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The Development of Professional Learning Communities and Their Teacher Leaders: An Activity Systems Analysis

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Professional learning communities can be effective vehicles for teacher learning and instructional improvement, partly because they help change professional culture. However, little is known about *how* these changes occur. We used activity systems analysis to investigate the development of professional learning communities and their teacher leaders (N = 9) based on interviews and observations over 2 years. Activity systems analysis enables researchers to understand change within complex

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qualitative data sets by finding systemic relations within the activity, specifying contradictions in the system, and explicating outcomes. The resulting activity system illuminates the transformation of a mostly private, autonomous, and egalitarian culture to one of nascent collaboration, reflection, and shared values, as well as teacher leaders' development of agency.

Professional development (PD) efforts increasingly include professional learning communities (PLCs) as part of their overall strategy (Borko, 2004; McLaughlin & Talbert, 2006; Van Es, 2009). PLCs aim to promote and sustain the learning of all teachers in the school community through collaboration with the shared purpose of improving student learning (Stoll, Bolam, McMahon, Wallace, & Thomas, 2006). A review of outcomes based on a small number of empirical studies demonstrates that "well-developed" PLCs can lead to improved teacher culture and practices (Vescio, Ross, & Adams, 2008, p. 80; Wenner & Campbell, 2017). However, it is unclear how PLCs become well developed because there is little analysis of the change mechanisms that yield professional improvement. Talbert (2009) pointed out that "the literature … offers little guidance on the change process … entailed in changing professional culture" (p. 556; see also Bannister, 2015; Postholm & Wæge, 2016). We aim to illuminate this "black box" (Little, 2003, p. 915). We studied the development of four PLCs over 2 years in one middle school through the eyes and activities of the teachers who led them. The teacher leaders' changing perceptions and enactment of their roles and goals and the resulting outcomes reflect the activity of a complex system—teacher leaders' activity in interaction with peers and tools within the organizational and policy environment at the time. We analyze this complex development as an activity system (Engeström, 1987; Yamagata-Lynch, 2010). Activity systems analysis (ASA) helps researchers make sense of complex real-world qualitative data sets by (a) specifying the unit of analysis, (b) finding systemic relations, (c) understanding tensions and contradictions in the system, and (d) explicating findings from qualitative analyses. First, we discuss the purpose of PLCs and the challenges teachers may encounter when leading them. Second, we explain the origins and assumptions of activity theory and its relevance to our research questions. Third, we describe the setting, a university–school collaboration to foster student engagement. Finally, we analyze interacting activity systems to explain the development of PLCs over 2 years as led by the teacher leaders.

PLCS

PLCs are constituted "not only in discrete acts of teacher sharing, but in the establishment of a school-wide culture that makes collaboration expected,

inclusive, genuine, ongoing, and focused on critically examining practice to improve student outcomes" (Seashore, Anderson, & Riedel, 2003, p. 3). Therefore, PLCs have been suggested as a promising approach to PD (Borko, 2004; Fullan, 2007; Little, 2003; Stoll et al., 2006; Vescio et al., 2008). In particular, PLCs most successful in improving student achievement have focused on changing teachers' instructional practices (Supovitz, 2002).

Teachers have traditionally had little access to the opportunities that PLCs might afford both because most of their time is spent isolated in their classrooms and because typical PD has not emphasized teachers learning from one another (Wilson & Berne, 1999). Hargreaves (2009) asserted, "Teachers can only really learn once they get outside their own classrooms and connect with other teachers. This is one of the essential principles behind PLCs" (p. 98).

Despite their promise, PLCs are difficult to develop (Grossman, Wineburg, & Woolworth, 2001). Effective PLCs demand skills that few teachers or principals have had the opportunity to learn, and by definition they challenge the status quo (Talbert, 2009). There is general agreement that an effective PLC demands at least a minimal level of (a) shared values and norms, (b) collaboration, (c) focus on student learning, (d) reflective dialogue, and (e) norms of making practice public (Louis, Marks, & Kruse, 1996; see also DuFour, DuFour, Eaker, & Many, 2006; Fullan, 2007; McLaughlin & Talbert, 2006; Stoll et al., 2006). These practices provide opportunities to learn from others and to increase overall instructional quality.

Shared values and norms signal the collective responsibility of educators related to assumptions about students, learning, teaching and teachers' roles, and human relationships in schools and society. Lee and Smith (1996) found that teachers' collective responsibility for student learning in high schools mediated students' engagement and achievement in most subjects and was especially powerful for students who were lower achievers. In a large national sample, Louis et al. (1996) found that participation in a professional community contributed strongly to teachers' responsibility for student learning. In Norway, Postholm and Wæge (2016) studied how teacher teams in three upper secondary schools formed a common research question, which led to collaboration and lasting change in instruction. *Collaboration* is more than collegial relationships; it refers to teachers creating new knowledge or programs that will improve their expertise and that have tangible products. Teachers both share expertise and call on one another to develop skills. Representations of teachers' practices, such as a replay of what they did in class or a rehearsal of what they might do in a situation (Horn, 2005), can help teachers learn about potentially effective practices. Horn, Garner, Kane, and Brasel (2017) found that collaboration led to teachers' help seeking outside of meetings and thus to changes in collegial relations. Therefore, collaboration can increase teachers' mutual support and collective responsibility for effective instruction.

A *focus on student learning* motivates all of the elements of a school-wide professional community. Teachers investigate how their instruction promotes student intellectual growth, thus affecting opportunities for students to learn. *Reflective dialogue* promotes awareness of one's teaching beliefs and practices. When teachers reflect on practice, it can lead to deeper understanding of how instruction can improve or inhibit student learning and engagement. *Making practice public* aims to open classrooms, normally private domains, to colleagues' advice and support. Teachers can share roles of mentor, advisor, or specialist. These roles may be realized in peer coaching, team teaching, or structured classroom observations (Louis et al., 1996).

TEACHERS AS LEADERS

Principals and outside experts or coaches have often led PLCs because of the presumed benefit of experience or desired expertise. For example, Sandholtz (2002) found that teachers involved in university–school partnerships valued opportunities to address issues of personal concern with university experts in content and other areas. Horn and Kane (2015) also described the potential for teachers' learning when teachers were working in professionally facilitated versus unfacilitated groups. They concluded that teachers who had not yet demonstrated facility with "ambitious mathematics instruction" (p. 17) had more opportunities for learning in facilitator-led discussions.

However, teachers, with their knowledge of and experience in local settings, are also positioned to provide instructional leadership. Fullan (2007) argued that *only* teachers can be effective change agents, because change is cultural and must come from within the school. Sandholtz (2002) stated that PD should be designed as "teachers teaching teachers" (p. 825) because teachers are more likely to value the contribution of their colleagues, who share daily experiences. Specifically, teachers have insider knowledge of students, the curriculum, and the school, which could possibly facilitate improved professional learning for colleagues and for themselves.

Teacher leadership is not well defined either "conceptually or operationally" (Wenner & Campbell, 2017; York-Barr & Duke, 2004, p. 255). Most recently in the United States, No Child Left Behind (2002) explicitly called on schools to reculture in order to increase instructional effectiveness, acknowledging teachers as creators and recreators of school culture. Leadership confers on teachers the opportunity to foster teacher improvement by modeling effective practices and collaborating with colleagues (Muijs & Harris, 2006).

To be effective as leaders, teachers must be experienced (and excellent) instructors who are respected by their peers and have established the norms of collegiality and trust necessary for cooperative goal setting and progress (York-Barr & Duke, 2004). Teacher leadership is thought to function primarily through relationship building and

collaboration, which are informal rather than formal processes. Informal social relationships are unlikely to be sufficient, however. Borko, Koellner, and Jacobs (2011) warned that PD leaders must also have the skills to encourage teacher engagement, promote teachers' commitment to change, and respond to the group's needs.

However, formal designation as leader has often hampered teacher leaders' attempts to support colleagues' improved practice because it violates long-standing norms of privacy, autonomy, decision making, and egalitarianism (Lortie, 1975; Margolis & Doering, 2012; Struyve, Meredith, & Gielen, 2014). Colleagues may perceive—and resent—a difference in the status of the leader, no longer one among equals (Smylie, 1992). The norm is that teachers may ask for help, but advice is not given unless it is solicited (Little, 1990). This puts the leader in a difficult situation. For example, Smylie and Denny (1990) studied 13 experienced teachers chosen to improve teacher learning opportunities and promote academic improvement. The leaders encountered obstacles, as their activities appeared to challenge traditional norms. Almost 20 years later, Donaldson et al. (2008) studied teachers with 3–10 years of experience who took on leadership roles. Those who held reform roles, such as teacher coach, reported resistance and resentment from colleagues because in advocating for improved practices they violated norms of seniority. In response, some changed titles to less threatening ones, like "facilitator," and reduced the scope of their work by assisting only willing teachers. These conflicts can discourage collaboration and consultation with others about practice (Little, 1990; Rosenholtz, 1989). Therefore, teacher leadership may coexist uneasily with traditional teacher culture.

The learning sciences has been interested in how teachers develop and learn during innovations like PLCs (Fishman & Davis, 2006). For example, Van Es (2009) studied how teachers learned to participate in communities of practice and how they enacted new norms of participation in the context of a mathematics video club. She chronicled shifting patterns of participation as teachers learned to enact roles consistent with the norms of video club to investigate students' mathematical thinking.

Other forms of participation can include teacher leadership, which requires effective boundary crossing within and across organizations. Such new roles can be challenging and psychologically difficult. Akkerman and Bruining (2016) studied partnerships between teachers in PD schools and university researchers in The Netherlands. Some teachers took on roles as brokers between the two groups. The authors found that although these teachers increased their involvement and commitment, they had difficulty involving other teachers in the project. Their findings illustrate the challenges of integrating new activities "especially in situations in which there is not yet a formalized structure for collaboration between different practices" (p. 250). This research has relevance for our study of how teachers learned new roles as leaders in an unfamiliar form of practice, PLCs.

THEORETICAL PERSPECTIVE

Cultural-Historical Activity Theory (CHAT)

CHAT was developed to study how human beings transform themselves and society in a particular cultural and historical situation. CHAT focuses on humans' collective activity and its mediation through tools. We selected this theoretical perspective because our goal was to study processes of development and change at one school during a 2-year PD project at a particular time in educational history, that of high-stakes assessment.

CHAT has roots in the cultural-historical school of Soviet psychology founded by L. S. Vygotsky, A. N. Leontiev, and A. R. Luria in the first few decades of the 20th century. Vygotsky's (1978) psychology was developed as a manifestation of Marxist theory to interpret the relation between individuals and their social environment as a single unit of analysis. It identified methods that could describe the relations between a person's mental processes and his or her interaction with cultural, historical, and institutional settings. The key to linking mental processes to the environment is *mediation*. The unit of analysis is object-oriented action mediated by cultural tools and signs (Cole & Engeström, 1993). The *subject* is the individual(s) whose intention is analyzed. The *object* is the goal of the action. In general, *object* is used to indicate what people are doing and why they are doing it—it is the "ultimate reason" for activity (Kaptelinin, 2005, p. 5) and it holds the aspects of an activity together (Hyysalo, 2005). Finally, the object becomes an *outcome* with the help of mediating cultural artifacts/tools, such as language or texts. Vygotsky's theory of mediated action constitutes the first generation of activity theory (see Figure 1, top of the triangle).

After Vygotsky's death, CHAT theorists extended his work on individual mediated action by positing human activity as the unit of analysis distributed

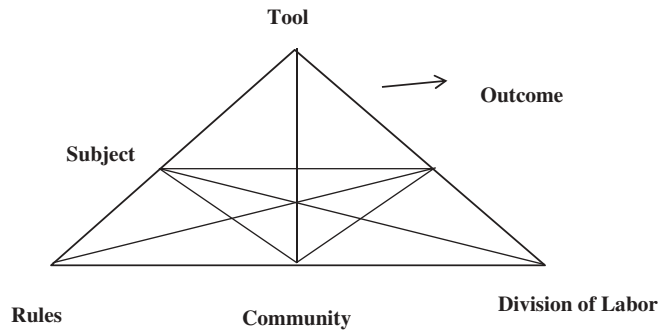

FIGURE 1 Engeström's triangle (adapted from Engeström, 1987, p. 78).

among individuals and objects. They further qualified the unit of analysis as object-oriented activity (Leontiev, 1981), or an activity system in which activities are performed both individually and collectively. By emphasizing the collective nature of activity, CHAT theorists introduced the notion that cognition is distributed among individuals, mediators, and the environment. This extended version of Vygotsky's (1978) representation provided a conceptual map of the distributed nature of human activity—across people, time, history, and culture (Cole & Engeström, 1993).

Following Leontiev (1981), Engeström (1987) extended the scope of the application of activity theory from the individual to the collective. An activity system as the unit of analysis is an "object-oriented, collective, and culturally mediated human activity" (Engeström & Miettinen, 1999, p. 9). Engeström defined activities as collective phenomena undertaken by a community acting together. By adding the component of community, he created a three-way interaction among subject, object, and community. Engeström's (1987) triangle schematizes an activity system. Figure 1 represents second-generation activity theory and can be applied to help interpret qualitative data in the specific case under investigation. We follow this approach in our analysis because our central focus was on the activity system of the PLCs.

Engeström (2001) introduced a third generation of activity theory, incorporating the idea of multiple interacting activity systems focused on a partially shared object. This approach extends understanding of the patterns of contradiction and tension that exist in the pursuit of a shared object. For example, Yamagata-Lynch and Haudenschild (2009) examined teachers' perceived sources of conflict in their PD. The two activity systems were those of teachers and those of school and university personnel who designed the PD. The two groups had two seemingly different (short-term) objects, with teachers focused on change in practice and PD designers focused on improving teacher quality and meeting state requirements. Negotiations were necessary to help both groups attain a new shared object of improving teaching and learning practices. We allude to interacting activity settings in our analyses.

ASA

Engeström (1987) and Engeström and Sannino (2010) introduced ASA to represent the complementary relationship between the activity system view and the subject's view. The researcher constructs the activity system "as if looking at it from above" but also selects a subject or subjects "through whose eyes … the activity is constructed" (Engeström & Miettinen, 1999, p. 10). Engeström's triangle builds on Vygotsky's mediated action triangle (subject, tools, object) and on the idea developed later of distributed cognition (see Figure 1). This expanded triangle includes community along with the subject in the human activity system (Cole & Engeström, 1993). Figure 1 illustrates that the subject–object–community relationship is mediated by the community's resources of tools and also by its rules and by

the negotiated division of labor. Specifically, the *community* is the social group with which the subject identifies during the activity. *Rules* refer to implicit or explicit regulations that constrain or afford the activity and inform participants about acceptable interactions with the community. The *division of labor* refers to the horizontal division of tasks and the vertical division of power and status. These three components illustrate the "multi-voicedness" of the activity system with different points of view, traditions, and interests (Engeström & Sannino, 2010, p. 5). They also portray the possibilities and restrictions for the subject's goal-directed actions. ASA helps to identify the mediators or components that are not visible in the actions of the subject even though the activity is visible. For example, a teacher leader's (i.e., subject's) actions are mediated by her discourse, the tools chosen, the cultural norms in place, and her status within the organization. The components of an activity system help to identify where the tensions in the system occur and how they interact to produce or constrain change.

Because activity systems are complex, "equilibrium is an exception and tensions, disturbances and local innovations are the rule and the engine of change" (Cole & Engeström, 1993, p. 8). The multi-voicedness of an activity system inevitably threatens its stability. ASA enables the specification of these tensions. Tensions may reside within or between the components (e.g., between subject and object) or between activity systems. The lines between the components in Figure 1 indicate possible sources of tension between components, which, if resolved, result in transformation of the activity. The emergent activity unfolds in the *zone of proximal development* of the activity, or the "distance between the present everyday actions of the individuals and the historically new form of the societal activity that can be collectively generated as a solution to the double bind potentially embedded in the everyday actions" (Engeström, 1987, p. 174). ASA permits the longitudinal analysis of collective activity and helps capture the cultural, historical, and dynamic nature of activity as well as the voices of participants in the emergent activity (Yamagata-Lynch, 2010). We use Engeström's (1987) triangle for our ASA because it is consistent with Leontiev's (1978) recognition that individuals or groups act collectively and it stipulates the possible mediators and sources of tension that arise in collective activity, causing transformation (or reproduction) of activity. In this study, ASA helped identify the cultural-historical-interpersonal activity among the teacher leaders, school community, and university researchers and how it was related to changes in the professional culture.

This study responds to the goal in the learning sciences to develop theory related to both classroom learning and its implementation (Penuel, Fishman, Cheng, & Sabelli, 2011). We examined the following research question: How did PLCs develop as systems with teachers as leaders during a PD program? In particular, how can one interpret this change process in terms of the systemic activity and its tensions?

THE STUDY

The principal at Augustus Middle School (a pseudonym) invited us to provide PD at her school because teachers perceived a "motivation problem" with students. Augustus was the lowest performing middle school in the district.

The Classroom Engagement Project was a 3-year PD project with all teachers in the school to foster student engagement in learning. In the first year (2009–-2010), we, the university researchers, introduced four principles related to student engagement: Students are more engaged when teachers support their needs for *competence, autonomy*, and *belongingness* and their desire for *meaningful learning*. We provided rationales for the principles and argued that teachers could enact these principles through classroom instructional strategies. For example, teacher feedback about student progress could support students' competence (see Turner, Christensen, Kackar-Cam, Trucano, & Fulmer, 2014, for more detail on the engagement principles). These principles furnished part of the content for the PLCs, which occurred during the second and third years of the PD project.

Our focus in this article is on the second and third years of the Classroom Engagement Project (2010–2012), when we instituted PLCs as a way of helping teachers recontextualize the four engagement principles in terms of their students and classroom instruction. We designated teachers to conduct the PLCs because of their insider knowledge of students, the curriculum, and the school and their rapport with colleagues. We also intended to support the agency and acknowledge the professionalism of the teachers by placing them at the center of the PD project. Our intention was to create a structure for learning, but one in which practice would develop through participation. In this article, we analyze the development of the PLCs as an activity system based on interviews with teacher leaders, observations of the PLCs, and tools that mediated activities in the PLCs. See Table 1 for an overview of the intervention. Because the focus of this article is on the development of the PLCs rather than the entire project, we refer to the "first" and "second" years of the PLCs in the rest of the article.

METHOD

Setting

The setting for the study was Augustus Middle School, a mostly rural school in the midwestern United States. In the summer before the Classroom Engagement Project officially began (2009), the school district unexpectedly received recession-related stimulus money from the federal government, which the district used to purchase PD programs. Most were related to instruction and assessment and so appeared to the teachers to overlap with the Classroom Engagement Project, which had just begun.

TABLE 1
Overview of the PD

Year	*Focus*	*Activities*	*Challenges*	*Data Collected*
1	Introduce teachers to engagement principles	3-hr PD sessions four times a year led by university researchers; teachers met in content area groups	Teachers were required to attend other PD also, which caused feelings of overwork and neglect of classroom responsibilities; not all teachers tried the strategies, and some had difficulty enacting strategies (e.g., leading discussions)	Observations of eight focal teachers, measures of student engagement over 3 years (Turner et al., 2014)
		Teacher leaders volunteered/ selected for Year 2	Some teachers were wary of violating the egalitarian code in teacher culture	Journal entries detailing process and interactions
2	Teacher leaders (a) deepen understanding of theoretical principles and instructional strategies to (b) recontextualize for colleagues through teacher lenses	Teacher leaders attended four 3-hr researcher-led workshops to discuss principles and strategies	Leaders were not confident in their ability to play their role; leaders relied on researchers' suggestions	Journal entries, curriculum developed for meetings
		Leaders conducted four 3-hr PLCs with content colleagues on principles and related instructional strategies using norms of PLCs	Uneven participation by colleagues; some leaders were wary of colleagues' reactions, value for PD; difficult to design engaging and informative sessions	Audio and video, transcripts, journal entries during observations
		Interviews with teacher leaders		Transcripts of audio
3	Same as Year 2; parallel focus on raising test scores	Same as Year 2	Leaders and teachers felt pressure from the principal and state; possible conflict between teaching for engagement and for higher test scores	Same as Year 2

Note. PD = professional development; PLC = professional learning community.

Just before the second year (2011–2012) of the PLCs began, the middle school learned that it had received a D grade from the state for insufficient student progress on the high-stakes standardized test. As mandated by the federal law No Child Left Behind (2002), all schools are required to measure progress in test scores among different subgroups, not as school-wide averages. The test scores fell short of goals for two subgroups of students: special education students and low-income students receiving free and reduced price lunch. The teachers were demoralized by this event. The district informed the principal that her contract would be extended for only 1 year rather than the usual two. The new social studies leader, a 30-year veteran, described the atmosphere in the school as "the worst [I have] seen it." This event focused the principal and the teachers on improving test scores and raised the possibility of devaluing the original object of the PLCs, which was to support engagement through instruction. Thus, the activity systems of the state, the school district, and the principal intervened in the activity system of the PLCs and imposed an additional object: improved test scores.

Participants. The principal and all teachers ($N = 32$) agreed to participate in the larger study and in the PLCs. In 2009, when the study began, Augustus spanned Grades 6 through 8 and served 641 students, 45% of whom received free or reduced lunch, the highest percentage of the three middle schools in the district. A total of 84% of the student body was Caucasian, 5% was multiethnic, 5% was African American, 3% was Hispanic, and 3% was Native American. The school district in which the school is located serves nearly 11,000 students; 79% are Caucasian, and 27% receive free and reduced lunch.

Selection of PLC Leaders. In the first year of the PLCs (2010–2011), nine teachers either volunteered or were selected as leaders by their colleagues across four content areas (mathematics, language arts, social studies, and science). Specialist teachers also participated in PLCs, but we do not report those results here. Teacher leaders represented all three grade levels (Grades 6, 7, 8). All teachers were Caucasian, with teaching experience ranging from 3 to 20 years. During the first year of the PLCs, three content groups had one single leader each; the social studies group had two leaders because both teachers volunteered. During the second year of the PLCs, there was one social studies leader and two leaders each in science, language arts, and mathematics (see Table 2). Three to five subject area teachers participated in each PLC along with the leader. During the second year of the PLCs, membership in some groups changed because some teaching assignments changed (e.g., from social studies to language arts).

TABLE 2
Teacher Leaders During 2 Years of PLCs

Teacher Leader Content Area	*Gender*	*Year of PLC*	*Years of Experience*	*Volunteer or Chosen by Colleagues*	*Recognized as Effective Teacher*
Social studies A	F	1	20+	Volunteer	Yes
Social studies B	F	1	20+	Volunteer	Yes
Mathematics[a]	F	1 and 2	20+	Volunteer	Yes
Science[b]	F	1 and 2	5–10	Chosen	No
Language arts[c]	F	1 and 2	10–15	Volunteer[c]	Yes
Language arts B[d]	F	2	15–20	Volunteer	Yes
Social studies	M	2	15–20	Volunteer	Yes
Science[e]	F	2	10–15	Volunteer	Yes
Mathematics	M	2	1–5	Volunteer	Yes

Note. PLC = professional learning community; F = female; M = male.
[a]The mathematics leader was a coleader in the second year but only consulted.
[b]The other science teachers did not want the leader role and asked the science leader to take it; she did not have the school-wide reputation of the other leaders.
[c]The language arts leader volunteered because she thought that the principal wanted her to do it.
[d]Social studies leader B joined the language arts group in Year 2 and agreed to colead.
[e]The new science leader coled with the original science leader.

Data Collection

In order to reduce the risk of systematic bias and enhance the trustworthiness of our findings, we drew on multiple data sources and collection methods (Lincoln & Guba, 1985). More specifically, in order to understand the nature of the leaders' goals for the PLCs, the leaders' perceptions of the PLCs, and the way in which the leaders enacted their goals during the PLCs, we collected three types of data: the teacher leaders' interactions with their colleagues during PLC meetings, interviews of teacher leaders following each PLC meeting, and field notes from each PLC meeting and teacher leader meeting (see below). We then triangulated the teacher leader interviews, observations of the PLC meetings, and data on teacher leader meetings.

Teacher Leader Meetings. During the 2 years of the PLCs, we conducted a meeting for the teacher leaders before each leader-led PLC. During the first year of the PLCs, the purpose was to give leaders an opportunity to better understand the match between engagement principles and related instructional strategies. Leaders devoted each PLC to one of the engagement principles (e.g., competence). During the second year of the PLCs, we encouraged leaders to explicitly discuss and try to enact the norms of the PLC (e.g., reflection, analyzing student work; see the literature review) in the

service of supporting student engagement. We encouraged leader discussion and joint planning (see Table 1). The first author and members of the research team led these meetings. Each meeting was audio recorded, and all members of the research team kept written field notes of the meetings.

Observation of PLC Meetings. Each content area PLC met four times per year (September, November, February, March) for 3 hr. This schedule was chosen to allow teachers to enact engagement strategies in their classrooms between meetings and then reflect on outcomes during their meetings. Leaders led discussions with content area colleagues about the meaning of the engagement principles and instructional strategies in relation to student engagement while beginning to enact goals of the PLCs, such as fostering reflection and encouraging collaboration.

Two researchers attended each PLC and interacted with the groups only when invited by the teachers. Most of these interactions involved clarification or elaboration of ideas regarding the engagement principles. Each meeting was audio- and videotaped, and each researcher in attendance kept written field notes of the meetings. The field notes from each researcher were combined and turned into narrative accounts of each PLC meeting (one per meeting). In addition, we transcribed the audio recordings from the PLC meetings. These records allowed us to reconstruct teacher leaders' interactions with colleagues and the artifacts they used, providing context for the leaders' interviews.

Interviews of Teacher Leaders. During the 2 years of the PLCs, we interviewed the teacher leaders after each of their four PLCs. Interviewers had attended the teacher's PLC. Interviews were semistructured and lasted about 45 min. Whenever possible, we conducted these interviews within a week of the PLC meetings. This timing allowed us to gain an understanding of leaders' perceptions of their roles, their goals, their construction of the relation between instruction and student engagement, and obstacles they encountered. In addition, we asked the same interview questions during all eight interviews (four per year for 2 years), which allowed us to track these ideas over time. Interviews were audio recorded and transcribed verbatim.

Data Analysis

All field notes and transcripts were converted to text documents. We analyzed the interviews in the following sequence. First we read all interview transcripts from the first year of the PLCs and selected quotes that were consistent with the broader categories of our interview questions (e.g., goals, roles). The first and third authors took margin notes relating the quotes to the interview questions and then compared interpretations. We then reread the quotes and our initial

interpretations and labeled each quote with a code. Codes were labels for leaders' unique responses to interview questions. For example, codes for leader role included feels responsible, comfortable with role, wary of role, low efficacy, feels autonomous, does not lead, and uncertain about goals. A total of 20% of the interviews were coded for reliability, which yielded a moderate level of interrater agreement ($\kappa = .57$). When coders disagreed, they discussed differences and came to agreement. If codes were similar, coders could agree on one code to represent several. However, in trying to differentiate nuances of meaning with different codes, we created a large number of codes, which yielded lower kappas (Sim & Wright, 2005).

Next we created a codebook by examining codes and grouping the ones that emerged most frequently across interviews into themes. Six big themes emerged from the interview data: (a) leader role, (b) goals for PLC, (c) (school and teacher) culture, (d) understanding/application of engagement principles and goals of PLCs, (e) obstacles, and (f) outcomes (see the Appendix for examples). As we continued to analyze the interviews from the second year of the PLCs using this codebook, we noticed that the six salient themes continued across years, but additional codes within themes were necessary to reflect the changes in how leaders talked about these themes from the first to the second year of the PLCs. For example, most leaders in the first year of the PLCs expressed discomfort in the leader role; by the second year, leaders were more comfortable with the role. Within each theme, we retained codes that appeared 25 times or more. Each leader mentioned from two to five of the major themes; there was some overlap among codes for the leaders, but no one code was mentioned by everyone. The resulting codebook consisted of six themes and 70 codes.

Next we examined our ethnographic notes from each leader's PLCs and teacher leader meetings. We read and reread the interactions among teacher leaders, their colleagues, and researchers looking for events that either supported or did not support the themes in the teacher leaders' interviews. In general, leaders' interactions with their colleagues and with the researchers reflected their responses in the interviews. Close examination of these data sources together allowed us to identify the social practices in the school, such as manifestations of teacher culture, power, and status, and how they played out during the 2 years of the PLCs. The analyses that follow relied on both social practices and discursive data.

Operationalization of CHAT

Table 3 describes how we operationalized the elements of the activity system. We used both the six themes that emerged from the leader interviews and the components of the PD design as sources. The subject, object, community, and division of labor were manifestations of our design. We asked teachers

TABLE 3
Operationalization of the Cultural-Historical Activity System (CHAT)

Dimension of Activity System	*Source: Design of PD*	*Source: Themes (From Interviews)*	*Explanation*
Subject	Teacher leaders to lead PD in Years 2 and 3		Teachers were chosen to lead because they were familiar with the students, curriculum, and school
Object	The object of the PD was to foster student engagement through improved instruction		The principal and her leadership team (teachers) invited the researchers to lead the PD and approved the object
Tools	Leader- and researcher-designed materials, group discourse, planning meeting for leaders		The researchers developed materials defining engagement principles and related instructional strategies and provided readings on the goals of a PLC (collaboration, etc.); tools were unfamiliar and leaders were uncertain about how to use them; planning meetings before PLCs were designed to support tool use
Rules	Leaders tried to meet expectations of the researchers and the principal	Roles	Leaders' roles were novel, thus difficult to fulfill
		Goals	Leaders' goals for the PLC conflicted with many colleagues' preference for less PD
		Culture	Leaders were uncomfortable with their new status because it violated the equality norm of teacher culture; some teachers believed that PD was unnecessary
		Obstacles	Colleagues complained of the time required for all PD, which made daily teaching responsibilities more challenging for them
			Pressures from standardized testing and the D grade did not match leaders' goals (influence of another activity system)

(*Continued*)

TABLE 3
(*Continued*)

Dimension of Activity System	*Source: Design of PD*	*Source: Themes (From Interviews)*	*Explanation*
Community	All teachers were required to participate in a PLC		Principal and researchers agreed that all should participate and endorsed the object; many teachers did not but had to comply
Division of labor	Leaders were responsible for enacting PLCs designed by the researchers and endorsed by the principal		Most teacher leaders endorsed the object but struggled to attain it because they had not designed the PD; they needed to comply with the goals of the researchers and the principal
Outcomes		Application of PLC and engagement principles	Leaders believed that participants developed a deeper understanding and increased applications
		Goals	Leaders reported progress meeting goals, including increased ownership of and engagement in the PLC, collaboration, and reflection

Note. CHAT = cultural-historical activity theory; PD = professional development; PLC = professional learning community.

(subjects) to serve as leaders in the PLCs to help colleagues understand how to support student engagement through improved instruction (object). The community reflected the interaction of researchers, who designed the PD; the principal, who supported it; and the teachers, who were required to participate. The division of labor reflected different responsibilities for community members. Researchers designed the PD and supported leaders. Leaders were responsible for enacting the PLCs to meet the object. The principal supported the researchers and regularly pointed out the benefits of the PD to the teachers.

Other components of the activity system were operationalized through analysis of the leader interviews as revealed in the six themes. The rules were the most complex and emerged from several themes (role, goals, culture, and obstacles) reflecting the leaders' awareness throughout the interviews of their complex and novel situation in the school (see Table 3 for examples). Finally, the outcomes cited by the leaders were evident in their interview comments about whether they

had succeeded in the application of PLC and engagement principles and whether they had met one of their goals, to promote ownership of the PLC and its object. External events also influenced the outcomes by virtue of being appropriated and modified by the activity system (Engeström, 1991).

Researcher Roles, Trustworthiness, and Rigor

We served as researchers, PD designers, observers at PLCs, and interviewers. These roles were necessarily overlapping and impossible to disentangle. In one sense, the overlap was informative. We could observe, for example, what leaders said and did at the leader workshops and how that information was recontextualized in the PLCs. We also endeavored to recognize and limit biases by sharing roles. We rotated partners so that no one or two researchers routinely attended the same PLCs or interviewed the same leaders. Two researchers attended each PLC as observers. Both took notes and transcribed them for descriptions of PLC activities and interactions, creating a range of representations of activity. These notes and videos of PLCs informed our analyses and gave the researchers an overview, enabling comparisons and contrasts. Researchers interviewed leaders whose PLC they had observed.

Thus, we attempted to meet criteria for trustworthiness and rigor in the following ways (Lincoln & Guba, 1985). To establish the truth value, or credibility, we spent a prolonged time in the field, and we had extensive and frequent contact with the teachers and principal at the school. We sampled the PLCs, through interviews and observations, on multiple occasions over 2 years. We triangulated methods, data sources, and investigators. We asked a peer, a qualitative researcher familiar with PLCs, teacher research, and CHAT, to read our manuscript for credibility several times. Interviews and observations were internally consistent; that is, participants' (leaders') behavior was consistent across these data sources and across years. Our teacher leader participants were representative of their school and, as revealed in the discussion of teacher culture, of other American teachers. Our use of triangulation and multiple investigators also contributed to the neutrality of the study. We used at least two data sources for the components in the ASA and field notes from all investigators.

RESULTS

In what follows, we first analyze the activity system from the first year of the PLCs and then follow it with analysis from the second year of the PLCs.

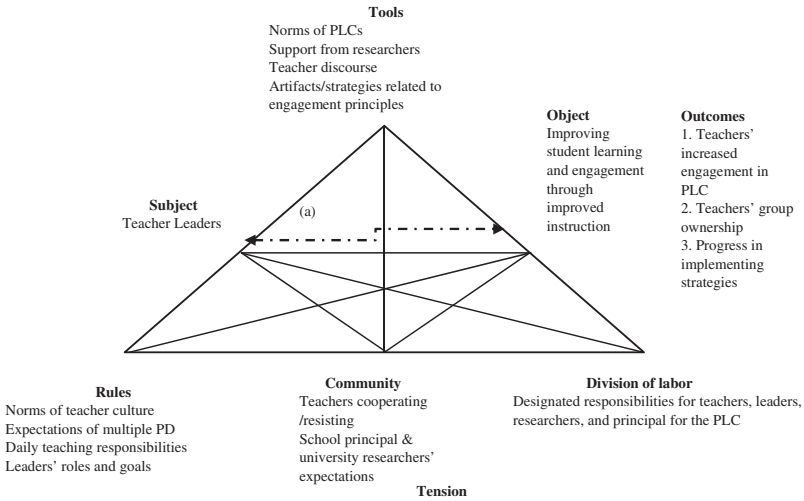

FIGURE 2 Activity system during the first year of the professional learning communities (PLCs). PD = professional development.

How Did PLCs Develop as Systems?

First Year of the PLCs: Competing Activity Systems in Constructing PLCs and Leaders' Roles. The subject of the activity system was the teacher leaders who were charged with guiding their colleagues toward the object of the PLCs, which was to support student engagement and learning through improved instruction (see Figure 2). Both the leaders' roles and the object were novel. The leaders had only learned about the engagement principles and instructional strategies 1 year earlier, along with their peers. Now they were charged with helping their colleagues understand and adopt this new way of thinking and acting.

Pursuit of the object was further complicated by membership in a diverse community including the teachers, the principal, and the researchers. Each of these community members had different responses to the PLCs. Some teachers cooperated, some were passive, and others resented and resisted the leaders' efforts. At the same time, the principal and researchers endorsed the PLCs as worthwhile. The leaders felt pressure to serve all of these masters.

There were several tools available to the leaders. We supported them with a general planning meeting before every PLC, although leaders made their own plans.

During the first year of the Classroom Engagement Project (2009), we had given the teachers extensive examples of strategies for supporting student engagement that the leaders could use. However, most of the tools were quite new, and the leaders were mostly uncertain about how to use them effectively. One familiar tool was discourse. The leaders already had relationships and shared experiences with colleagues, which we assumed could help them engage the group in dialogue about the engagement principles in their subject areas.

In this first year of the PLCs, leaders relied on discourse more than other tools, but discourse represented different mediational means in each PLC. All of the teacher leaders used the generic word *sharing*, but the tools they used revealed their different interpretations of that activity. The mathematics leader asked colleagues to "tell about" what they were doing in their classrooms. The science leader often "shared" instructional resources that she had found or developed and used them as opportunities to talk about strategies aligned with the engagement principles. The social studies leaders referred to opportunities for reflection as "sharing." The different discourses of sharing mediated the ways in which leaders and teachers constructed meaning in the PLCs and their resulting outcomes.

The rules under which the leaders worked made their task more difficult. Some leaders felt that they were violating the egalitarian norm of teacher culture, which asserts that all teachers are equal. Now they had a new status as leader. One leader reported, "In education, you have to be careful … that … you're not doing anything that makes it look like you're blowing your own horn …" Another aspect of the rules required all of the teachers to attend district PD *in addition to* the PLCs. Many teachers expressed skepticism about the value of all of the PD; some believed that instructional change was unnecessary. Moreover, they complained that the PD robbed them of time for their most important responsibility: teaching. Many also viewed the PD as imposed by the district, the principal, and the researchers rather than something they chose. The leaders may also have been held partly responsible for the burden of the PD because they accepted the leadership role. It is ironic that although teacher leaders were positioned to lead the PLCs because of their membership in the school community, they now faced disapproval from that very community. As a result, the leaders changed their designation to "coach." Finally, the leaders felt a conflict between their roles as leaders and their roles as teachers in this community. The language arts leader said, "I haven't felt like a leader. I felt like the colleague and I'm very comfortable with that feeling … [I feel] like an encouraging cheerleader."

In the division of labor, new expectations upended traditional ones. The leaders were supposed to be the "change makers," and the teachers were supposed to be the implementers. In other forms of PD, the principal or the

researchers would assume responsibility for leading, but in this situation they assumed support roles. Furthermore, the leaders, chosen because they were experts on their school community, had not had the opportunity to develop the expertise seemingly required to help colleagues recontextualize instructional practice as "engaging" or to do so in a format—the PLCs—that was fairly alien to normative school practices.

The establishment of the PLCs had changed the status quo—the normal roles and expectations for the participants—and created tensions or contradictions in the system. In this activity system, the tension was between the subject and the object: Inexperienced leaders struggled to attain a novel object. Mediating this systemic tension were the elements of tools, rules, community, and division of labor, which were in mutual relations. In the division of labor, the leaders were responsible for helping teachers improve instruction, but the tools were unfamiliar. Also, the support that leaders received from researchers and the principal felt insufficient in this challenge to the status quo. There was resistance from the teacher community. Colleagues questioned the leaders' legitimacy and the value of the PLC and complained about the loss of instructional time. Rules clashed.

To illustrate the leaders' conceptions of the object, the tools they used, and the group interaction, we present two contrasting examples from the social studies and mathematics PLCs. These leaders' subjectivity, or personal sense of the object (Leontiev, 1978), led them to perceive it differently and thus to conduct the PLCs differently. In the excerpts here, the PLCs were exploring how to support students' competence as a means to engagement.

The social studies leaders strove to support student engagement through professional improvement. Because they were aware of complaints about excessive PD and the leaders' new roles, they explicitly designed early meetings to foster trust and to emphasize practical outcomes. Leader B elaborated, "I do want them to find a feeling that this is their own … to find ways to make this [PLC] productive." In their first meeting, they described the PLC to their group as "actually spending time thinking about practice and what practices work well and what don't and why is that.…" Nevertheless, one teacher corrected papers during the first PLC, seeming to show resistance. In response, the leaders began to construct activities in later meetings that required the participation of all members.

During the last PLC of the year, leader B adapted a tool called "conversation cards," which she had developed in her classroom to promote discussion. Each numbered card contained a question about competence. The goal was to foster reflection on competence, beginning with teachers' personal experience, and then use those reflections to illuminate students' experiences. In the following example, questions usually drew at least five responses or comments, although we have edited for brevity. The majority of speech turns ranged from 100 to 200

words. The discussion stayed on topic for 45 min, and most of the teachers participated.

Male 1 (M1) [reading question]: What area of your life do you feel competent in?

M2: I actually feel competent in like public speaking now, which is something that I didn't feel competent in before.… My first interview for a job, I literally had beads of sweat roll off the tip of my nose.…

M3 [reading]: Okay, … how do you know?…

Leader A: … the way I [know I am] competent is the … feedback you get from other(s)

Leader B: so what needs to come from inside … what do you see that your students might need to feel competent?…

M4: confidence.…

Leader B: How do you think they develop that confidence?…

M4: … prior success.… But I think that some kids just don't recognize that they can get better, because if they don't get it instantly, they [give up].…

M3: … how do we make it appealing enough that they would be willing to work at it?… breed that internal motivation so that [they] go after it?…

Leader B [reading]: When have you felt incompetent and why? Maybe we should ask those kids …

M2: I feel nervous and stressed and uncomfortable.…

Leader A: So just think if you were in school and every time you tried to read, that happened, a little mistake, and you said, "I'm never going to try this again."

Leader B: So how do we support the development of skill so that they can be successful?…

M2: … I don't give in when they want to give up. But support them in their struggle by just giving them a little bit that will get them that little bit further.…

Leader A: Right, "Look, you went from here to here. You have accomplished that." I tell my reading class … they just haven't learned it YET.… what do we need to do … to help them be successful, which is a way to support competency?

Teachers continued the conversation mentioning several strategies, including scaffolding, displaying student work, recognizing students' effort, and creating opportunities for success. By the spring, the social studies teachers were willingly participating in PLCs and took the opportunity to reflect on the meaning of the engagement principles seriously.

The mathematics leader did not appear to structure her PLCs explicitly as PD but rather as a time to "meet together and talk," as she acknowledged in her introduction to the PLC here. Thus, her PLCs resembled "shop talk" more than reflection. Unlike the other leaders, she rarely prepared activities or materials to translate the engagement principles into classroom practice. Whereas other leaders tried to connect engagement principles, instructional practices, and student behaviors, the mathematics leader focused on *what* teachers were doing rather than *why*, even though there were opportunities to connect instruction to engagement. For example, the teachers were using a new project-based mathematics curriculum that year and sometimes commented that their students were more engaged in learning. Although these comments provided opportunities to discuss why instruction was meaningful and supported students' engagement, the leader did not take them up. In addition, the mathematics teachers did not seem as interested in or receptive to the goal of increasing student engagement as did some other groups. Thus, meetings sometimes focused on blaming students for a lack of effort rather than analyzing the underlying cause. As the year progressed, teachers sometimes resisted the leader's approach by changing the agenda into one that reflected their own concerns about the mathematics curriculum and student effort. One mathematics teacher appeared to publicly mock the strategies that his leader used throughout the year.

In this excerpt, the mathematics leader also used the conversation cards, which social studies leader B had offered to all of the leaders. The mathematics leader was not able to sustain conversation about student competence, and the conversation verged repeatedly to topics in which teachers seemed more interested. Although the discussion began with recognition of the importance of competence for students, in the end the discussion flagged and the teachers did not get to the core idea of relating student competence to their instruction. Teachers often provided one-word answers, possibly with a goal of completing the agenda rather than reflecting on the object of supporting student engagement. Almost all of the discussion using the conversation cards is transcribed here; most of the PLC digressed to other topics.

Leader: Well why don't we go ahead and get started and it is kind of a relaxing day today. We get to talk to each other. There's not a huge push to get a lot—we're going to get a lot done—but it's just mainly a discussion, which is so nice.

Female 1 (F1) [reads the first question]: What is competence?

M1 [reading from researchers' handout in a sing-song voice]: It's a fundamental human need *[teachers laughing]* all of us want to feel that we are good at something or improving at it. Even students who deny they care about learning or school know how important achievement is and would like to be successful.…

Leader: … They do wanna succeed. Yeah … Don't you think?…

M1: I think they all do, it's just that some of them cover it up. "Well, I don't care," because they don't think they're very good or they don't want to look stupid …

Leader: And that could be a build up from years, you know? If they think they're not good in math because of previous years, you know?…

F1: Sometimes they choose not to and let everyone else do the work and.…

[Teachers begin a 15-min digression on curriculum and instructional issues]

F4 [reading]: What common words or perceptions do we have about competency?
Leader: Smart

F2: I think as teachers we probably think mastery.

F3: A's and B's.…

Leader: That's probably pretty good. Anything else? Okay, let's go on to [question] number 3.

M1 [reading]: What makes you feel competent as a teacher?

M1: I also like when the kids are struggling and all of a sudden you see the lightbulb …

M2: Like when we're doing group work … it's nice when one group who really understood it shares it and the other groups are like, "OOHHH, YAAAH!!!"

F3: I like it when they can explain it back … show you how it could be done.…
[Another long digression]

Leader: [Pause] Well okay, how about number 5?

M2 [reading]: How can we transfer our personal experiences with competency to our classroom? *[Long pause]*

Leader: … I bet all of us … felt good in school and were competent.… I think we're aware of kids who don't [feel comfortable]. And parents who don't.

F3: I just think showing an enthusiasm for the subject matter.

[Another digression]

M2: … kind of being a role model for some students and saying, "Well I was successful because I worked hard in school and I did my best all the time." … So I try to get that across to my students.… work hard and just do your best. If you get those instilled, then you can do anything.

F3: [Question] Six, how do we recognize when a student feels competent in our classroom?

F2: Smiles.

F3: Participates.

Leader: Leads.

M2: Shares.

F2: Just engaged.

M1: I think their energy and their excitement

M3: [My question] is what do we do for a student that seems to lack competency in our classroom?

F2: Well I call on them when I know they have the right answer.

Leader: Well that was a great discussion! Why don't we take a 10-minute break?

Unlike the social studies group, the mathematics group seemed more intent on completing the activity than using the activity to address issues that they recognized in their students' behavior. The social studies group concluded with suggestions for addressing competence issues, whereas the mathematics leader concluded the discussion after just one suggestion to support competence. Throughout the year, the mathematics leader seemed uncertain about how to engage her group, and discussions remained on a surface level.

How Can One Interpret Changes in the PLCs in Terms of the Systemic Activity and Its Tensions?

After 9 months of PLCs, the outcomes of the activity system, as expressed in leaders' interviews, were increased group engagement and ownership and progress in implementing strategies (see Figure 2). The outcomes imply that the leaders believed that the tension was lessening or resolving. We observed that after a year of participation in PLCs, many teachers became more accustomed to discussing instructional strategies and student engagement. They appeared to take more ownership of student engagement, and, because the meetings often focused on how strategy implementation had worked, the teachers were implementing strategies in their classrooms.

We attribute these outcomes to the fact that as teachers became more familiar with the PLC process and the object, they began to acclimate to the activity and to find some value in it. The leaders in the social studies and science groups encouraged such change. Through their local innovations (Cole & Engeström, 1993), they took care to structure the PLCs to meet their colleagues' needs, thus increasing cooperation and buy-in. These leaders became better at engaging their colleagues, and the colleagues became more engaged. Social studies leader A said, "It became appropriate to talk to your colleagues, to discuss things, to reflect." The science leader commented, "As the year progressed we got into not just some surface stuff, we got into deeper conversations." Her ongoing attempts

to guide teachers to analyze instructional materials and how they were related to learning and engagement may have served to awaken colleagues' interest in something more meaningful than the instructional routines they normally engaged.

In the other two groups, the PLCs addressed the object mostly by evaluating the effects of strategy implementation but often diverged to topics of curriculum, testing, and student effort. The mathematics leader mused, "People … shared a little bit more of … how they feel about things … so, I'm sure it got a little deeper, maybe." The language arts leader represented teachers' engagement, ownership, and sense making as follows: "Even when we're off task, those conversations to me are valuable, because … we don't get to sit down very often and just talk about our craft." Although PD overload and loss of instructional time remained an obstacle, it may have been that the teachers came to value having time to discuss instruction, which is uncommon in the United States. Overall, leaders' roles and goals appeared to normalize over the year.

Second Year of the PLCs: Collision of Standards-Based Reform and the Culture of PLCs. The subject guiding the activity system was the teacher leaders (see Figure 3). The new object, to increase test scores, was added to the original object in response to the D grade that the school had received from the state related to standardized achievement test scores. Some believed that the two

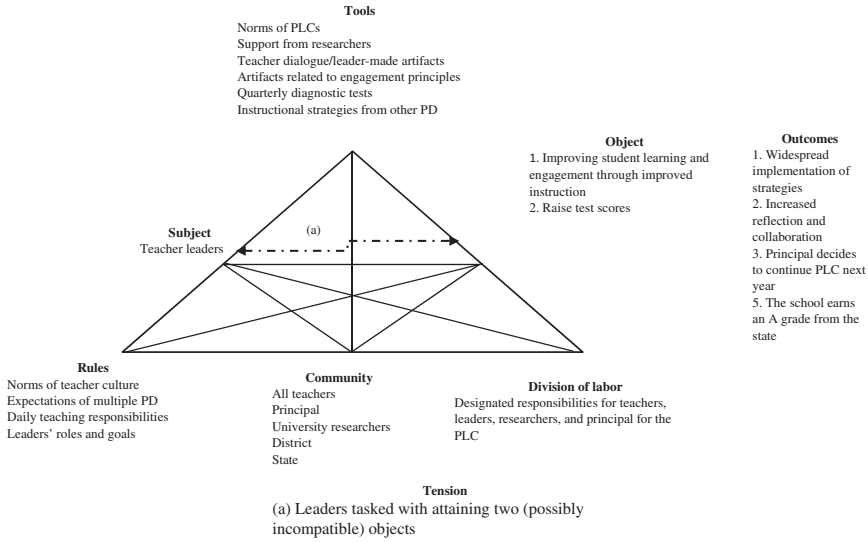

FIGURE 3 Activity system during the second year of the professional learning communities (PLCs). PD = professional development.

objects were incompatible, but the principal believed that increasing student engagement and learning would lead to better test scores.

Relations among members of the community changed. During the first year of the PLCs, the teachers had been divided over the requirement for PD. But this year, the threat of accountability tended to unify the leaders and teachers, who were all responsible for improving test scores. The community expanded to include the school district and the state, because they were monitoring the principal's and teachers' efforts to improve test scores. The principal's role in the community changed from supporting to influencing the purpose of the PLCs. The role of the researchers in the community was diminished with the emphasis on test scores.

The tools for attaining the object included continued researcher support and artifacts for engagement principles as well as the norms of the PLC. During the first year of the PLCs, the leaders focused almost exclusively on engagement and instruction. This year, researchers explicitly encouraged the leaders to emphasize some of the norms of the PLC, which we believed might increase the quality of interaction. Most of the leaders led activities on reflection for the teachers. Many also analyzed some student data, which in turn tended to support collaboration. In addition, the principal required that teachers administer quarterly diagnostic tests to monitor student test performance. This new tool provided data on student progress on content standards, potentially enabling teachers to adjust instruction.

The rules that guided the subject were similar to those of the previous year, although teachers were more supportive of the leaders' role and they began to acknowledge the opportunity the PLCs provided to work on raising student achievement. The division of labor changed also. In the first year, the principal and researchers supported the leaders, who were to attain the object. In the new division of labor, the principal asserted her authority by tasking the leaders *and teachers* with instructional improvement and raising achievement scores. Her visits to the PLC meetings briefly displaced the leaders' agenda and changed the foci of the meetings to achievement testing and standards. After a mathematics PLC in which the principal challenged teachers to explain why quarterly test scores were low, one teacher commented, "It's just not … a good environment for a teacher … there's so much stress around the testing. I don't think that's the best learning environment for the kids either. But, that's reality I guess." The researchers retained the role of supporting teacher leaders.

The tension produced by the components of the activity system was between the subject and the object—the leaders were expected to attain two objects, which many saw as contradictory. Mediating this systemic tension were the interacting elements of community, tools, division of labor, and rules. In the community, the principal had taken away the autonomy of the leaders and asserted her power in focusing both the leaders and teachers on achievement scores. Teachers were required to use a new tool, diagnostic testing, which took

time and attention away from the original object. In the division of labor, the principal expected both leaders and teachers to work to attain both objects, even though her directives appeared to emphasize one: raising achievement scores. All of this occurred within the context of the rules, which required teachers to continue attending PD and the PLCs, possibly making it more difficult to provide the good instruction that would support improved test scores.

Despite the upset of events as the second year of the PLCs began, some changes positioned the PLCs to better address the challenges. The leadership was stronger in both mathematics and science and thus more focused on instructional improvement. The new mathematics leader brought different tools and the additional science leader provided welcome affirmation of the original leader's focus on instructional strategies. The new social studies leader was a respected veteran teacher (see Table 2). Also, both leaders and teachers were more familiar with the potential and processes of a PLC. In the excerpts here, we illustrate how the mathematics and science leaders tried to assimilate the demands of the quarterly tests into instructional decisions. In contrast, the language arts group struggled to continue the focus on the engagement principles in the new environment focused on standards and testing.

The new quarterly tests placed an emphasis on content area vocabulary, and this topic became a focus for the leaders of the mathematics and science PLCs. The new mathematics leader tried to address the increased instructional responsibilities as an opportunity. In the first PLC, the leader engaged the group in discussing the best ways to teach mathematics vocabulary, weaving in the use of effective instructional strategies.

> *Leader*: [Are there] some other strategies for improving our vocabulary development?
>
> *F1*: I just think using it—like you said, instead of saying "flip the second fraction," we say "we multiply by the reciprocal."
>
> *Leader*: Any other strategies you can think of?
>
> *F1*: You could have a problem and have a vocabulary word that would match what you are doing in the problem …
>
> *Leader*: … like commutative property.
>
> *Leader*: Has anyone used the vocabulary strategies before a unit or chapter? I have never done it before, I usually do it as a review.
>
> *F1*: … if you go over the word in advance, there is no reason for them to remember them. Unless you are using it and making it applicable, the kids don't retain it. That's why I have a hard time with some of these vocabulary words. I need to cover them … for example, *right prism*. The kids need to know what a right prism is, but how does that apply to what we are doing now? Just to cover it.… If you can make

> it useful and apply it to something, that's good. But if you don't apply it to something … it is meaningless to them.

Although the directive to emphasize content area vocabulary was an additional responsibility, the teachers appeared to take it seriously, evaluating effective ways to teach it. F1's comments also imply that she (and the group) were interested not just in better test scores but also in student learning. There were frequent exchanges among the mathematics teachers in the second year of the PLCs about student learning problems and how to address them. In this way, teachers began to hear about their peers' thinking and practice that may have been inaccessible before the PLCs.

The mathematics leader also encouraged discussions of student work. In this example from the second PLC, he described an application of finding the area of an irregular shape. He modeled the importance of asking students to apply mathematical concepts, not just algorithms, and of students' approaches to problem solving. The problem involved a man who was making kidney-shaped desks and who needed to know the amount of supplies to buy.

> And we talked before we did this about how area is the amount of space on the inside of an object and how many square units can fit on the inside of an object.… So when they got this there were groups initially who just … traced it, looked at it, counted all the way across, counted the height and said "We'll just multiply those two things together." So I said, "Uh, is this a rectangle?"… And they were like "Oh, no." So then they realized that they would actually have to count all the square units. Some groups figured that out right away … and it was interesting just to see how they did that.… Other groups started in the middle and counted the whole ones first and then worried about the outside ones last, so as they're working, I'm just going around and seeing what they're doing and ask them questions like "Why are you doing that?"… So, it was interesting, I think it got the point across of what area is, what we measure it in, so that was good.

In this excerpt, the leader modeled how to reflect on student thinking and how to foster it. This model was in contrast to more superficial descriptions of activities from the first year of the PLCs, which rarely analyzed students' learning, and it represents the tenor of the mathematics leader's contribution to his PLC. However, tensions remained. The leader admitted during an interview that the burden of time out of the classroom continued to be a problem: "[The PLC] feels like just another thing that we have to do on top of all of our teaching.… I'm gone 30 days during this year" for PD.

Like the mathematics leader, the two science leaders had accepted the new focus on content area vocabulary introduced by the quarterly tests. During the year, they devoted much time to introducing vocabulary strategies they had learned in another PD called Content Literacy. The new science leader B was

one of the most experienced and respected teachers in the school. In the middle of the first meeting, she suddenly admitted to her colleagues that she was overwhelmed with all of the new demands:

> Personally, I feel overwhelmed.… I feel that there are too many things on my plate. I was in the worst mood yesterday I have been in all year.… It wasn't characteristic of me … it was not the students.… I love the students. I am feeling overwhelmed with all these different meetings … and new curriculum and I feel like I am not doing my best. [But] I am *trying* my very best. I feel like I need to be working 20 hours a night.…

This comment stands in contrast to her successful leadership in the PLC and demonstrates the conflict that most teachers felt. Despite her best and sincere efforts to follow the principal's directives about focusing on vocabulary (and test scores), even this master teacher felt great strain. However, after this admission, she still defended the extra effort to a colleague who complained about the increased demands on teachers.

> *F1*: When you see something like this [notebook] with all these different strategies. … first, I'm overwhelmed by this list; I don't even know what some of them [strategies] are … because I think of all the things I should be doing.… I can't do all this stuff.
>
> *Leader B*: I am feeling overwhelmed, because part of me is a perfectionist. I'm not doing it and I want to do everything and we can't. For the vocabulary development. … Maybe take a class a week and grade their rubrics, so we are doing it, but make it manageable.
>
> *F1*: That's a problem. I feel like there is so much pressure on us … I feel like the higher ups … they don't care how much time we spend doing this. They don't care how much time outside of class.… They just want us to perform. They just want the kids to perform; it's all on our shoulders. It's not on the kids' shoulders. It's not on the parents' shoulders. It's on our shoulders.… My back is bending, it's going to break.
>
> *Leader B*: I do need to think about how to meet the expectations that we know we have to meet, but to do them in a manageable way.… I am very optimistic I will find that manageable way.… We need to be doing content literacy strategies; we can't do everything, every day, every week … It has to be a manageable load or we are going to be too stressed to be effective in the classroom.

Despite her personal struggle, leader B's refusal to let the teacher's complaints derail the purpose of the PLC demonstrated her professional ethic and her willingness to challenge the norms of teacher culture and discourage "gripe sessions," which were frequent in several PLCs the previous year.

During the third meeting of the language arts PLC, the leaders were still struggling to design activities related to the engagement principles, which they saw as valuable. In this excerpt, teachers discussed ideas about reintroducing a focus on belongingness to counteract some negative trends in student behavior. During the conversation, teachers frequently referenced testing and how it had taken away time and emphasis from activities important for student learning.

F4: [Even the hallways] were so clean for the first part of the year. Now there's gum on the floor.… I was kind of hoping that as a building we could … think of some things that would help resurrect the good feelings we had at the beginning.

F2: I don't think as teachers we can do anymore than we're doing.

F1: So let's think about the belongingness activities.

F5: I think with language arts we can tie it [in] … there's an article about bullying. We could … tie it back to the book.

F2: You know, everything is so academic [focused] and [related to the] Acuity *[diagnostic test]*. We need time to talk about issues and you know it used to be that we had um a time to teach that (e.g., bullying).

Teachers discussed various ways they could connect belongingness activities to their curriculum. One teacher described the value that her students gained from a visit to the local homeless shelter and how, despite the emphasis on test scores, she continued the activity.

That's what [the students will] take away. They're not gonna take away Acuity *[the diagnostic test]*. They're gonna remember that project … and going to the homeless shelter and listening to three guests.… All the pressure this year. [But] I just, I couldn't let it [the project] go. (F4)

The principal joined the meeting and changed the topic to piloting the upcoming Common Core standards. After she left, the teachers had a lengthy conversation about standards, testing, and test preparation. Teachers realized that this focus was in contrast to their earlier discussion about enacting engagement strategies:

F3: But the point is so many of those [test prep] activities are contrary to everything —[we have been focused on]

F2: yeah, absolutely. That's not how it supposed to be

F4: It's so opposite

After a long discussion of managing student behavior, the teachers reiterated their intention to focus on the engagement principles as a way of "improving the [school] culture."

> Well, I don't want to abandon the idea of trying to improve the culture … through our engagement partnership.… I think we're doing it well. We're mindful of it, we're trying to place it in there.… How can we improve belongingness, competency, meaningfulness, autonomy … within our school so that there's that climate and culture that we're all trying to [attain]? (F1)

The language arts PLC reflected the teachers' difficulty trying to attain two objects that they often believed were incompatible. But by their last PLC, the tension between the two objects had immobilized the group. Leader B summed up, "We came [to the PLC], planned to be productive, we had materials there, but we still have so much emotion that it's like we need to go to therapy before we can get through this year."

How Can One Interpret Changes in the PLCs in Terms of the Systemic Activity and Its Tensions?

The outcomes of the activity system of the PLCs in the second year, as expressed in leaders' interviews, included a wider implementation of instructional strategies and the introduction of forms of collaboration and reflection. Science leader A observed, "… Last year people were trying to make sense of things and it seems like this year everybody is starting to put things together." Language arts leader B reflected that "we are providing activities that are more engaging to the students … We see strategies that … have an end purpose … it's not just doing it to do it.…"

There was a concerted emphasis on professional improvement, possibly because of the D grade, the additional assessments, and the principal's involvement. In contrast to language arts leader A's belief that "you're not going to get the in-depth reflection this year, because there's no mindset for it," others disagreed. The social studies leader said, "I think more of [the teachers] are doing it [reflecting]. I can honestly say that if you had asked teachers here 5 years ago … they didn't think about what they were doing. Now, I would say most do [reflect]." Science leader A agreed: "Now we've got the time built in that we can reflect more deeply than probably [we] ever had in the past."

Emphasizing newly developed collaboration, the mathematics leader commented,

> I loved talking about what everyone did, how it worked, how we would change it … [in the past] we don't get to do that a whole lot, [just] here and there between classes or after school, before school … we're so busy.

Another benefit of collaboration, according to the mathematics leader, was that "I think it [PLC] makes [teachers] feel like they're important to the group and it kind of tells them that their opinion matters." As a result, the teachers and principal decided to continue the PLCs during the year after we left (2012–2013). Finally, test scores improved and the school received an A grade from the state for the 2011–2012 school year.

DISCUSSION

The notion of the PLC is in vogue, but it is far from clear that PLCs are a panacea for school reform. The goals of PLCs—shared values and norms, collaboration, a focus on student learning, reflective dialogue, and norms of making practice public—challenge the private, egalitarian, and autonomous culture of schools. How teachers learn such demanding and often threatening practices will affect whether PLCs can thrive in schools.

The goal of this article was to analyze the "change process … entailed in changing professional culture" (Talbert, 2009, p. 556). Tensions in the activity systems suggest that the components with the strongest influence on the development of the PLCs and their leaders over the 2 years were teacher culture, the role of PD and its perceived overload, and the emphasis on improving test scores introduced by the principal after the D grade was received. The interaction of such events may have been the change mechanism that directed the PLCs through the zone of proximal development of the activity (Engeström, 1987). The interaction of these events helps describe the distance between the original, "everyday actions of the individuals and the historically new form of the societal activity" that offered a new solution to the need for student engagement and learning (Engeström, 1987, p. 174). We discuss each here.

Teacher Leadership and Teacher Culture: An Uneasy Relationship

PLCs are an ambitious form of school reform because they aim to change the culture of schools. Although they have been enacted with many forms of leadership, in our PD we designated teacher leaders as change agents. We did so based on the thoughts of experts in educational change, like Fullan (2007), who has insisted that *only* teachers can be effective change agents because only teachers can change the culture. We also intended to empower teacher leaders as experts in the conditions of their school community. Thus, the fact that teachers led the PLCs was significant in their development because it was a novel role for teachers and because it had little precedent in the school.

To be effective leaders, teachers must know how to build relationships and foster collaboration (York-Barr & Duke, 2004). At the same time, they must also

have the skills to encourage teacher engagement, promote teachers' commitment to change, and respond to the group's needs (Borko et al., 2011)—a very tall order for most teachers. Although the leaders had cultivated relationships through informal collaboration, these social encounters had not challenged the cultural norms of teaching (Little, 1990; Lortie, 1975).

Positioning teachers as leaders, therefore, created a cultural conflict that played out from the moment the leaders were chosen (Donaldson et al., 2008; Margolis & Doering, 2012). The leaders' role was made more contentious by the teachers' dissatisfaction with the demands of PD. Engaging teachers in change depended on whether leaders thought that change was desirable and whether they would encourage collective responsibility for student engagement and learning. How leaders addressed this conflict was related to activity and change in their PLCs.

Little (1990) has described teacher collaboration and collegiality along a continuum from promoting independence to promoting interdependence and from preserving autonomy to engaging in joint work. The less effective leaders (especially in the first year of the PLCs) maintained the norms of the culture by affirming colleagues and pursuing a surface-level compliance with the object of scrutinizing instructional practice. They reinforced teacher independence through interactions like "storytelling," "scanning for ideas," and offering aid if requested (Little, 1990, p. 513). Discussions were similar to the quick interactions that teachers have in the halls or lounge—incomplete accounts of more complex practice. Discussions did not reveal the principles that informed teachers' planning or teaching and thus preserved autonomy and privacy. For example, the interaction in the less effective groups consisted of such accounts as describing a technique for group work or offering a suggestion for forming groups but did not interrogate their relation to the teachers' beliefs, their practices, or student learning.

The more effective leaders promoted more advanced forms of collaboration like "sharing" or making their work accessible to others and occasionally approached a "collective autonomy" in joint work (Little, 1990, p. 513). Although teachers had to make their practice more public, they were also credited for their expertise, as noted by the mathematics leader. In the first year of the PLCs, the social studies and science leaders attempted to challenge the culture by creating opportunities for reflection, including disagreement and deprivatization of practice. In the second year of the PLCs, more leaders endorsed cultural change and used strategies that promoted interaction regarding more substantive issues like the relation of instruction to learning.

The Disruptive Force of PD. The goal of the Classroom Engagement Project and the PLCs was to provide teachers with the rationale and strategies to improve

student engagement and learning. Many in the community were not convinced of the need for instructional change. Although teachers complained about the burden of PD, many of the strategies they learned in the additional PD programs made their way into their instruction, supporting both student engagement and learning. These strategies became tools to marry the seemingly incompatible objects of student engagement and improved test scores in the second year of the PLCs. The strategies offered instructional variety, were more pedagogically effective than some typical instruction, and encouraged teachers to pay more attention to learning. These strategies may have emerged as a "germ cell" idea for the reorganization of the activity in order to "solve its aggravated inner contradictions" which "gains momentum and is turned into a model" (Engeström, 1991, pp. 268–269). The availability of new instructional strategies provided a conceptual and practical link between student engagement and learning.

The Object of the PLCs: How the Emphasis on Test Scores Catalyzed the Community. At the beginning of the PLCs, neither the teacher leaders nor the teachers had necessarily endorsed the object of the PLCs, the improvement of instruction. To many, instruction was a teacher's personal domain and thus not open to collective scrutiny (Lortie, 1975). To judge some instruction better than others violated egalitarianism. Therefore, the assumption that instruction could and should improve challenged teachers' prerogative to make personal decisions (Little, 1990).

Yet the state's sanction and the principal's unwavering focus on collective responsibility for instruction gave tangible purpose to the PLCs. The leaders and teachers had no choice but to cooperate in efforts to raise achievement. They realized that they needed one another's contributions in order to succeed in their own work. As Hargreaves (2009) asserted, teachers cannot learn unless they get outside their own classrooms to connect with other teachers.

Although teachers had always shared ideas, they had never done so in such a sustained way (12–15 hr per year) or with the explicit focus on student learning. Both this new way of interacting and the possible perception of professional benefits shifted norms somewhat from autonomy to collaboration and from privacy to group reflection. With the threats of the second year of the PLCs, the leaders built on these emerging practices to grapple with strategies to raise achievement. In this process, some may have abandoned more ambitious instruction, but collaboration also gave weaker teachers access to instructional practices of the stronger teachers, which may have contributed to improved test scores (Horn et al., 2017). The external pressures were "appropriated by the activity system, turned and modified into internal factors" that caused change (Engeström, 1991, pp. 268–269). Both the leaders and the principal agreed that professional responsibility for student learning had increased.

Understanding Changes in Teacher Leaders' Reports and Actions. Engeström and Sannino (2010) argued that the most important result of change is agency. By creating PLCs, we positioned teacher leaders as change agents, but leaders did not initially feel agentic. It was only through the dialectical process described here that leaders resolved some tensions and transformed the original object. The leaders owned the new object of professional improvement and increased achievement in the second year. The PLCs became useful to leaders (and teachers) as tools for attaining the object. The outcomes supported leaders' competence and hence their learning and agency.

Limitations

A limitation of this analysis is that the outcomes are unique to the case. However, PLCs will experience contradictions as activity systems transform (or not), and so the processes of change (e.g., mediation, tensions) are applicable to all activity systems. Other limitations include the need to freeze frames of activity in the triangle and take the components, such as rules and tools, out of their context. Diagramming activity systems was a tool for visualizing and putting into words the teacher leaders' interviews, actions, and tool use. By specifying potential mediators and tensions simultaneously, however, we found the diagrams more of an asset than a liability. ASA prompted many insights into the data set, not least of which was that the D grade and the subsequent diagnostic testing prompted some teachers to question existing norms and help propel change.

Future Research

There is scant empirical research on the development and efficacy of PLCs; therefore, future research should examine other models, participants, and outcomes. As scholarship on teacher leaders develops, it is worthwhile to examine leadership in light of teacher culture and how teachers learn from one another (e.g., Horn et al., 2017). ASA has focused attention on tensions that are inevitable (and generative) in activity systems. This lens on development and change could be used productively in studies of PLCs and teacher leadership.

Conclusion

As this study showed, PLCs are difficult to develop because they challenge the status quo in schools. Learning scientists are well positioned to continue the study and development of PLCs because of their focus on learning processes, learning environments, and design-based research. PLCs are meant to be sites of collective teacher learning and conceptual change. Analyses of how teachers learn in the zone of proximal development of the activity (Engeström, 1987) and which tools are most

helpful in supporting learning should provide information for the design of effective PLCs. Furthermore, analyses of the learning environment can suggest, as do the components in the activity systems, how roles, power, policy, and community cohesion can afford or constrain learning in PLCs. ASA offers one tool for investigating how transformations happen and how professional cultures change.

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APPENDIX: THEMES, CODES, AND REPRESENTATIVE QUOTES

TABLE A-1
Themes, Codes, and Representative Quotes

Codes	*Themes*
Leader goals	
Reflection: Professional improvement	"[The goal is] not so much just sharing, 'This is what we did,' but … other details about it. 'What … could you do better, how did the students … like it? Did they learn from it?' Things like that I guess."
Reflection: Shared values	"I think it was mainly vocabulary and the reflections; those things I wanted to talk about. Make sure that … everybody was more or less on the same platform."
Take perspective of others	"One [goal] was to try and explain what a PLC was because we, they didn't really [know]."
Build relationships	"… and I kind of just wanted to get a feel for what this group, you know, how they were going to participate."
Leader roles	
Comfortable with role	"I figure, I was volunteered, picked, however you want to say it, to be the leader—that's my job. Do the best I can."
Low efficacy	"I was nervous and tongue tied at the very beginning of the meeting and that was the first thing I talked about, and I felt the least comfortable with."
Failure to lead	"Umm supportive, a resource, cheerleader … that's it right now, that's as far as I see … my role being."
Wary of role	"So my role was probably more to be the observer to see and kind of reflect upon it in that way because one thing we didn't want to do was overwhelm people."
Teacher culture	
Challenge norms	"I think [PLC norms of] focus on student learning, making practice public and then reflective dialogue, those three are the ones … they're more risky [for teachers]."
Challenge norms	"Having this idea [that] your door is closed and nobody knows what's going on … [sends a negative message] to kids or parents. We can't do that anymore."
Maintain norms	"[If] I'm watching their class, I'm not going to feel comfortable at all saying 'Oh, well you could have done this or that.' I'm sorry, I just … and I know there's a lot of people who feel just like me" (regarding making practice public).
Understand/apply engagement principles	
Uncertain	"I personally don't feel as competent dealing with competency, the whole idea of all the questioning and all, that just kind of scares me a little bit …"

(*Continued*)

TABLE A-1
(*Continued*)

Codes	*Themes*
Able to apply	"So they [students] had a little bit of choice [autonomy] in that and it was just out of the [ordinary] for them. It wasn't just a, here's 20 questions for a test. Show your work and give your answer in the blank or whatever. But it was, they were actually making something [meaningfulness]. It was more of a project for them than a test And they did very, very well. And so, that was something completely different … than I've probably ever done as a teacher."
Uncertain	"What does that mean? That something was meaningful … to kids?"
Understand/apply norms of PLC	
PLC goals: Shallow	"… because it was more just colleagues having a discussion which is really where I'm more comfortable anyways than taking on a leadership role."
PLC goals: Deep	"And I also wanted to talk about the idea of grouping, trying to get some different ideas about grouping, and trying to get people to think about how they were doing it, and why they should be doing it."
PLC goals: Deep	"Whereas if we didn't come out and actually spend time sharing that, people might have just kept to themselves a little more …"
Obstacles	
Training/PD	"And so when you have [PD name] and you have [Classroom Engagement Project] and then you have [PD name] and you have [PD name] and you have … it's really … it is overwhelming."
Time	"[The PD] feels like just another thing that we have to do on top of all of our teaching.… I'm gone 30 days during this year."
School climate	"But we still have so much emotion that it's like we need to go to therapy before we can get through this year."
Testing	"We've got testing, testing, and more testing … Time is becoming very precious … um I think you're going to meet with resistance."
Outcomes	
Reflection on progress+	"… we are … providing activities that are more engaging to the students, and definitely that's what we see. We see strategies that … have an end purpose, and that's really clear, it's not just doing it to do it … there's a goal, there's a purpose behind it. So I think that we're providing more of those experiences with the children."
Reflection on progress+ Collaboration	"It became appropriate to talk to your colleagues, to discuss things, to reflect."
	"I loved talking about what everyone did, how it worked, how we would change it.… Hearing from other people was nice because … we don't get to do that a whole lot, [just] here and there between classes or after school, before school … I mean, we're so busy."

Note. PLC = professional learning community; PD = professional development.