional thought in sociology (Barley and Kunda 2001; Hallett and Ventresca 2006; Powell and Colyvas 2008), is rather to bridge that divide through the systematic investigation of practice that builds on interpretivist traditions in the field.

3. Developed as a tool for research and for teacher development, the Flanders system charted the incidence of seven categories of teacher talk (such as giving instructions, asking questions, providing information, praising or encouraging, accepting or using the ideas of students) and two categories of student talk (either responding to the teacher or initiating a question or other action). When used to tally the frequency of categories and to display the sequence of their use in three-second intervals over a lesson period, the Flanders scheme establishes the proportion and type of teacher and student talk and the degree to which the classroom exhibits a positive or negative affect. The interaction coding scheme developed by Flanders, like those developed in medicine (Heritage and Maynard 2006), owe a debt to the Bales Interaction Process Analysis introduced by sociologist Robert Bales (1950) as a means for studying small-group interaction.

References

Anderegg, Cathryn. 2007. "Classrooms and Schools Analyzing Student Data: A Study of Educational Practice." PhD diss., Pepperdine University.

Bales, Robert F. 1950. *Interaction Process Analysis: A Method for the Study of Small Groups*. Chicago: University of Chicago Press.

Barley, Stephen R. 2008. "Coalface Institutionalism." In *The SAGE Handbook of Organizational Institutionalism*, ed. Royston Greenwood, Christine Oliver, Roy Suddaby, and Kerstin Sahlin. Los Angeles: Sage.

Barley, Stephen R., and Gideon Kunda. 2001. "Bringing Work Back In." *Organization Science* 12 (1): 76–95.

Barrett, Tarika. 2009. "Teacher Conversation and Community: What Matters in Smaller Learning Communities and Inquiry-Based High School Reform." PhD diss., New York University.

Borko, Hilda. 2004. "Professional Development and Teacher Learning: Mapping the Terrain." *Educational Researcher* 33 (November): 3–15.

Boudett, Kathryn P., Elizabeth A. City, and Richard J. Murnane. 2005. *Data Wise: A Step-By-Step Guide to Using Assessment Results to Improve Teaching and Learning*. Cambridge, MA: Harvard Education Press.

Bowker, Geoffrey C., and Susan Leigh Star. 1999. *Sorting Things Out: Classification and Its Consequences*. Cambridge, MA: MIT Press.

Bryk, Anthony S., Penny Bender Sebring, Elaine Allensworth, Stuart Luppescu, and John Q. Easton. 2010. *Organizing Schools for Improvement*. Chicago: University of Chicago Press.

Coburn, Cynthia E. 2006. "Framing the Problem of Reading Instruction: Using Frame Analysis to Uncover the Microprocesses of Policy Implementation in Schools." *American Educational Research Journal* 43 (3): 343–79.

Coburn, Cynthia E., Judith Touré, and Mika Yamashita. 2009. "Evidence, Interpretation, and Persuasion: Instructional Decision Making at the District Central Office." *Teachers College Record* 111 (4): 1115–61.

Coburn, Cynthia E., and Erica O. Turner. 2012. "The Practice of Data Use: An Introduction." *American Journal of Education* 118 (2): 99–111.

Cook, Scott D. N., and John Seely Brown. 1999. "Bridging Epistemologies: The Generative Dance between Organizational Knowledge and Organizational Knowing." *Organization Science* 10 (4): 381–400.

Daly, Alan J. 2010. *Social Network Theory and Educational Change*. Cambridge, MA: Harvard Education Press.

Douglas, Mary. 1986. *How Institutions Think*. Syracuse, NY: Syracuse University Press.

Drew, Paul, and John Heritage. 1992. *Talk at Work: Interaction in Institutional Settings*. Cambridge: Cambridge University Press.

Earl, Lorna M. 2008. "Leadership for Evidence-Informed Conversations." In Earl and Timperley, *Professional Learning Conversations*.

Earl, Lorna M., and Helen Timperley. 2008. *Professional Learning Conversations: Challenges in Using Evidence for Improvement*. New York: Springer.

Elliott, Rebekah, Elham Kazemi, Kristin Lesseig, Judith Mumme, Cathy Carroll, and Megan Kelley-Petersen. 2009. "Conceptualizing the Work of Leading Mathematical Tasks in Professional Development." *Journal of Teacher Education* 60 (4): 364–79.

Engestrom, Yrjo, and David Middleton. 1998. *Cognition and Communication at Work*. Cambridge: Cambridge University Press.

Erickson, Frederick. 2004. *Talk and Social Theory: Ecologies of Speaking and Listening in Everyday Life*. Cambridge: Polity.

Falk, Andrew. Forthcoming. "Teachers Learning from Professional Development in Elementary Science: Reciprocal Relations between Formative Assessment and Pedagogical Content Knowledge." *Science Education*.

Feldman, Martha S., and Brian T. Pentland. 2003. "Reconceptualizing Organizational Routines as a Source of Flexibility and Change." *Administrative Science Quarterly* 48 (1): 94–118.

Flanders, Ned A. 1960. *Interaction Analysis in the Classroom*. Minneapolis: College of Education, University of Minnesota.

Hallett, Tim, and Marc J. Ventresca. 2006. "Inhabited Institutions: Social Interactions and Organizational Forms in Gouldner's *Patterns of Industrial Bureaucracy*." *Theory and Society* 35 (2): 213–36.

Heritage, John, and Douglas W. Maynard. 2006. *Communication in Medical Care: Interaction between Primary Care Physicians and Patients*. Cambridge: Cambridge University Press.

Hollingsworth, Sandra H. 1994. *Teacher Research and Educational Reform: Ninety-Third Yearbook of the National Society for the Study of Education*. Chicago: University of Chicago Press.

Horn, Ilana S. 2007. "Fast Kids, Slow Kids, Lazy Kids: Framing the Mismatch Problem in Math Teachers' Conversations." *Journal of the Learning Sciences* 16 (1): 37–79.

Horn, Ilana S., and Judith W. Little. 2010. "Attending to Problems of Practice: Routines and Resources for Professional Learning in Teachers' Workplace Interactions." *American Educational Research Journal* 47 (1): 181–217.

Hutchins, Edwin. 1995. *Cognition in the Wild*. Cambridge, MA: MIT Press.

Hutchins, Edwin, and Tove Klausen. 1998. "Distributed Cognition in an Airline Cockpit." In Engestrom and Middleton, *Cognition and Communication at Work*.

Jurow, Aachey S. 2004. "Generalizing in Interaction: Middle School Mathematics Students Making Mathematical Generalizations in a Population-Modeling Project." *Mind, Culture and Activity* 11 (4): 279–300.

Kazemi, Elham, and Megan L. Franke. 2004. "Teacher Learning in Mathematics: Using Student Work to Promote Collective Inquiry." *Journal of Mathematics Teacher Education* 7:203–35.

Kellogg, Katherine C. 2009. "Operating Room: Relational Spaces and Microinstitutional Change in Surgery." *American Journal of Sociology* 115 (3): 657–711.

Lampert, Magdalene. 2001. *Teaching Problems and the Problems of Teaching*. New Haven, CT: Yale University Press.

Lasky, Sue, Gene Schaffer, and Tim Hopkins. 2008. "Learning to Think and Talk from Evidence: Developing System-Wide Capacity for Learning Conversations." In Earl and Timperley, *Professional Learning Conversations*.

Latour, Bruno, and Steve Woolgar. 1986. *Laboratory Life: The Construction of Scientific Facts*. Princeton, NJ: Princeton University Press.

Little, Judith W. 2007. "Teachers' Accounts of Classroom Experience as a Resource for Professional Learning and Instructional Decision Making." In Moss, *Evidence and Decision Making*.

Little, Judith W., and M. W. Curry. 2008. "Structuring Talk about Teaching and Learning: The Use of Evidence in Protocol-Based Conversation." In Earl and Timperley, *Professional Learning Conversations*.

Little, Judith W., Maryl Gearhart, Marnie Curry, and Judith Kafka. 2003. "Looking at Student Work for Teacher Learning, Teacher Community, and School Reform." *Phi Delta Kappan* 83 (November): 184–92.

Louis, Karen S., and Sharon D. Kruse. 1995. *Professionalism and Community: Perspectives on Reforming Urban Schools*. Thousand Oaks, CA: Corwin.

Luff, Paul, Jon Hindmarsh, and Christian Heath. 2000. *Workplace Studies: Recovering Work Practice and Informing System Design*. Cambridge: Cambridge University Press.

Macbeth, Douglas. 2003. "Hugh Mehan's *Learning Lessons* Reconsidered: On the Differences between the Naturalistic and Critical Analysis of Classroom Discourse." *American Educational Research Journal* 40 (1): 239–80.

Mandinach, Ellen B., and Margaret Honey. 2008. *Data-Driven School Improvement: Linking Data and Learning*. New York: Teachers College Press.

Mehan, Hugh. 1979. *Learning Lessons: Social Organization in the Classroom*. Cambridge, MA: Harvard University Press.

Mishler, Elliot G. 1984. *Medical Discourse: Dialectics of Medical Interviews*. Norwood, NJ: Ablex.

Moss, Pamela. 2007. *Evidence and Decision Making*. Hoboken, NJ: Wiley-Blackwell.

Phillips, Denis. 2007. "Adding Complexity: Philosophical Perspectives on the Relationship between Evidence and Policy." In Moss, *Evidence and Decision Making*.

Powell, Walter W., and Jeannette A. Colyvas. 2008. "Microfoundations of Institutional Theory." In *The SAGE Handbook of Organizational Institutionalism*, ed. Royson Greenwood, Christine Oliver, Roy Suddaby, and Kerstin Sahlin. Los Angeles: Sage.

Sherer, Jennifer Z., and James P. Spillane. 2011. "Constancy and Change in Work Practice in Schools: The Role of Organizational Routines." *Teachers College Record* 113:611–57.

Spillane, James P. 2012. "Data in Practice: Conceptualizing the Data-Based Decision-Making Phenomena." *American Journal of Education* 118 (2): 113–41.

Stoelinga, Sara Ray. 2008. "Leading from Above and Below: Formal and Informal Teacher Leadership." In *Effective Teacher Leadership: Using Research to Inform and Reform*, ed. Melinda M. Mangin and Sara Ray Stoelinga. New York: Teachers College Press.

Timperley, Helen. 2008. "Evidence-Informed Conversations Making a Difference to Student Achievement." In Earl and Timperley, *Professional Learning Conversations*.

Young, Viki M. 2006. "Teachers' Use of Data: Loose Coupling, Agenda Setting, and Team Norms." *American Journal of Education* 112 (4): 521–48.

Young, Viki M., and Debbie H. Kim. 2010. "Using Assessments for Instructional Improvement: A Literature Review." *Education Policy Analysis Archives* 18 (August), http://epaa.asu.edu/ojs/article/view/809.