CHAPTER 1

Using High-Performing Collaborative Teams for Mathematics

The Common Core State Standards provide a consistent, clear understanding of what students are expected to learn, so that teachers and parents know what they need to do to help them learn. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers. With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy.

—NGA & CCSSO

Students arrive at middle school with many challenges, and grades 6–8 teachers are expected to ensure all students achieve proficiency in the rigorous Standards for mathematics content as well as the Standards for Mathematical Practice described in the CCSS. How can you successfully help your middle school students achieve these expectations?

One of the characteristics of high-performing and high-impact schools that are successfully closing achievement gaps is their focus on teacher collaboration as a key to improving instruction and reaching all students (Education Trust, 2005; Kersaint, 2007). A collaborative culture is one of the best ways for teachers to acquire both the instructional knowledge and skills required to meet this challenge, as well as the energy and support necessary to reach all students (Leithwood & Seashore Louis, 1998). Seeley (2009) characterizes this challenge by noting, "Alone we can accomplish great things. . . . But together, with creativity, wisdom, energy, and, most of all commitment, there is no end to what we might do" (pp. 225–226).

A core premise of this book is that *professional learning communities* provide the best collaborative environment necessary for you to share your creativity and wisdom, create more equitable learning experiences for all grade-level students, and harness the energy and persistence necessary to meet your students' needs, as well as the challenges of understanding and implementing of the CCSS expectations for grades 6–8.

Research affirms the value of your collaboration with others and its positive impact on student achievement (Learning Forward, 2011). Many professional organizations include teacher collaboration as an essential part of professional growth and responsibility (Learning Forward, 2011; National Board of Professional Teaching Standards, 2010;

National Council of Supervisors of Mathematics, 2007). Whether you are a veteran or novice mathematics teacher, your participation in a collaborative team benefits student learning.

Just as students in groups need direction and support to work together well, middle school teachers in collaborative teams also need direction and support to effectively collaborate. This chapter defines and details how to operate successfully as you make the paradigm shift from working as an individual in relative isolation to working within a highly effective collaborative team. Whether you are part of a new team, or a veteran team with deep experience in the PLC process, this chapter enables you to identify the current stage of your collaboration and the types of work and discussions in those stages and provides several critical collaborative protocols through which you can measure your team's continued progress.

Professional Development Paradigm Shift

The Common Core State Standards for mathematics (NGA & CCSSO, 2010a) are a significant advance over previous mathematics standards in terms of their requirements for students, teachers, and organization and structure and their treatment of particular mathematical content. These advances include:

- Emphasis on developing students' conceptual understanding as well as procedural skills

- Fewer topics taught with greater depth at each grade level, providing more focus and coherence within and across the grades

- Increased rigor of content and assessment of content knowledge combined with increased emphasis on applications

- Focus on the progression of standards across grades, reflecting, to the extent possible, how students learn necessary content

- Inclusion of habits of mind—the Standards for Mathematical Practice—that students are to develop in addition to content expectations

As described in chapters 2, 3, and 4, implementing the CCSS in grades 6–8 will require reasonable but significant changes in your mathematics curriculum, instruction, and assessment. To successfully meet those changes, you will need to be engaged in significant, ongoing professional learning with your colleagues.

The fundamental purpose of professional development is the continuous improvement of professional practice (Corcoran, Shields, & Zucker, 1998). Typically, professional development consists of events—experts lead one-day presentations, courses, conferences, or webinars—that you might engage in periodically. While such events can be valuable and instructive, especially as ways to gain initial understanding of the CCSS, they are far from sufficient to support ongoing reflection about and changes in your instruction and assessment.

What is needed is ongoing, sustained professional learning with colleagues—that is, engaging colleagues in a collaborative learning team as part of a larger professional

learning community. Linda Darling-Hammond (2010) summarizes effective professional development, as follows:

> Effective professional development is sustained, ongoing, content-focused, and embedded in professional learning communities where teachers work over time on problems of practice with other teachers in their subject area or school. Furthermore, it focuses on concrete tasks of teaching, assessment, observation, and reflection, looking at how students learn specific content in particular contexts. . . . It is often useful for teachers to be put in the position of studying the very material that they intend to teach to their own students. (pp. 226–227)

In other words, effective mathematics professional development is in many ways the opposite of much of the professional development that you might experience—it is sustained and embedded within professional learning communities and focused on the actual tasks of teaching using the materials teachers use with students. What is meant by *sustained*? It means *effective professional development*—programs that have demonstrated positive and significant effects on student achievement with between thirty and one hundred hours of contact time for teacher collaboration over the course of six to twelve months (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009; Garet et al., 2010). This high-quality professional development often involves collaborative teacher study in a structured way of the very curriculum that is being taught as well as students' acquisition of that curriculum. Embedded in your instructional practice at the lesson level, this approach ultimately leads to your deeper understanding and thus wider adoption of the curricular and instructional innovations sought (Cohen & Hill, 2001; Hiebert, Gallimore, & Stigler, 2002; Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Wayne, Yoon, Zhu, Cronen, & Garet, 2008). These are precisely the components that must be included in professional development efforts for middle school mathematics teachers to enable them to meet successfully the implementation challenges of the CCSS.

Your collaborative effort is part of the necessary professional development paradigm shift required to effectively address *equity*, a critical aspect of middle school mathematics instruction. Equity—ensuring that all students have the opportunities and supports they need to achieve at high levels—is one of your greatest challenges as a grades 6–8 teacher. Too often, grades 6–8 teachers work as independent contractors, developing lesson plans, assessments, and intervention strategies alone, without consultation with colleagues. This lack of collaborative effort creates inequities in students' mathematics instructional experiences and is a contributing factor to achievement gaps. Equity is mostly about consistency in providing high-quality learning opportunities across classrooms. In order to improve mathematics education within schools across the United States, this inconsistency in quality of instruction due to teacher isolation must be overcome (Kanold, 2006). How can this be done? By engaging in a collaborative learning team as the engine that drives the professional learning community process in your school, middle school mathematics teachers can strive to overcome disparities in student achievement. Your collaborative teams provide the supportive environment necessary to share your creativity and wisdom and to harness the energy and persistence necessary to meet the demands of students' needs and the challenges that arise from Common Core expectations.

Teacher Collaboration in a Professional Learning Community

Although great teaching does not look the same in every classroom, the Common Core standards expect you and your colleagues to commit to high-quality instruction and assessment processes as an essential element of successful student learning. Implementing the CCSS with fidelity requires you to not just teach mathematics content but to teach students processes and proficiencies for ways of thinking and doing mathematics—a habit of mind, so to speak. In the CCSS, these learning processes are revealed through the eight Standards for Mathematical Practice (see chapter 2) and the Standards for Mathematical Content (see chapter 3). Your participation and engagement in effective collaborative team discussions on a unit-by-unit basis allow for the creation and implementation of a rigorous and coherent mathematics curriculum and prevent ineffective instructional practices. Implementing the CCSS for mathematics means you and your colleagues working together in collaborative teams must "balance personal goals with collective goals, acquire resources for [your] work, and share those resources to support the work of others" (Garmston & Wellman, 2009, p. 33).

Professional learning communities have become ubiquitous in education, and you may equate PLCs with teacher collaboration. At the same time, various definitions and understandings regarding a PLC *culture* abound. In this book, we use the work of DuFour, DuFour, and Eaker's (2008) *Revisiting Professional Learning Communities at Work* and DuFour, DuFour, Eaker, and Many's (2010) *Learning by Doing* to define the conditions for collaborative mathematics learning teams in an authentic PLC culture. For our purposes, we will refer to grade-level or course-level groups of teachers working together in a PLC culture and process as *collaborative teams*.

DuFour et al. (2008) define a PLC as

> educators committed to working collaboratively in ongoing processes of collective inquiry and action research to achieve better results for the students they serve. Professional learning communities operate under the assumption that the key to improved learning for students is continuous, job-embedded learning for educators. (p. 14)

Typically, schools or districts commit to operating as a PLC with various collaborative learning teams (like grade-level teachers or mathematics teachers) operating interdependently within it to accomplish the larger PLC goals. Becoming a collaborative learning team (collaborative team) is more than meeting regularly to discuss instruction with your collaborative team members. The defining feature of a learning community is "a focus on and commitment to the learning of each student" (DuFour et al., 2008, p. 15). DuFour et al. (2008) identify six characteristics of effective PLCs.

1. PLCs have shared mission (purpose), vision (clear direction), values (collective commitments), and goals (indicators, timelines, and targets)—all focused on student learning.

2. There is a collaborative culture with a focus on learning. However, collaboration is a means to an end, not an end in itself. According to DuFour et al. (2008),

"*Collaboration* is a systematic process in which teachers work together, interdependently, to analyze and *impact* professional practice in order to improve results for their students, their teams, and their school" (p. 16).

3. Collaborative teams engage in collective inquiry into "1) best practices about teaching and learning, 2) a candid clarification of their current practices, and 3) an honest assessment of their students' current levels of learning" (DuFour et al., 2008, p. 16).

4. PLCs are action oriented; they learn by doing. In other words, team members not only read, analyze, and plan but also act on their plans, then learn from the results of their actions.

5. They are committed to continuous improvement. The goal is to create conditions for perpetual learning by engaging in an ongoing improvement cycle of gathering evidence of student learning; developing and selecting strategies to address learning needs; implementing the strategies and analyzing their effectiveness; and then applying new knowledge in the next cycle.

6. Collaborative team members are results oriented. All teachers' efforts "must be assessed on the basis of results rather than intentions" (DuFour et al., 2008, p. 17).

In short, a PLC process involves a shift from a culture of isolated, independent professional practice focused on the achievement of students in your class to one of collaborative, interdependent practice with shared accountability for the learning of all students—even those that you do not teach personally. No longer is the focus on *my* students or *your* students, rather it centers on *our* students in the grade level or in the course.

Considering the unprecedented clarity of the CCSS for mathematics, DuFour et al. (2010) verify why is it essential to take action in your collaborative team to develop a shared understanding of the content and the assessment of what is to be taught, because doing so:

- Promotes clarity among your colleagues
- Ensures consistent curricular priorities among teachers
- Is critical to the development of common pacing required for highly effective common assessments
- Ensures that the curriculum is viable—that it can be taught in the allotted time
- Creates ownership among all teachers required to teach and assess the intended curriculum

Teacher Collaboration Versus Cooperation or Coordination

Although teacher collaboration is an essential aspect of a PLC, what is often considered *collaboration* is actually cooperation or coordination. Cooperation is about being a team player. One potential danger of cooperation is the exclusion of a diversity of team member

ideas. Consider a scenario in which your team members share ideas and lesson plans about how they each teach a learning target about defining and interpreting integer exponents to eighth-grade students. In this case, teachers share resources to cooperate, although each teacher retains his or her own authority to teach and assess the learning target as he or she best understands it.

Coordination, on the other hand, requires the teacher team to do more planning and communicating than cooperation does. Efficiency regarding the management aspects of the course tends to drive teachers to coordinate. For example, an eighth-grade team may coordinate a schedule so all teachers have access to the computer lab to explore geometric transformations during the geometry unit, or it might divide up different content standards from a particular CCSS content standard cluster in order to create end-of-unit assessments for the team. Note that coordination can serve purposes of efficiency but does little to push inquiry and discussion of the daily instruction and assessment in the classroom—the true purpose and high-leverage work of middle school collaborative teams in a PLC.

Whereas *cooperating* and *coordinating* are about individuals on the teacher team making decisions, *collaborating* is about creating interdependence with your colleagues as you work beyond consensus building. When your team is collaborating effectively, members are creating new structures and ways of working that are focused on academic success for all students, not just the students in their own classes. Graham and Ferriter (2008) offer a useful framework that details seven stages of development of collaborative teams. The level at which teams fall within Graham and Ferriter's framework is directly correlated to the level by which team members effectively collaborate. Table 1.1 highlights these seven stages.

Teams that are at the first three stages of collaborative team development are trying to understand what they are supposed to do and accomplish as a team. Consider the following scenario. The seventh-grade team begins meeting weekly at the beginning of the year with little direction as to the purpose of meeting (stage one). Shortly, the team begins to share how each teacher approached proportional reasoning—7.RP (see appendix C, page 194)—in his or her respective classrooms (stage two). By the end of the semester, your seventh-grade collaborative team begins to discuss the homework problems that best represented what students should know and be able to do as they work with the constant of proportionality in tables and graphs—7.RP.2b (see appendix C, page 195)—and who would compile the assignment sheet for this standard to be distributed to students (stage three). At this stage, the seventh-grade teachers are *cooperating* as they begin to share their own classroom practices and delegate team responsibilities.

Teams in stages four and five are coordinating around common planning of instruction, developing common assessment instruments and tasks, and analyzing student-learning results. Consider this scenario. An eighth-grade team comes together to develop a common quiz (stage four) to assess students' ability to use data from a random sample to draw inferences about populations—8.SP (see appendix D, page 206). The following year, the eighth-grade team also creates common assessment instruments for all course

Table 1.1: The Seven Stages of Teacher Collaboration Diagnostic Tool

Stage	Questions That Define This Stage
Stage one: Filling the time	What exactly are we supposed to do as a team? Why are we meeting?
Stage two: Sharing personal practice	What is everyone doing in his or her classroom for instruction, lesson planning, and assessment during this unit?
Stage three: Planning, planning, planning	What should we be teaching during this unit, and how do we lighten the load for each other?
Stage four: Developing common assessments	How will we know if students learned the standards? What does mastery look like for the standards in this unit?
Stage five: Analyzing student learning	Are students learning what they are supposed to be learning? Do we agree on student evidence of learning during this unit?
Stage six: Adapting instruction to student needs	How can we adjust instruction to help those students struggling and those exceeding expectations?
Stage seven: Reflecting on instruction	Which lesson-design practices are most effective with our students?

Source: Adapted from Graham & Ferriter, 2008.

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units or chapters and uses collaborative team time to analyze and compare results, in order to determine how all eighth-grade students are performing on the learning standards for the course and subsequently take action on that learning (stage five).

In the final two stages, teams begin deep collaboration as members take collective responsibility for the learning of all students, differentiating instruction and designing assessments based on student needs by reflecting on the question, Which of our instructional and assessment practices are most effective with our students? After analyzing the data from the unit common assessment instrument (test), the eighth-grade team has identified a small group of students struggling to apply some of the Pythagorean relationships (8.G, see appendix D, page 205). The team develops a differentiated lesson to extend the knowledge and reasoning of students who have mastered the learning target and provide targeted support for struggling learners (stage six). The eighth-grade team will be at a stage seven when it regularly makes adjustments to instruction based on learner needs and discusses the instructional strategies that have the greatest impact on student learning.

Using table 1.1 to diagnose and assess your collaborative team's development supplies crucial data for the appropriate supports, resources, and professional development action. At what stage do your collaborative teams operate? Are teachers cooperating, coordinating, or collaborating? When your collaborative team works together, are discussions

focused on sharing each teacher's lessons or activities without inquiry into assessing student learning? Are meetings centered on when the unit test will be given in class without questioning how teachers are connecting larger concepts throughout the unit? You can use the descriptors in table 1.1 to determine your current team's stage of development.

There are several high-leverage actions (see page 20) that describe the work of a high-functioning collaborative team that has been working together for several years. If your team is just getting started, or is not engaged in any of these actions currently, do not try to implement all of these actions simultaneously. Each activity requires considerable effort and commitment. Less is more. Focus on a few actions for the year and work to implement them well.

Collaborative Practices

The goal of teacher collaboration is deep, widespread knowledge of subject-area content and consistent implementation of best-practice instruction for that content. The structure designed for collaborative efforts is critical for success. Five aspects of collaborative practice are the following:

1. Collaborative team participants

2. Collaborative team commitments

3. Collaborative team leaders

4. Collaborative team agendas and meeting minutes

5. Collaborative team time

In order to do the work of the team described in table 1.1 and to move effectively and efficiently to the more advanced stages of team collaboration, it is important that your team responds to each of these five collaboration factors.

Collaborative Team Participants

Individual team members' needs, interests, and expertise will often affect the flow and the work of your team. Collaborative team members may also vary according to the needs of your school or district. Typically, middle or junior high school collaborative teams are comprised of all teachers of a particular grade level or course, including teachers for students with special needs or English learners (ELs) who are supporting mathematics instruction. Your collaborative teams might also benefit from other faculty and staff members participating on your team, including faculty members from other departments and school support personnel, such as counselors or paraprofessional tutors.

Team members need only have a common curricular, instructional, and assessment focus about which to collaborate. While there is no ideal or magic number of teachers on a collaborative team, experience seems to suggest that teams much larger than seven or eight can be challenging (Horn, 2010). When your team is too large, discussions become unwieldy and a few extroverted teachers can hijack participation, limiting other team

members' voices. It is possible for larger teams to engage in productive dialogue; however, a higher level of facilitation will be required. Your middle school mathematics department should also consider individual compatibility when making recommendations for assignments to grade-level collaborative teams. The ability to work with colleagues who understand how to share information and work with a positive attitude on various team projects is important. One way to nurture this expectation for becoming an effective team member is through the development of clear team commitments and behaviors.

Collaborative Team Commitments

The purpose of collective team commitments is to create a respectful, open environment that encourages diversity of ideas and invites criticism combined with close inspection of practices and procedures. Various protocols are available to assist your teams in establishing actions to which team members agree to adhere. The process need not be arduous, complicated, or time consuming. The protocol in figure 1.1 is one model that your team can use to establish and review collective commitments throughout the year.

Setting Team Collective Commitments

Because we need our best from one another in working as a team, it is essential that we set collective commitments for our work cultures. Collective commitments are values and beliefs that will describe how we choose to treat each other and how we can expect to be treated.

As we set three to four collective commitments for ourselves, please note that establishing these does not mean that we are not already good people who work together productively. Having collective commitments simply reminds us to be highly conscious about our actions and what we can expect from each other as we engage in conversations about our challenging work.

Step one: Write three or four "We will" statements that you think will have the most positive influence on our group as we collaborate on significant issues about teaching and learning. Perhaps reflect on past actions or behaviors that have made teams less than productive. These are only a jumpstart for your thinking.

Step two: Partner with another colleague to talk about your choices and the reasons for your selection. Together decide on three or four commitments from your combined lists.

Step three: Move as a pair to partner with two to four other colleagues to talk about your choices and the reasons for your selection. Together decide on three or four commitments from your combined lists.

Step four: Make a group decision. Prepare to share your choices with the whole group.

Step five: Adopt collective commitments by consensus. Invite clarification and advocacy for particular commitments. Give all participants four votes for norm selection. It is wise not to have more than three or four.

Source: Adapted from P. Luidens, personal communication, January 27 and April 9, 2010.

Figure 1.1: Setting middle school teacher team collective commitments protocol.

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Your middle or junior high school collaborative team should keep collective commitments focused on behaviors and practices that will support the collaborative work of your team. Some teams find it useful to post their norms in a conspicuous place as a reminder to each other. Other collaborative teams might choose to highlight a commitment at each meeting as a reminder of the commitments of the team. For great advice and insight into collaborative team protocols, go to www.allthingsplc.info under Tools & Resources for additional ideas. Visit **go.solution-tree.com/commoncore** for links to additional resources.

As an example, members of a seventh-grade collaborative team decided their collective commitments would be to: (1) listen to understand, (2) challenge ideas, and (3) keep the focus on teaching and learning. Although the team included most of the same people as the previous year, team members reflected on the previous year and observed that sometimes one or two individuals passionate about their ideas often hijacked the discussions without hearing others' ideas. The collective commitments reflect the collaborative team's dedication to hearing all ideas and respectfully challenging each other.

Each team member has the responsibility to hold one another accountable for the agreed-on team commitments in a form of lateral or peer-to-peer accountability and collaboration. To address team members for not adhering to the norms is a permissible and expected aspect of the team culture. Your collaborative team might find it useful to establish a collective commitment that addresses what happens when a commitment is not honored. The purpose of the collective commitments is to raise the level of professionalism and liberate your team to openly, safely, and respectfully discuss the work at hand. As your collaborative teams grow and develop or change membership, collective commitments will likely change. Regardless of whether your collaborative team members change, you should revisit your collective commitments a minimum of once each school year, usually at the start of the year.

Collaborative Team Leaders

Just as effective professional development doesn't happen without planning and facilitation, collaborative team meetings also need intentional forethought and someone from your team to lead the group. The role of team leader or meeting facilitator might rotate or be delegated to one individual. On one hand, one person assigned team leader for the entire school year might bring continuity to team discussions and functions. (A team leader may have other responsibilities related to the work of the team in addition to leading team meetings.) On the other hand, perhaps rotating the role of team leader or meeting facilitator gives more teachers the opportunity to take ownership and develop in their ability to facilitate discussions. To make the most of the collaborative meetings, the team leader's role should involve intentionally maximizing your group's ability to collaborate by inviting diversity of thought and challenging ideas and practices. An effective collaborative team always knows who is driving the meeting. An effective middle or junior high school mathematics team leader will encourage all members to participate and ask questions of each other to push for clarity and understanding. An effective team leader will also summarize team questions, understandings, decisions, and actionable items in a timely fashion.

Collaborative Team Agendas and Meeting Minutes

Designing time for mathematics collaborative teams is a considerable commitment of resources in people, money, and time. The payoff occurs when collaboration around teaching and learning mathematics results in professional growth and increased student achievement. Agendas and meeting minutes are tools that lend themselves to more efficient use of time. The team leader is responsible for seeking input from team members, determining the agenda, and making the agenda public to the team a few days prior to the meeting. Agendas acknowledge that time is valuable and are essential to successful meetings (Garmston & Wellman, 2009). An agenda need not be complicated or long. Figure 1.2 provides a sample agenda from a seventh-grade collaborative team.
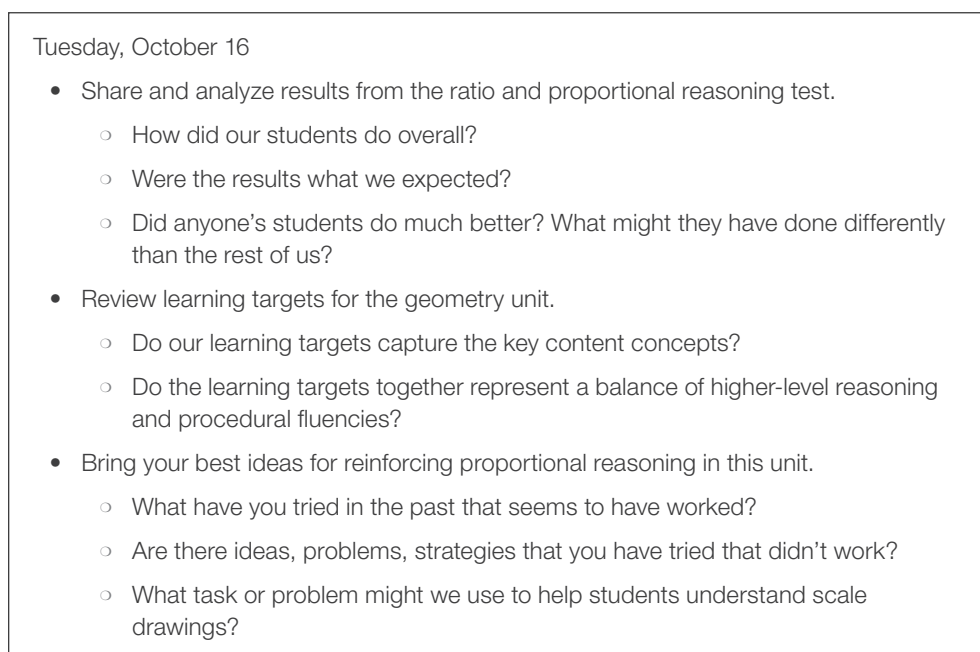

Tuesday, October 16

- Share and analyze results from the ratio and proportional reasoning test.
    - How did our students do overall?
    - Were the results what we expected?
    - Did anyone's students do much better? What might they have done differently than the rest of us?
- Review learning targets for the geometry unit.
    - Do our learning targets capture the key content concepts?
    - Do the learning targets together represent a balance of higher-level reasoning and procedural fluencies?
- Bring your best ideas for reinforcing proportional reasoning in this unit.
    - What have you tried in the past that seems to have worked?
    - Are there ideas, problems, strategies that you have tried that didn't work?
    - What task or problem might we use to help students understand scale drawings?

Figure 1.2: Sample team-meeting agenda.

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Meeting minutes are beneficial and do not need to be overly detailed. Minutes serve many useful purposes. First, minutes for each meeting capture the actions and decisions that the team has made. Teams have found it useful to go back to minutes earlier in the year or even to the previous year to recall discussions related to the ordering of content or why they decided to use a particular instructional approach for a concept. Minutes also capture who is responsible for various action steps, such as creating a scoring rubric and key for a quiz or test, or arranging for copies of artifacts for all team members.

Notice that the minutes in figure 1.2 are quick bullet points that communicate the focus of the meeting so team members can come prepared with ideas, data, or other possible resources for the next meeting. Also note that the team leader provides guiding questions for team members to reflect on prior to the meeting. He or she primes the

pump of expectations, so to speak. Team members can give prior thought and consideration to the topics, thus making the meeting more productive.

If you are like most middle school teachers, you serve on multiple teams—both your mathematics teams and a grade-level team—creating a challenge to attend all team meetings. The minutes are also an efficient way to communicate to others what transpired at the meeting. So if you are unable to attend a meeting, you can use the minutes as a resource to see what was discussed and decided. Much like students absent from class, if you are absent from the meeting, you are still expected to know and carry out the team's decisions. Technology is an effective means by which to make minutes public to others. For example, teams can post minutes in an email, to a wiki, to a team blog, or on a team website.

The minutes also provide one form of communication to the mathematics department chairperson, school principal, or other relevant school leaders. The minutes allow school leaders to provide targeted guidance, direction, or resources to support the work of your collaborative team. Figure 1.3 provides an example of a sixth-grade team's meeting minutes that were posted electronically. Notice how the meeting blends a balance of team procedural issues (when to give the formative cumulative exam based on the calendar) with team instructional issues (students' struggle and teacher review of student work).

- We debriefed the high-cognitive-demand Mixing Juice task, discussed how each teacher introduced it, discussed students' struggles, and reviewed our collective student work. We also updated teacher notes about student solutions, how to score the solutions, and discussed practices to introduce when students don't produce the solution.

- After today's meeting, we are thinking about doing a variation of Julie's social-emotional learning activity after the first quiz, which we'll discuss at the next meeting.

- We discussed how to deal with the shortened first-term grading period. We are thinking we should stay with the plan of giving the formative cumulative exam on the Monday after the grading period ends.

- We decided that we would only spend two class periods on the end-of-unit project—one to get students started and the other to review completed projects—and have students complete the rest outside class. Alison is ordering project supplies. We made a schedule of teachers and classrooms that would be available before and after school for students who want to work on projects at school.

Figure 1.3: Sample team-meeting minutes.

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Laying the groundwork for collaboration by articulating both the expectations of how your collaborative team members work together (toward constructive discussions and decision making) and the logistics of announcing and capturing your team discussions is essential. Attention to these fundamental team-management issues supports deeper and more meaningful discussions that will impact student learning of mathematics. Once expectations have been articulated about collaboration, your collaborative teams can engage in meaningful discussions around mathematics teaching and learning.

Collaborative Team Time

Clearly, for collaborative teams to work effectively, you need adequate time for collaboration. The research indicates that significant achievement gains are only achieved when grade-level or course-based teams of teachers are provided with sufficient and consistent time to collaborate (Saunders, Goldenberg, & Gallimore, 2009).

The world's highest-performing countries in mathematics allow significant time for mathematics teachers to collaborate and learn from one another (Barber & Mourshed, 2007; Stigler & Hiebert, 1999). This requires that school districts shift their priorities to support regular collaborative professional development opportunities in the form of grade-level or course-based teacher collaborative team time (Hiebert & Stigler, 2004). Finding adequate team time is clearly one of the challenges educators face in implementing PLCs. But, it can be done.

How much time? As a grades 6–8 teacher you should have dedicated periods of grade-level, course-based, or cross-grade-level teacher collaborative team time every week, with at least sixty to ninety minutes of meeting time. This time needs to be embedded within your professional workday; that is, it should not be scheduled every Tuesday after school once a week (Buffum et al., 2009).

Figure 1.4 provides a few ideas to make your collaborative team professional development time a priority (Bowgren & Sever, 2010; Loucks-Horsley, Stiles, Mundry, Love, & Hewson, 2009).

1. Provide common time by scheduling most, if not all, team members the same planning period during the day.

2. Create an altered schedule for early-release or late-arrival students on an ongoing basis, if feasible to your community.

3. Use substitute teachers to roll through the day, releasing different collaborative teams for two to three hours at a time.

4. Occasionally release teachers from teaching duties or other nonteaching duties in order to collaborate with colleagues.

5. Restructure time by permanently altering teacher responsibilities, the teaching schedule, the school day, or the school calendar.

6. Purchase teacher time by providing monetary compensation for after-school, weekend, or summer work.

Figure 1.4: Options for scheduling teacher collaboration time.

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Typically, schedules in middle schools have built-in time for interdisciplinary team meetings. A core premise of the original middle school concept was that each teacher is part of an interdisciplinary team—mathematics; English, reading, and language arts; science; and social studies teachers—that is responsible for teaching the same group of students. Ideally, the interdisciplinary team operates as a collaborative team. Both

discipline-specific and interdisciplinary collaborative teams can operate within a middle or junior high school: the teams' goals and work are different but complementary. One focuses on discipline-specific teaching and learning; the other focuses more on student support, often the social and emotional needs of students. The challenge is scheduling the team meeting time so that both collaborative teams can work effectively.

The High-Leverage Work of Mathematics Collaborative Teams in a PLC

Your collaboration with colleagues is about "purposeful peer interaction" (Fullan, 2008, p. 41). Purposeful peer interaction begins as you use a common vocabulary for your team discussions. It is an important factor contributing to your focused interactions with colleagues. The vocabulary and format of the CCSS grades 6–8 may be somewhat different from what you are accustomed to using. Figure 1.5 defines key terms used in the CCSS and identifies the domains that are presented in grades 6–8 (see appendices B, C, and D for complete listings of these content standards).

Standards define what students should understand and be able to do.

Content standard clusters summarize groups of related standards. Note that standards from different clusters may sometimes be closely related because mathematics is a connected subject.

Domains are larger groups of related standards. Standards from different domains may sometimes be closely related. The domains for grades 6–8 are Ratios and Proportional Relationships (grades 6 and 7), the Number System, Expressions and Equations, Functions (grade 8), Geometry, and Statistics and Probability.

Source: Adapted from NGA & CCSSO, 2010a, pp. 44–45.

Figure 1.5: How to read the CCSS for mathematics.

Visit **go.solution-tree.com/commoncore** for a reproducible version of this figure.

The focus and coherence of the CCSS for grades 6–8 mathematics (see appendices B, C, and D for each grade level respectively) and the careful attention paid to standards progressions mean that some of the topics you traditionally taught in certain grades have been moved to other grades, and some topics have simply been eliminated from the middle school curriculum. For example, Numbers and Operations with fractions and its attendant standards are mostly completed by the end of fifth grade as standards for Ratios and Proportional Reasoning begin. The purpose of this more focused curriculum is to provide you more time to teach fewer critical topics in greater depth. (See chapter 3 for a discussion of specific changes.)

You need to spend time in your grade-level, course-level, or cross-grade-level (vertical) collaborative team reviewing and reaching agreement on the scope and sequence you will use to ensure alignment of the mathematics content with your district's expectations as well as the CCSS. You should also spend some collaborative team time in vertical team discussions. For example, if you are a seventh-grade teacher, you should meet with sixth- and eighth-grade teachers to ensure appropriate articulation across grade levels.

Overall, the work of your collaborative team should focus on reaching agreement and taking action in five fundamental areas.

1. **Content**, **teaching**, **and learning**: The team must agree on the mathematics (content) students should learn, the mathematical tasks they should experience, and the instructional strategies to ensure student engagement and acquisition of conceptual understanding, procedural fluency, problem solving, and reasoning capabilities. (See chapters 2 and 3.)

2. **Summative assessment instruments**: The team must agree on the development and use of common and coherent unit or chapter summative assessment instruments to determine if students have learned the agreed-on curriculum and how to respond when students either don't learn or do learn that curriculum. (See chapter 4.)

3. **Formative assessment processes**: The team must agree on the development and use of a common formative assessment and feedback process to monitor students' learning. (See chapters 4 and 5.)

4. **Support and intervention**: The team must agree on appropriate mathematics intervention, instruction, and intentional student support based on the results of formative classroom assessments, including results on summative assessment instruments. (See chapters 4 and 5.)

5. **SMART goals**: The team must agree on SMART (strategic and specific, measurable, attainable, results oriented, and time bound) goal targets and disaggregation of data to monitor progress of all students (Kanold, 2011; O'Neill & Conzemius, 2005). (See chapters 4 and 5.)

Your collaborative team can use these areas to provide direction and consolidate planning for instruction and assessment. Figure 1.6 describes high-leverage, high-inquiry collaborative team tasks for your team's meaningful collaboration.

Collaborative Teacher Team Agreements for Teaching and Learning

1. The team designs and develops agreed-on prior knowledge skills to be assessed and taught during each lesson of the unit or chapter.

2. The team designs and implements agreed-on lesson-design elements that ensure students actively engage with the mathematics. Students experience some aspect of the CCSS Mathematical Practices (such as Construct viable arguments and critique the reasoning of others or Attend to precision) with the language embedded in the daily lessons of every unit or chapter.

3. The team designs and implements agreed-on lesson-design elements that allow for student-led summaries and demonstrations of learning the daily lesson.

4. The team designs and implements agreed-on lesson-design elements that include the strategic use of tools—including technology—for developing student understanding.

Figure 1.6: High-leverage activities of grades 6–8 grade-level and course-level collaborative teams.

Collaborative Team Agreements for Assessment Instruments and Tools

1. The team designs and implements agreed-on common assessment instruments based on high-quality exam designs. The collaborative team designs all unit exams, unit quizzes, final exams, writing assignments, and projects for the course.

2. The team designs and implements agreed-on common assessment instrument scoring rubrics for each assessment in advance of the exam.

3. The team designs and implements agreed-on common scoring and grading feedback (level of specificity to the feedback) of the assessment instruments. Two or more team members together grade a small sample of student work to check on consistency in scoring and grading feedback.

Collaborative Team Agreements for Formative Assessment Feedback

1. The team designs and implements agreed-on adjustments to instruction and intentional student support based on the results of both formative daily classroom assessments and the results of student performance on unit or chapter assessment instruments, such as quizzes and tests.

2. The team designs and implements agreed-on levels of rigor for daily in-class prompts and common high-cognitive-demand tasks used to assess student understanding of various mathematical concepts and skills. This also applies to team agreement to minimize the variance in rigor and task selection for homework assignments and expectations for makeup work. This applies to depth, quality, and timeliness of teacher descriptive formative feedback on all student work.

3. The team designs and implements agreed-on methods to teach students to self-assess and set goals. Self-assessment includes students using teacher feedback, feedback from other students, or their own monitoring and self-assessment to identify what they need to work on and to set goals for future learning.

Visit **go.solution-tree.com/commoncore** for a reproducible version of this figure.

You can use figure 1.6 as a diagnostic tool to measure the focus of the work and energy of your team. Do you have low implementation or high implementation for each of the high-leverage actions? Meaningful implementation of the CCSS will require time—time to digest the CCSS for mathematics for grades 6–8; time to create a focused and coherent curriculum; and time to design instruction and assessments around the high-leverage actions listed in figure 1.6.

Collaborative Protocols

Several protocols combine collaboration with a spotlight on the teaching and learning of mathematics. Five structured protocols can be especially beneficial for you and your team. These protocols provide different settings in which you can collaborate and share reflections and beliefs about teaching and learning.

1. **Lesson study:** Lesson study differs from lesson planning. Lesson study focuses on what teachers want students to learn; lesson planning focuses on what teachers plan to teach. A modified lesson study example is shown in the feature box on

page 24 and can be used to improve the quality of your lessons and instruction as a team.

2. **Peer coaching**: Peer coaching is a kind of partnership in which two or three teachers engage in conversations focused on their reflections and thinking about their instructional practices. The discussions lead to a refinement and formative assessment response to classroom practice. The participants may rotate roles— discussion leader, mentor, or advocate. Teachers who engage in peer coaching are willing to reveal strengths and weaknesses to each other. Peer coaching creates an environment in which teachers can be secure, connected, and empowered through transparent discussions of each others' practice.

3. **Case study**: Case study can be used to address a wide range of topics or problems the collaborative team encounters. The case study presents a story—one involving issues or conflicts that need to be resolved through analysis of available resources leading to constructive plans to address the problem. Typically, case studies are used to examine complex problems—the school's culture, climate, attendance, achievement, teaching, and learning (Baccellieri, 2010).

4. **Book study**: Book study is a familiar and popular activity for you to engage in conversations with colleagues about professional books. It may be a formalized activity for some collaborative teams; however, book study can emerge in any number of ways—from hearing an author speak at a conference, from a colleague's enthusiastic review of a book, or from the mutual interests of teachers who want to learn more about a topic. Book study promotes conversations among faculty and staff that can lead to the application of new ideas in the classroom and improvement of existing knowledge and skills. Book study is a great way to connect with a personal learning network as you blog, tweet, Skype, or use other forms of communication to connect with colleagues outside of your school.

5. **Collaborative grading**: Collaborative grading occurs as your team reaches stages four and five (see table 1.1, page 13) of team collaboration. In this situation, you and your colleagues design a common unit test together and assign point values with scoring rubrics for each question on the exam. Together you grade and discuss the quality of student responses on the assessment instrument and develop an inter-rater reliability for scoring of the assessment tool. Achieving consistency in grading students' assignments and assessments is an important goal for collaborative teams.

From the point of view of instructional transparency and improvement, lesson study is a particularly powerful collaborative tool that merits close consideration. Lesson study has been shown to be very effective as a collaborative protocol with a high impact on teacher professional learning (Hiebert & Stigler, 1999). A modified lesson study provides a reflective collaborative team activity.

Example of a Lesson-Study Group in Action

Typically, teachers choose a content area that data indicate is problematic for students. Consider a lesson-study group that develops a goal related to the CCSS Mathematical Practices (see appendix A, page 181). The teachers select Mathematical Practice 1 as the goal—students will learn to make sense of problems and persevere in solving them. They share ideas about how to help students achieve this goal through the content of the lesson. The teachers select content from the CCSS domains and content standard clusters that presents a particular challenge to students. In this case, the group chooses "Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions" (6.NS.1, see appendix B, page 188). The teachers use various resources to learn more about the content and its connections to other mathematical concepts, as well as information from research about students learning this content. From those resources, the teachers together designed a lesson to address the goal. One team member was asked to teach the lesson and be observed by one or two other members of the team. The teacher who taught the lesson and the observers debriefed the team about their observations and made changes to the lesson design. The revised lesson was taught with a final debriefing of the second instructional episode. By the end of the lesson study, these teachers have increased their knowledge of pedagogy and mathematics content. By contributing to development of the lesson and engaging in discussions of the lesson's strengths and limitations, they have also raised the level of respect and trust among team members. The lessons learned from participating in lesson study extend to the teachers' daily instruction.

Lesson study may seem time and work intensive for a single lesson. Nonetheless, the benefit of lesson study is the teacher professional learning that results from the deep, collaborative discussions about mathematics content, instruction, and student learning. The lesson-design tool in figure 2.16 (page 69) is designed to support your lesson-study work. Also, see the lesson-study references listed in the Extending My Understanding section at the end of this chapter for more information about this powerful activity for stages six and seven (see table 1.1, page 13) collaborative team development.

Looking Ahead

The CCSS for mathematics define what students should know and be able to do to be college and career ready—which now includes mathematics content through second-year algebra, along with proficiency in the Standards for Mathematical Practice (see appendix A, page 181).

Your collaborative team is the key to all students successfully learning the Common Core mathematics standards for grades 6–8 through effective instruction, assessment, and intervention practices. In subsequent chapters, we'll provide tools to assist you and your colleagues' work to make the vision of the Common Core for mathematics a reality for all students.

Highly accomplished middle school mathematics teachers value and practice effective collaboration, which professional organizations have identified as an essential element

to teacher professional development (Learning Forward, 2011; National Board for Professional Teaching Standards, 2010). Teacher collaboration is not the icing on top of the proverbial cake. Instead, it is the egg in the batter holding the cake together. Your school is a learning institution responsible for educating students and preparing them for the future. Your school is also a learning institution for the adults. The professional learning of teachers is not solely a prerequisite for improved student achievement. It is a commitment to the investment in the professionals like you, who have the largest impact on students in schools. The process of collaboration capitalizes on the fact that teachers come together with diverse experiences and knowledge to create a whole that is larger than the sum of the parts. Teacher collaboration is *the* solution to your sustained professional learning—the ongoing and never-ending process of growth necessary to meet the classroom demands of the CCSS expectations.

Chapter 1 Extending My Understanding

1. A critical tenet of a mathematics department in a PLC is a shared vision of teaching and learning mathematics.

   ○ Do you have a shared vision of what teaching and learning mathematics looks like? If not, how might you create one?

   ○ Does this vision build on current research in mathematics education?

   ○ Does your vision embrace collaboration as fundamental to professional learning?

2. Graham and Ferriter (2008) identify seven stages of collaborative team development. These stages characterize team development evolving from cooperating to coordinating leading ultimately to a truly collaborative team.

   ○ Using table 1.1 (page 13), at what stage are your teams operating?

   ○ What role might you play in helping your team transition to a more advanced stage?

3. Using figure 1.6 (page 21), identify the high-leverage actions your team currently practices extremely well. What is your current level of implementation on a scale of 0 percent (low) and 100 percent (high)? How might you use this information to identify which actions should be your team's priority during this or the next school year?

4. Implementing the CCSS might seem daunting to some teachers, and as a result, there may be resistance or half-hearted attempts to needed changes in content, instruction, or assessment. Consider leading your collaborative team through a Best Hopes, Worst Fears activity. Give team members two index cards. On one, have them identify their best hopes for implementing the CCSS. On the other card, have team members record their worst fears. Depending on the level of trust and comfort of the team, the team leader might collect the index cards and read the best hopes and worst fears anonymously, or individuals can read

their hopes and fears aloud to the group. The purpose is to uncover concerns that if left covered might undermine collaborative teamwork. Team members should talk about how they can support one another to minimize fears and achieve best hopes.

Online Resources

Visit **go.solution-tree.com/commoncore** for links to these resources. Visit **go.solution -tree.com/plcbooks** for additional resources about professional learning communities.

- *The Five Disciplines of PLC Leaders* **(Kanold, 2011; go.solution-tree .com/plcbooks/Reproducibles_5DOPLCL.html):** Chapter 3 discusses the commitment to a shared mission and vision by all adults in a school for several tools targeted toward monitoring collaborative actions. These reproducibles engage teachers in professional learning and reflection.

- **AllThingsPLC (www.allthingsplc.info):** Search the Tools & Resources of this website for sample agendas and activities and insights for effective collaborative teamwork.

- **The Educator's PLN—The Personal Learning Network for Educators (http://edupln.ning.com):** This website offers tips, tools, and benefits for starting your own PLN.

- **The Center for Comprehensive School Reform and Improvement (www .centerforcsri.org/plc/websites.html):** This website offers a collection of resources to support an in-depth examination of the work of learning teams.

- **Inside Mathematics (2010a; www.insidemathematics.org/index.php /tools-for-teachers/tools-for-coaches):** This portion of the Inside Mathematics website helps mathematics, teachers, coaches, and specialists support the professional learning teams they lead. Tools to support lesson study and teacher learning, including video vignettes that model coaching conversations, are available.

- **Inside Mathematics (2010b; www.insidemathematics.org/index.php /tools-for-teachers/tools-for-principals-and-administrators):** This portion of the Inside Mathematics website supports school-based administrators and district mathematics supervisors who have the responsibility for establishing the structure and vision for the professional development work of grade-level and cross-grade level learning teams or in a PLC.

- **Learning Forward (2011; www.learningforward.org/standards/standards .cfm):** Learning Forward is an international association of learning educators focused on increasing student achievement through more effective professional learning. This website provides a wealth of resources, including an online annotated bibliography of articles and websites to support the work of professional learning teams.

- **National Council of Supervisors of Mathematics (NCSM; www.math ematicsleadership.org):** NCSM is an international leader collaborating to achieve excellence and equity in mathematics education at all levels. This portion of the NCSM website provides a variety of resources for mathematics coaches and specialists to support the professional learning teams they lead.

- **The Mathematics Common Core Toolbox (www.ccsstoolbox.com):** This website provides coherent and research-affirmed protocols and tools to help you in your CCSS collaborative teamwork. The website also provides sample scope and sequence documents and advice for how to prepare for CCSS for mathematics implementation.

- **Chicago Lesson Study Group (www.lessonstudygroup.net/index.php):** This website provides a forum for teachers to learn about and practice lesson study to steadily improve student learning. To learn more about lesson study or other collaborative protocols, see the following resources.

  - *Lesson Study: A Handbook of Teacher-Led Instructional Change* (Lewis, 2002)

  - *Powerful Designs for Professional Learning* (Easton, 2008)

  - *Leading Lesson Study: A Practical Guide for Teachers and Facilitators* (Stepanek, Appel, Leong, Managan, & Mitchell, 2007)

  - *Data-Driven Dialogue: A Facilitator's Guide to Collaborative Inquiry* (Wellman & Lipton, 2004)

- **The National Commission on Teaching and America's Future (NCTAF & WestEd, 2010; www.nctaf.org/wp-content/uploads/STEMTeachersin ProfessionalLearningCommunities.AKnowledgeSynthesis.pdf):** With the support of the National Science Foundation and in collaboration with WestEd, NCTAF (2010) released *STEM Teachers in Professional Learning Communities: A Knowledge Synthesis*. NCTAF and WestEd conducted a two-year analysis of research studies that document what happens when science, technology, engineering, and mathematics teachers work together in professional learning communities to improve teaching and increase student achievement. This report summarizes that work and provides examples of projects building on that model.

- *Learning by Doing: A Handbook for Professional Learning Communities at Work* **(DuFour et al., 2010; go.solution-tree.com/PLCbooks/Reproducibles _LBD2nd.html):** This resource and its reproducible materials help educators close the knowing-doing gap as they transform their schools into professional learning communities.