2000). The impact in the classrooms is also having an impact on students: Mathematics scores on standardized test increased in CFG classrooms.

In the Boston public schools, coaches are supporting schoolwide changes in leadership, culture, and content areas. Since 1999, the 132 schools have benefited from the sustained support of a coach—either a content coach in literacy or a change coach. In 2000, mathematics coaches joined the literacy coaches.

Although somewhat different from one-on-one teacher coaching situations, Boston's schoolwide coaches engage in many of the same professional development activities with many of the same goals and benefits. For example, change coaches work with whole faculties in schools to develop instructional leadership teams, lead teachers in examining student work, and guide schools in analyses of data to drive their reform efforts. Content coaches work one-on-one with individual teachers, facilitate demonstration lessons during six- to eight-week sessions with different grade level teachers, and lead study groups.

Behind all coaching in Boston schools is the idea that coaching needs to address the specific learning needs of teachers and schools and that to reduce isolation and increase collaboration teachers need opportunities to observe in each other's classes and reflect on their own teaching in collegial environments. Coaches are helping schools develop these collegial environments.

The other tenet driving the use of coaches is that to build capacity, teacher leadership needs to be expanded. Schools establish instructional leadership teams with the guidance of their coach, and teachers in schools throughout the city are taking on more diverse leadership roles.

The practice-based, school-based nature of coaching in Boston has resulted in changed cultures in schools, increases in student learning, and individual teacher growth and learning (Guiney, 2001).

### Commentary

Several issues arise when coaching is introduced to teachers, whether in a department, as a schoolwide effort, or as a part of a professional development program or initiative. First, norms of isolation and privacy work against many teachers' willingness to open their classrooms and their teaching to observation and scrutiny. Going slowly, developing trusting, building relationships before classroom observations occur, and having a very specific focus that is nonthreatening but challenging are some ways to overcome teachers' hesitancy.

Time for making and discussing classroom observations is a challenge within a typical school schedule. Creative solutions include rearranging planning times, using team teaching, and having substitutes and volunteers work with students on independent projects during demonstration time.



It is important that before coaching is initiated the school or district decides on the coaching methods it will use and plans for the training coaches will receive. As noted at the beginning of this section, not only does coaching have many labels, but also each type has a different purpose, technique, and outcome. Studying and then learning the techniques, through reading or focused professional development, can maximize the impact of coaching as a professional learning strategy. (See the Resources section for materials for review.)

### Resources

Association for Supervision and Curriculum Development (ASCD), Alexandria, VA (www.ascd.org). Consult the Web site for information on professional development in peer coaching and mentoring.

Caccia, P. F. (1996). Linguistic coaching: Helping beginning teachers defeat discouragement. *Educational Leadership, 53*(6), 17-20.

Costa, A., & Garmston, R. (2002). *Cognitive coaching: A foundation for renaissance schools* (2nd ed.). Norwood, MA: Christopher Gordon.

Glickman, C. D. (2002). *Leadership for learning: How to help teachers succeed.* Alexandria, VA: ASCD. (Contains peer coaching forms.)

National School Reform Faculty. Harmony School Education Center (www.harmonyschool.org).

National Staff Development Council (NSDC), Oxford, OH. Consult the Web site for information on professional development in peer coaching.

Phillips, M. D., & Glickman, C. D. (1991). Peer coaching: Developmental approach to enhancing teacher thinking. *Journal of Staff Development, 12*(2), 20-25.

WestEd and the WGBH Educational Foundation. (2003). *Teachers as learners: A multimedia kit for professional development in science and mathematics.* Thousand Oaks, CA: Corwin Press. (See Tape 4, Program 2, *Content-based coaching: Belmont public schools, Belmont, MA;* and Tape 4, Program 1, *Curriculum-focused coaching, City On A Hill Charter School, Boston.*)

## Demonstration Lessons

*Kendra, a second-grade teacher, and Jamika, a third-grade teacher, are participating in a demonstration lesson study group as part of their district's approach to supporting teachers as they implement the new mathematics curriculum. They are both experienced teachers but are new to the curriculum being introduced. As part of the demonstration lesson group, they have requested that they spend some time looking at how the curriculum in second grade supports the content in third grade. In response to their request, the teachers in the group, all second- and third-grade teachers, are observing the teacher leader who has been working with them all year coteach lessons in two classrooms. During the preobservation conference, they discuss their questions about how the lesson in second grade and its underlying concepts can be built on in the lesson being taught in third grade. They also decide that they want to make sure to watch for how the teacher leader asks questions to probe*

*for student thinking and talk with him during the postobservation conference about any "teaching decisions" he makes based on what he thinks students understand.*

*After observing both lessons, the teachers gather for the postobservation conference. Kendra starts the conversation by noting, "I really saw how the mathematical concepts in my class are transferred to third grade." The discussion quickly moves into sharing how they think the curriculum aligns with the school goals and what they know from their student data about the gaps in students' mathematical learning and understanding. They raise and discuss in-depth such questions as "How do I address errors in thinking when I notice them? What are the concepts behind each of the activities in the curriculum in second and third grades? What are the mathematical ideas that are built on from first through fifth grades?" The teacher leader provides great insight for the other teachers by sharing his own thinking about the specific teaching moves and the minute-by-minute decisions that he made based on his understanding of the purpose and learning intent of the lesson. In particular, hearing the reasons why the teacher leader chose the strategies he did helps the other teachers to become more conscious of the need to connect teaching moves to purpose. By the end of the conference, more questions than answers have been raised, but all of the teachers are ready for their next demonstration lesson study and the chance to continue exploring.*

Demonstration lessons are professional learning opportunities that are practice based and provide an opportunity for enhancing teacher practice and reflection. The learning is grounded in teachers' daily work and directly connected to the content and curriculum that they teach in their classrooms. Teachers' expertise and knowledge are brought to the learning situation, and through collegial reflection, their perceptions and understandings are increased.

Many school districts have been using demonstration lessons as a key component of reform. Often, the term refers to a master, experienced teacher or facilitator presenting an exemplary model of teaching that other teachers observe and then discuss. Observing teachers are expected to gain insights and ideas for use in their own classrooms and often to implement what they observe. Groups of teachers meet ahead of time to discuss the goals and intent of observing one teacher in the group conduct a classroom lesson. All others in the group observe the lesson and then debrief their experience. Unlike lesson study that is focused on fine-tuning a lesson (as described in the Lesson Study section), demonstration lessons aim to help teachers actually see what it looks like to teach in particular ways. They may focus on how the teacher identifies and addresses students' prior conceptions or on the questions a teacher asks of students as they explain how they solved a mathematics problem.

The purpose of demonstration lessons is not always to teach an exemplary, model lesson to other teachers but rather to use a "prelesson, classroom demonstration lesson observation, and postlesson debrief" cycle as a catalyst for in-depth reflection on science and mathematics teaching and



learning. In the same way that teachers use student work as a means for increasing their understanding of student understanding, teacher work—in this case, classroom teaching—is used as a means for increasing understanding of teaching practices specific to mathematics and science education.

For example, in the previous vignette, the demonstration lesson observation and accompanying pre- and postlesson discussions focused on enhancing second- and third-grade teachers' implementation of a mathematics curriculum and understanding the mathematical concepts common to both second- and third-grade student learning. The teachers were all either second- or third-grade teachers, and the explicit purpose of the demonstration lesson and discussion was on increasing understanding of the concepts addressed at each grade and to enhance implementation of the curriculum. The new learning in this vignette does not come from the observation alone. The prelesson and postlesson discussions are critical in raising the teachers' awareness of the larger mathematical concepts, increasing their understanding of the overall curriculum, and providing them with specific "teaching moves" related to implementing the lessons in the curriculum. In addition, their discussions highlight several issues frequently asked by science and mathematics teachers, including "How do I know if the students are learning?" and "What are the key concepts behind the activities?" Through collegial discussion they share their ideas and develop greater understanding.

Demonstration lessons are often used as a strategy in combination with other professional learning strategies, such as with curriculum implementation, action research, study groups, lesson study, or case discussions. As the previous vignette illustrated, demonstration lessons can provide a vision of learning and teaching associated with the implementation of a set of instructional materials for numerous teachers within one school. Or, in another case, teachers who are participating in a study group might decide to use demonstration lessons to enhance their understanding of questioning strategies that lead to increased student understanding of science or mathematics concepts. Demonstration lessons—whether implemented alone or in combination with other strategies—are an effective way to increase collegial and reflective interactions on science and mathematics teaching and learning.

**KEY ELEMENTS FOR DEMONSTRATION LESSONS**

- **Groups of teachers observe each other.**
- **There is a cycle of prediscussion, observation, postdiscussion.**
- **Observations and discussions are facilitated.**
- **A clear purpose and intent focus the discussions and observations.**

### Key Elements

*Groups of teachers observe each other.* Unlike coaching or mentor-

ing—that can occur in one-on-one situations—demonstration lessons usually involve groups of teachers working together. One of the underlying principles girding the strategy is that the interactions of a group of teachers lead to more diverse discussions, bring varied perspectives to the discussions, and provide an opportunity to observe different teaching approaches. Together, they develop a shared vision of what teaching and learning should look like.

*There is a cycle of prediscussion, observation, postdiscussion.* During the prediscussion, teachers learn about the goal and purposes of the specific lesson they will observe, become familiar with the instructional materials used in the lesson, and hear from the teacher whose classroom the lesson will be taught in about what students have done prior to this lesson to build conceptual understanding of the content. The lesson is then taught by a teacher leader in one of the teacher's classrooms, cotaught by the teacher leader and teacher, or taught by the teacher himself or herself with his or her own students. The observing teachers take notes and attend to specific classroom practices identified during the prediscussion. The postdiscussion engages teachers in a dialogue regarding what was observed—usually after the demonstration teacher reflects on what he or she experienced and perceived—and the facilitator raises issues related to content, pedagogy, instruction, or assessment that were related to the teaching of the lesson. Many groups also ask teachers to reflect in a journal at the end of the postdiscussion on their insights or perceptions. Thus, the common experience of discussing and observing the same lesson provides a basis for grounding science and mathematics issues within a context.

*Observations and discussions are facilitated.* Although demonstration lessons can be conducted without a "trained expert," it is essential that the prediscussion, the demonstration lesson itself, the teachers' observations, and the postdiscussion are facilitated by an experienced teacher or leader. The teachers as a group need a clear focus and purpose for their discussions and observations, and a facilitator enhances the dialogue among the teachers, raising important issues in science and mathematics content and teaching.

*A clear purpose and intent focus the discussions and observations.* As just noted, a clear purpose and intent are needed for this strategy to be successful. Often, the implementation of instructional materials and the accompanying teaching strategies are the goal for teachers engaged in demonstration lessons. Teachers benefit from observing another teacher conduct a lesson that they themselves will then teach in their own classrooms. They agree in the prediscussion on a focus for the observation (e.g., the demonstration teacher's questioning strategies or student interactions and discussions). The postdiscussion is guided by reflections on and discussions of what was



observed using specific evidence from notes taken during the observation. This enables participants to replay a moment and ask the demonstration teacher, "What were you thinking when you said. . . ."

### Implementation Requirements

*Time and structure.* As with all professional learning strategies, but especially those that are job embedded and occur during the school day, teachers need protected time to interact with each other. Demonstration lessons necessarily include numerous teachers being released from their classrooms to observe lessons being taught and to reflect on their observations.

*Critical reflection in a risk-free environment.* For many teachers, it can be intimidating to have others observe their teaching and to then engage in critical reflection on what was observed. It is essential for this strategy that teachers feel comfortable with each other and have experience critiquing teaching practices in a nonthreatening environment before engaging in observation. Often, teachers will use videotapes of other teachers' classrooms as practice for learning to observe demonstration lessons. In many cases, the teacher leader teaches or coteaches the lesson in one of the participating teacher's classrooms to build trust and to reduce anxiety. This strategy requires an attitude of self-reflection on the part of all involved with the goal of improving each teacher's understanding and practice.

*A process of examining lessons.* Demonstration lessons require that teachers agree on and use a common structure and process for documenting their observations. This can include note taking, scripting of observations, or videotaping of lessons.

### Examples

Demonstration lessons are part of the Clark County, Las Vegas, Nevada, professional development design for supporting teachers' implementation of the FOSS science curriculum. Teachers are guided through discussions and observations by teacher leaders who have experience with the FOSS curriculum and have received their own professional development to enhance their understanding of adult learning and effective professional development.

Each demonstration lesson session begins with a preobservation discussion during which the teacher leader (who usually teaches the lesson) describes the lesson to be taught, the hands-on activity the lesson uses, the purposes and goals of the lesson, and the student learning outcomes. Teachers raise questions and discuss issues related to teaching the unit and they identify a focus for their observation of the demonstration lesson.

As a group, teachers then observe the lesson being taught, documenting their observations by, for example, noting specific questioning strategies the teacher leader uses or writing down comments the students make during their conversations. After the lesson, the postconference debriefing provides an opportunity to discuss their observations and ask questions of the demonstration teacher.

The use of demonstration lessons to support curriculum implementation has met with success in Clark County. Teachers benefit from the varied perspectives that are brought to conversations and discussions. They are able to observe how others teach the FOSS units and share their ideas for teaching with each other. Teachers are supported as they begin to implement the units and are challenged once they have gained more experience with individual units. The discussions before and after observations stay focused on teaching strategies and the resulting student learning, helping teachers avoid the "open the kit and teach the activity" that is sometimes common with hands-on science curriculum. As one teacher in Clark County remarked, "The collaboration among a group of teachers promotes a dialogue of reflection. It gets us out of our own classes and lets us see others teaching, which makes us reflect on our own teaching."

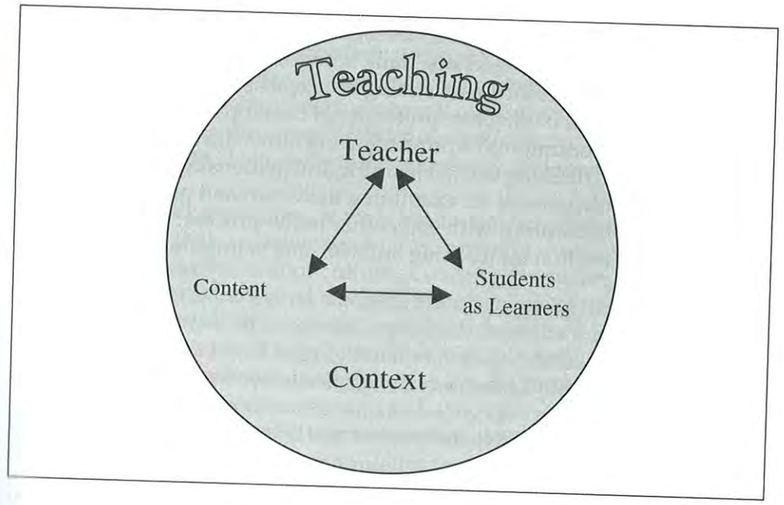
The previous vignette is based on another example of demonstration lessons being used to support curriculum, in this case, mathematics curriculum. In Bracken Elementary School in Nevada, teacher leaders work with other teachers to help them implement the Investigations curriculum in elementary school. What is not captured in the vignette is the extent to which teachers in this image engage in in-depth discussion regarding the teaching moves that the teacher leader made to ensure that all students in the class understood the underlying concepts in the lesson. For example, when it was evident to the teacher leader that students were having difficulty skip counting to 100 by 4's, he stopped the activity and posed questions to help students refocus on the purpose, directed their attention to a visual representation of skip counting by 4's, and asked individual students to explain their thinking. During the postobservation conference, the teacher leader described how he knew students were experiencing confusion, what he did about it, and why. It is conversations like this that enhanced both the understanding of the teachers in the demonstration lesson group and their ability to make similar teaching moves in their own classrooms.

### Commentary

As noted previously, one of the changes in professional development in recent years has been an increased focus on embedding teachers' learning in their practice. Demonstration lessons are an example of such practice-based learning. For example, the focus for learning and observations during the teaching of a demonstration lesson is often on the interaction between the science or mathematics content, the students, and the teacher. Judith Mumme and Nanette Seago (2002) have adapted the work of Deborah Ball



**Figure 5.7.** Teaching Interactions




and David Cohen (2000) to reflect this interaction (see Figure 5.7). Mumme and Seago define teaching as "a set of relationships between teacher and student, student and content, and teacher and content" (p. 3). Teachers must have an in-depth understanding of the science or mathematics content, knowledge of their students' needs and prior experiences and how students learn the content, and the teaching strategies and activities that will lead to student learning. In demonstration lessons, observing teachers often identify this interactive relationship as the focus of their observations, attending to the ways in which the demonstration teacher guides and facilitates learning based on her knowledge and understanding of the content, students, and teaching strategies. Through postobservation discussions, observing teachers can further question the demonstration teacher to surface her thinking about how she approached the lesson and why she engaged in certain activities, behaviors, or questioning at certain times during the lesson.

In addition, by focusing on the dynamic interactions in teaching, demonstration lessons raise the level of in-depth discussions and learning. For example, during the postobservation discussion, the focus stays on understanding what the students learned and understood, why the teacher asked certain questions or guided the students in certain directions, and what was significant about the content being presented. Keeping the observations and discussions focused on these interactions helps avoid discussions that emphasize only the most obvious actions and behaviors in a classroom, such as the ways in which students are grouped or the hands-on activity

itself. Rather, the increased learning comes from examining the thoughts and perceptions regarding *why* students were grouped the way they were or what content was learned by engaging in the hands-on activity.

Finally, because demonstration lessons require administrative support and structural changes in teachers' daily schedules, a school that routinely uses demonstration lessons as a strategy for teachers' learning embodies one of the principles of effective professional development: lifelong learning for teachers. Continuous improvement in knowledge, skills, and understandings is key to lifelong teacher learning and demonstration lessons provide teachers with a model for examining their own and others' practice, a structure for collaborating with each other in the process, and convey the message that reflection on teaching and learning is important.

## Resources

Glickman, C. D. (2002). *Leadership for learning: How to help teachers succeed.* Alexandria, VA: ASCD.

Joyce, B., & Showers, B. (1988). *Student achievement through staff development.* New York: Longman.

WestEd and the WGBH Educational Foundation. (2003). *Teachers as learners: A multimedia kit for professional development in science and mathematics.* Thousand Oaks, CA: Corwin Press. (See Tape 2, Program 5, *Observing mathematics teaching, Clark County Schools, Las Vegas, NV;* and Tape 3, Program 2, *Observing science teaching, Clark County Schools, Las Vegas, NV.*)

## Mentoring

*Jacob was anxious about starting his first week as a fifth-grade teacher at the local elementary school. He had done his student teaching and practicum experiences in elementary schools and had some sense of what to expect, but was not sure about how he would be received by the other teachers. Some of his anxiety was lessened by the summer meetings he had with his mentor, Wesley. They met for coffee a few times and spent a day at the school helping Jacob learn his way around. It was a relief just to know where the supply closet was located!*

*When Jacob arrived at school on Monday morning, Wesley was already waiting for him in Jacob's classroom. The students weren't scheduled to start school for another three days so Jacob knew he had some time to adjust. Wesley welcomed him and let him know that they would spend the day together walking through the school to meet all of the other teachers, reviewing the curriculum and lessons Jacob would teach his first few weeks, and working with Elisabeth, the technology specialist, to orient him to the computers in his classroom and the school networking system.*

*At the end of the day, Jacob was feeling welcomed and more comfortable about joining an already cohesive faculty; they had organized a pitch-in lunch to give him a chance to be with the entire faculty and the principal in an informal setting. He admired the friendly and collegial interactions and knew he would have several "mentor buddies" in addition to Wesley. Before Jacob left for the day, he met with Wesley to debrief on how the day went and to discuss any unanswered questions. They reviewed the schedule for the next day when Jacob would meet with teachers from other grades to discuss the mathematics curriculum and with the school's instructional leadership team to discuss some schoolwide issues, such as "What is expected of us here at this school? How are we evaluated? How do we know if students are learning what we are teaching?" Wesley assured Jacob that this was not going to be a crash course in teaching, but only the beginning to his immersion into teaching.*



Mentoring, like coaching, is a teacher-to-teacher professional development strategy that sustains long-term, ongoing professional learning embedded within the school culture. Coaching, however, can and often does involve two experienced teachers, although one of the teachers might have more expertise in a certain area, such as with a specific teaching approach or with a set of instructional materials. Mentoring, on the other hand, usually occurs between a teacher new to the field and a more experienced teacher or an experienced teacher taking on a new role or new teaching approach. That said, effective mentors also serve as a coach to the new teacher. It is within the coaching role that mentors assist new teachers in becoming more deliberate about effective teaching, learning, and assessing.

In mentoring, a primary purpose is to provide support for the new teacher and to enhance the leadership roles of the mentor. A mentor is an experienced teacher who serves as content specialist, guide, provider of resources, advocate, facilitator, coach, and collaborator with the goal of enhancing science and mathematics teaching practices of a less experienced teacher. Mentors in science and mathematics programs are typically teachers with more content knowledge or experience in using a particular curricular program or teaching practices. Sometimes, scientists and mathematicians are mentors for teachers, helping them to develop an increased understanding of the content they are teaching and to incorporate discussions of real-world applications in their teaching of science or mathematics content. They also take on the role of "problem-solvers for instructional dilemmas" to help teachers address many of the challenges in their first years of teaching (Robbins, 1999, p. 40).

Mentoring as a strategy for professional learning has expanded in recent years to focus on the retention of practicing teachers and, specifically, the support of new teachers in their first years. Of new teachers, 30% to 50% leave the profession during their first few years of teaching with the highest attrition rates occurring in urban settings (National Commission on Teaching and America's Future, 1996). A recent online survey by the National Science Teachers Association (NSTA, 2001) found that 33% of those teachers with one to three years of experience are considering leaving the profession. Beginning teachers who are not provided with adequate support and help with their transition feel isolated and begin to question their

competence and their career choice, leading them to leave within their first three years of teaching. Effective mentoring programs have shown a significant increase of teacher retention ranging from 85% to 90% (Newton et al., 1994; Villani, 2002). The National Commission on Mathematics and Science Teaching for the 21st Century (2000) report calls for induction programs that will bring new teachers into the culture and practices of the school. Such programs would provide formal mentoring, collegial learning groups, and classroom observation and critique.

In addition, demanding standards and changing demographics present challenges for new and experienced teachers. Educating highly diverse students to meet much higher science and mathematics standards requires tremendous skills on the part of teachers. Teachers today need to provide a wide range of learning experiences connected to what a diverse student body knows, how they learn, and the content and structure of the disciplines (Ball & Cohen, 1999; Darling-Hammond & McLaughlin, 1999). Teachers need opportunities over time to deepen their understanding of how children learn science and mathematics and to stay abreast of emerging research. Veteran and novice teachers alike need collegial arrangements, like mentoring, that provide a structure through which they continually develop their expertise as teachers (Bransford, Brown, & Cocking, 1999).

**KEY ELEMENTS FOR MENTORING**

- **The mentoring relationship focuses on science and mathematics content and pedagogical content knowledge.**
- **New teachers and mentors have valuable expertise to share with each other.**
- **It is essential to have mutual agreement and understanding on the goal and purpose of the mentoring relationship.**

## Key Elements

*The mentoring relationship focuses on science and mathematics content and pedagogical content knowledge.* If mentoring only addresses the generic teaching strategies of new teachers or how to manage the classroom, there is little opportunity for science or mathematics content knowledge to be increased. Mentors need in-depth science or mathematics content and pedagogical content knowledge to provide the most effective help to new teachers who are learning to teach or use new strategies.

*New teachers and mentors have valuable expertise to share with each other.* Although the intent of mentoring relationships is for the mentor to enhance the learning and growth of the new teacher, teachers new to teaching bring their own level of expertise and learning to the relationship. For example, new teachers often have a wealth of information on new research and learning in their content area, how students learn the content, and awareness of curricular goals and standards. The mentor's role is to facilitate the translation of the new teachers' knowledge into classroom practices. When working with experienced teachers, mentors can help them build on their existing expertise and knowledge as they, for example, try new teaching strategies or implement a new curriculum.



*It is essential to have mutual agreement and understanding on the goal and purpose of the mentoring relationship.* For individuals pursuing mentoring as a structure for continual learning, both the new teacher and the mentor must have common goals and intended outcomes. In situations in which a mentoring program has been instituted schoolwide, it is critical that the school goals (e.g., orientation to a new curriculum, instructional improvement, or changing the culture of the school) align with the goals of the individuals engaging in the mentoring relationship.

## Implementation Requirements

*Mentor competencies.* Mentors need their own professional development and orientation to their roles. Although a mentor may have extensive experience as a teacher of students, mentoring adults requires additional knowledge, skills, and abilities including the following:

- *Establish a climate of peer support.* Mentors need to know how to nurture a supportive environment and relationship with the new teacher by communicating an attitude of support rather than one of an expert with all of the answers (Denmark & Podsen, 2000, p. 21).
- *Model reflective teaching practices.* One of the most valuable aspects of mentoring relationships is the opportunity for the new teacher to learn about the ways in which the mentor thinks about teaching and learning—"getting inside the mentor's head." In addition, by modeling reflection, mentors provide new teachers with a valuable skill and attitude for continuous learning that is part of the teaching profession. "Mentors can assist novices in translating content knowledge and skills into successful instructional behaviors . . . by demonstrating a reflective approach to teaching, self evaluation, and implementation of new ideas" (Denmark & Podsen, 2000, p. 21).
- *Stay current on research.* Mentors can model best practice professional learning by reading recent research and sharing articles, books, and other resources with novice teachers. Accompanying discussions and reflections enhance the learning of both.

*Structure for assignments.* Given the interpersonal nature of mentoring relationships, it is critical that the mentor and new teacher develop a collaborative, mutually rewarding environment for learning. Careful attention must be given to "matching" mentors and new teachers. Criteria are often used in making these matches and include alignment of content areas, grade levels, or even personal interests. If mentoring "matches" are not effective, however, structures need to be in place to allow either the new teacher or mentor to withdraw from the relationship and identify another mentor or new teacher.

*Time.* Time is a key component for implementation of mentoring as a professional learning strategy. Time must be allocated to building the mentoring relationship, for observing in classrooms, and for informal and formal interactions. Not only is structured daily or weekly time essential, but the mentoring relationship necessarily evolves over time and often requires several years to develop its full benefits for the mentor, the novice teacher, and the students in both teachers' classrooms.

### Examples

The Dover-Sherborn regional school district located in Dover, Massachusetts, is in the fifth year of a comprehensive teacher leader mentoring model that supports science and mathematics teachers as well as teachers in other disciplines. In this model, two teacher leaders are identified in each of four schools who provide mentor training for mentors in each building, serve as liaisons to the administrative council and school committee, and manage the logistics of scheduling release time for mentors and new teachers to observe one another's classrooms. Learning and leading happen at multiple levels in the Dover-Sherborn model—for teacher leaders, mentor teachers, and new teachers.

Teacher leaders work with an outside consultant and meet four to six times per year to deepen their communication and leadership skills as they are developing a multiyear strategy to mentor new teachers within their district. Several professional development strategies are combined to provide continued support to new teachers. In the first year, the primary strategies are coaching, mentoring, and classroom observation. In preparation for the 2002-2003 school year, teacher leaders and administrators have agreed to expand support to new teachers through a focused use of examining student work.

Mentor teachers are provided with initial mentor training during the summer workshops. The focus of this training is on the needs of new teachers, communication skills, conferencing and coaching skills, and data gathering strategies. Throughout the school year, teacher leaders work with mentor teachers one-on-one to problem solve around challenges that may arise when working with new teachers. In addition, mentor teachers participate in three to four afterschool seminars with their new teachers. Topics for these sessions are based on an assessment of the new teachers' needs and their concerns at different points during the school year.



New teachers participate in a summer orientation session where they learn about the "nuts and bolts" of their school and classroom responsibilities, meet their mentor teacher, and learn about the ongoing learning opportunities available to them throughout the school year. New teachers and mentors engage in four classroom conferencing and observation cycles throughout the school year. The Dover-Sherborn teacher leaders have created and utilized videotapes of colleagues within their district to provide examples/models of "strategies in action" for new teachers. For example, tapes have provided examples of how to start class, manage difficult behavior, deal with the "paper chase," conduct a concept attainment lesson, and assess how students are understanding "in the moment."

Overall, the key features of the Dover-Sherborn model include strong and ongoing teacher leadership, building of professional culture that supports and expects opportunities for teachers to observe one another and talk about what they are learning, enhancing internal capacity to design and implement professional development, utilization of financial and other resources from multiple sources that continue to provide formal support, and administrator involvement and commitment.

The Northern New England CoMentoring Network (NNECN) is a collaboration among organizations in three states, New Hampshire, Maine, and Vermont, that is designed to provide mentoring and leadership professional development for teachers throughout the three states. The goal is to support and retain middle and high school new or transitional teachers in mathematics and science and to increase the professional learning of experienced teachers. Through the three-year content-focused program, mentors develop skills and knowledge to help them build schools' capacity for supporting novice teachers in their first three years of science or mathematics teaching.

The tiered support that mentors provide is aligned with the professional development experiences they have during the three years and is designed to allow mentors the necessary time and commitment to support several teachers. In the first year, mentors focus in-depth on developing their own mentoring and leadership skills and knowledge and work with one new teacher helping him or her problem solve their most immediate needs as a new teacher. In the second year, mentors continue their own learning and begin to address the needs of teachers entering their second year of teaching—implementing strategies for curriculum, instruction, and assessment that are standards based. In the third year, mentors add another new teacher to work with while decreasing the dependence of their first-year teachers by helping them focus on their own self-assessment, reflection, and teaching. During the three years, mentors and new teachers engage in a variety of learning situations, including study groups, collaborative action research,

research literature circles, national standards studies, attending conferences together, peer observations, and electronic networks. All of these activities provide opportunities for both the mentor and new teacher to learn and continually grow as professionals.

### Commentary

In recent years, mentoring as a formal structure for providing professional learning has grown into a strategy used with novice teachers, experienced teachers, principals, and administrators. Its influence on enhancing practice and learning appears to be largely positive. For example, according to the National Center for Education Statistics (2001) report, 66% of teachers responded that collaborating with a mentor improved their teaching and 52% of mentor teachers responded that the relationship improved their teaching.

As mentoring becomes more prevalent, there are, however, issues that impact the successful implementation of formal structures for mentoring. First, many projects are learning that simply matching a mentor with a new teacher is often not successful. As noted previously, careful consideration and thought must go into pairing teachers in a mentoring relationship. For example, mentors should volunteer to serve in mentor roles, be committed to the time and interpersonal requirements of the role, and recognize that they too can benefit from the relationship. In addition, structures should be in place that allow mentors and new teachers to "select" alternate partners should there be major obstacles to an effective relationship. Some programs anticipate the critical need for the "authentic" development of a mentoring relationship and pair teachers with a team of mentors, resulting in individual relationships developing at a more authentic level.

Second, the school culture must support collegial interactions among teachers. Instituting a mentoring program in a school in which time is not provided for collegial interactions or in which teachers' continual learning is not valued often results in failure of the mentoring program. A related issue noted previously is ensuring that the goals and intended outcomes of the individual mentoring relationships align with the overall school goals. For example, one initial activity for a newly developing mentoring relationship is to examine the school vision and mission concerning science and mathematics teaching and learning and identify specific teaching practices (e.g., implementing a specific set of instructional materials designed to address specific student learning goals) to focus on in the mentoring situation. It is also important to balance the individual needs of the new teacher with the goals of the mentor and the school's goals.

Finally, it is critical for professional developers and administrators who are considering mentoring programs as a strategy for inducting new teachers or supporting veteran teachers to use new teaching strategies to consider the overall professional development provided for both new and



experienced teachers. Mentoring alone cannot address all of the learning needs of all teachers in the school. Teachers also need opportunities to increase their understanding of science and mathematics content, interact with a larger professional community outside of the school, and attend sessions off-site that enhance their learning.

### Resources


Fiedler, E. F., & Haselkorn, D. (1999). *Learning the ropes: Urban teacher induction programs and practices in the United States.* Belmont, MA: Recruiting New Teachers.

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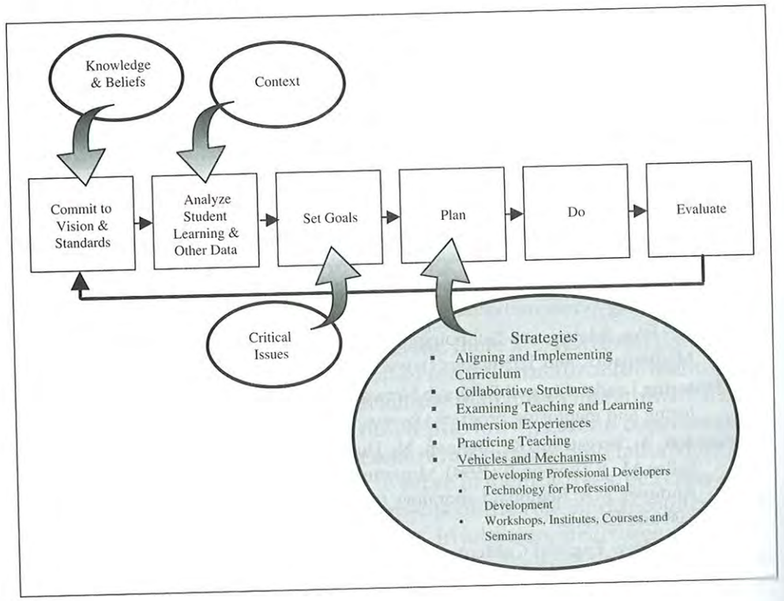
## VEHICLES AND MECHANISMS

This section describes three professional development strategies that are used as structures through which teacher learning is provided. The content and experiences included in these structures vary widely and often include other strategies described in this chapter. The vehicles or mechanisms for professional learning are developing professional developers; technology for professional development; and workshops, institutes, courses, and seminars. (See Figure 5.8.) Each is based on several underlying assumptions about teaching, learning, and professional development.

**Figure 5.8.** Strategies for Professional Learning: Vehicles and Mechanisms




### Underlying Assumptions

*External knowledge is valuable.* Educators must constantly expand their knowledge of both their teaching fields and how to teach them. The structures of the strategies described in this section provide teachers with opportunities to connect with outside sources of knowledge in a focused, direct, and intense way.

*Learning outside of the work environment allows in-depth study and practice needed for success.* Time away from their classrooms and the opportunity to reflect, think deeply, argue alternative explanations, interact with other educators, and practice new ideas and techniques in safe settings are valuable learning opportunities for teachers. Adults benefit from time spent as focused learners being guided through new material and helped to make meaning of it for their own growth and experience.

*Teachers take responsibility for their own learning.* Increasingly, individual teachers are taking the initiative to design their own professional development plans and to seek resources and avenues for their ongoing learning, such as through the structures described in this section. One resource for individual teachers is a CD produced by the Eisenhower National Clearinghouse in collaboration with the National Staff Development Council, *By Your Own Design* (2002). The CD provides frameworks for planning effective professional development, resources, and links to other sites and organizations. Similarly, the NSTA and other professional organizations have Web sites that include information on resources and access to online courses. They also provide formats for networking with other teachers in the same content area.



*Developing leadership strengthens schoolwide and districtwide reform efforts.* Developing the leadership skills and knowledge of teachers not only benefits individual teachers but also the schools and districts within which they work. Science and mathematics education programs rely on the expertise of teacher leaders and professional developers to sustain the efforts and continual learning of teachers and students.

## Developing Professional Developers

*Sandra Hart had taught fourth grade for five years when her school became a pilot site for the district's new science program. She and her colleagues received the new set of instructional materials and participated in three days of workshops for each of the next two years. When the district recruited teachers to help prepare and support other teachers to use the program, she readily volunteered because she loved using it with her students and had observed an increase in student learning during the time she taught using the new materials, and she wanted to share the many strategies she had developed to make it work well in her classroom.*

*Sandra and nine other teachers became the staff developers for the program. They attended a two-week leadership academy during the summer, at which they increased their understanding and skills in the program; learned to conduct workshops; practiced skills in coaching, consultation, and collaboration; and learned about the change process. Released half time to be staff developers for two schools each, the ten teachers met weekly and, with the support and assistance of the district's curriculum coordinator, designed and implemented a plan for districtwide program change.*

The strategy of identifying and developing professional developers has been used widely in mathematics and science improvement. When professional development was narrowly construed as training, this strategy was more commonly called "train the trainer." Now, however, as professional development has broadened to include a variety of strategies to support professional learning, so too have the roles and attendant skills of those who help professionals learn. Train the trainer has become "professionally develop the professional developer."

This strategy has two distinct benefits to the individuals involved. First, individuals who serve as professional developers increase their own knowledge and skills in mathematics and science, learning, and teaching. The following adage applies: There is no better way to learn something than to have to teach it. Second, the new professional developers acquire skills and knowledge well beyond what they need to teach students—those required to support change.

These additional abilities help schools, departments, and districts build the capacity to collaborate, experiment, and continuously improve. Increasingly, schools are implementing job-embedded, practice-based professional learning experiences for teachers. Developing a cadre of experienced school-based or district-based leaders and professional developers who engage in these types of ongoing learning opportunities with teachers enhances the capacity of schools to meet the needs of all teachers, both those new to the field and those with extensive experience. This can result in more learning for all students and for all members of the school community. Given the critical need in mathematics and science to retain new teachers and support more experienced teachers (National Commission on Mathematics and Science Teaching for the 21st Century, 2000), developing teacher leaders and professional developers can renew and challenge teachers and contribute to the cultural shift in schools toward learning communities. As Katzenmeyer and Moller (1996) note, "Restructuring the school as a workplace for teacher leaders to have collegial interactions is one initiative that can encourage talented teachers to remain in the profession. Teacher leadership opportunities can promote teaching as a more desirable career and help to retain outstanding teachers who can assist in the complex tasks of school change" (p. 93).

The strategy of developing professional developers designates teachers, administrators, or other school personnel and local service providers as leaders of other teachers, often in regard to a particular program or change initiative. These individuals are responsible for preparing others to use new programs or approaches or to induct new teachers into effective use of existing methods. The preparation and support of these new professional developers are critical to their success and require careful planning for effective recruitment, training, incentives, and support.

Professional developers need a broad range of knowledge and skills. Depending on the roles they play—for example, trainer, mentor, coach, and consultant—they must develop expertise in the content and pedagogical content of mathematics and science education, organizational change, adult learning and development, coaching, evaluation, and many of the professional development strategies described in this chapter.

As an organization or project considers its long-term professional development plan, there are many benefits to using local professionals to assume professional development roles. It provides accessible local "talent" who can implement new programs and professional development. It

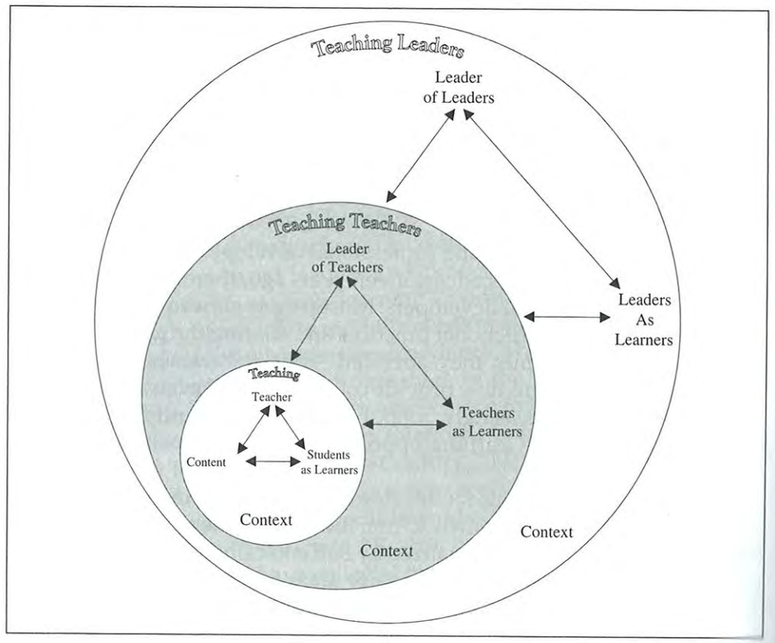


builds local capacity for ongoing development and can serve as a reward for teachers and other professionals who have the requisite skills, attitudes, and interest. Investing in professional developers also provides the school, district, or project with individuals who can connect those in the organization to innovations occurring outside through national and regional networking. As discussed previously, developing leadership is both a critical issue (see Chapter 4) to consider in a professional development design and a guiding goal or purpose for any professional development program. Developing professional developers can serve as one strategy for enhancing the capacity of programs to support continual learning and sustain the program.

The processes for preparing professional developers have been evolving during the past two decades. Fifteen years ago, there were few formal programs for professional developers. Most people grew into their roles by implementing new instructional practices and sharing the good ones with colleagues and sometimes they attended "train the trainer" workshops. Many graduate programs now provide coursework and even majors in staff development and, increasingly, school districts are identifying and supporting staff to provide learning opportunities for their colleagues in the district.

The content of programs for developing professional developers can be guided by a conceptual framework from Judith Mumme and Nanette Seago (2002), based on work conceptualized by Ball and Cohen (2000). This framework suggests that there are three major areas of knowledge professional developers must understand and be able to support teachers to know. These include science or mathematics content, students' thinking and learning, and a repertoire of teaching strategies. These three areas of knowledge interact with one another to bring learning into the classroom. They form the content of what professional developers must know and be able to do. As Figure 5.9 shows, in the classroom (the innermost circle), the teaching of mathematics or science is the complex interaction between the teacher implementing teaching strategies, the content of mathematics or science, and the students' thinking and learning. In a professional development setting (the middle circle), the content becomes the triangular interaction of these three factors, with the learner now the teacher participating in the professional development, and the teacher now the professional developer implementing professional development strategies. These relationships expand further when the focus is on leadership development and developing professional developers (the outermost circle): The content becomes professional development to enhance classroom learning and teaching, the learner is now the professional developer learning new skills and knowledge, and the teacher is the trainer implementing and teaching effective professional development strategies. This model has been used in numerous professional development experiences to help new professional developers remain focused on and attentive to the specific, and ultimate, content

**Figure 5.9.** A Taxonomy of Teaching and Learning




and purpose of their work—student learning in science and mathematics classrooms—by examining the interactions among students, learners, and their content.

**KEY ELEMENTS FOR DEVELOPING PROFESSIONAL DEVELOPERS**

- **Effective professional developers have diverse knowledge and skills.**
- **Professional developers use a repertoire of professional development strategies.**
- **Professional developers have their own learner community.**

## Key Elements

*Effective professional developers have diverse knowledge and skills.* Local professional developers develop in-depth understanding of science and mathematics content; a thorough knowledge of the best practices in teaching, learning, and school organization; self-awareness and an ability to be self-critical; willingness to learn from mistakes and successes; knowledge of schools, both



the learning and teaching processes and the political structures and culture; knowledge of how adults learn; and an understanding of the process of implementing and evaluating changes. Professional developers must also be skillful organizers and coordinators, networkers and relationship builders, and fundraisers. Effective professional developers are flexible, adaptable, and creative. They value the knowledge adults bring to their learning experiences and are willing to take risks and experiment with new approaches and ideas.

*Professional developers use a repertoire of professional development strategies.* The work of the professional developer is varied depending on the goals of teacher learning. For example, when new curriculum is being implemented, professional developers conduct workshops and in-class demonstrations, coach teachers, facilitate problem-solving or trouble-shooting sessions, brief and consult with administrators, and possibly organize material support systems. When teachers' content knowledge is being enriched, professional developers may teach content courses, lead study groups focused on science or mathematics content, or select and introduce replacement units rich in new content not previously taught by teachers.

*Professional developers have their own learner community.* Collegiality and collaboration among professional developers leads to many positive outcomes. Professional developers need access to many resources—the latest findings from research and information about effective programs—and an awareness of the quality of training programs and curriculum. Professional developers cannot work in isolation; they must continually expand their knowledge and stay current in the field. Through national and regional networking, they gain access to these important resources and continue their own development.

## Implementation Requirements

*Ongoing training and support for professional developers.* To build the capacity within a system, new professional developers need to be continually recruited, trained, coached, and supported. Just as new teachers need support, so too do new professional developers. There is no one prescription, however, for developing the requisite skills and knowledge of professional developers. Many colleges and universities offer courses that address inservice education, coaching, collaboration, and change management in schools. Some institutions offer doctoral-level training in staff development. More commonly, school-based professional developers develop the necessary skills through workshops on effective training, team development, and change management (many of which are offered by the Association for Supervision and Curriculum Development and the National Staff

Development Council) and by continuing their development in their particular area of expertise (e.g., science or mathematics education, assessment practice, or action research). They are involved in self-study and networks and are mentored by more experienced staff developers. They read journal articles, attend training or conferences, and join online networks.

*Allocate time to do the work.* Designing and conducting learning experiences for others is not a job that can be done after school and on weekends if it is to be done correctly. When local professional developers are used well, they have time released from student responsibilities to do their work.

*Communicate clear expectations for professional developers.* One way the school administration supports local professional developers is to communicate clear expectations for performance, time requirements, and available resources. In addition, issues that can create problems or signal a lack of support are anticipated, such as how the new professional developers will be introduced to their peers and what, if any, benefits or rewards the professional developer will receive for taking on the new role.

*Conduct ongoing evaluation of programs and performance to ensure quality.* The professional developer and school staff should gather formal and informal data on all professional development activities through a variety of mechanisms (e.g., surveys, observations, and interviews). (See the Resources section.) Data should be analyzed to determine what, if any, changes are needed in the programs. Similarly, the performance of professional developers can be monitored on an ongoing basis, with opportunities to discuss strengths and weaknesses and areas that can be improved.

### Examples

The Leadership Curriculum for Mathematics Professional Development (LCMPD) project is developing leadership curriculum materials to use for professional development of mathematics teachers and leaders. The project is firmly grounded in the content of mathematics—mathematical concepts and problem-solving experiences are at the core of the curriculum. The project uses immersion in mathematical learning to develop the "skills, sensibilities, and long-term capacity of teacher leaders, enabling them to design and implement quality mathematics professional development" (J. Mumme, personal communication, June 14, 2002).

The curriculum contains three-hour videocases that teacher leaders observe, discuss, read about, and reflect on, focusing on the issues that are critical for mathematics professional developers. The videocases highlight six leadership principles: designing for learning; building a professional community; knowing the mathematics used in practice; understanding how to manage discourse; knowing how to select, adapt, and create strategies; and



using a lens of equity (J. Mumme, personal communication, June 14, 2002). The curriculum materials include the videocases, mathematics activities, interviews, commentaries, research papers, articles, references to the literature, assignments designed to help apply learnings to practice, and facilitator guides. The curriculum is being developed to support Web-based formats and will also include a CD, extending the capacity of the project to distance learning. The curriculum materials are designed to be used as a "case method, lesson study approach" to help leaders inquire into K–12 mathematics professional development practices, in much the same way that teachers use videotapes to inquire into teaching practices.

The Mathematics Case Project at WestEd focuses on recruiting, identifying, and supporting new teacher leaders. Project leaders strongly believe that all teachers can lead their colleagues in examining student ideas and can come to new understanding about the content and how students think about the mathematical ideas. One of the project's main strategies is to encourage case discussants to take on roles as case facilitators and professional developers. (See Chapter 4, Ensuring Equity section, for a more thorough description of this project.) Carne Barnett Clarke, the director of the project, describes what she has learned in the process of becoming an effective facilitator of case discussions as follows (Barnett & Friedman, 1997):

> As a facilitator, I also had to learn to depend on case discussion participants to modify their own opinions and ideas as their pedagogical content knowledge grew. However, it was not a laissez-faire approach. I learned ways to evoke deeper analysis of student thinking, to elicit alternative points of view by playing devil's advocate, and to press for justifications and consequences of various ideas. I learned to "pull" ideas from the group and ways to reflect them back for further analysis. I continue to grapple with the balance between taking an active role in the discussion process, sharing authority with the group, and maintaining my neutrality toward the ideas brought up.

Even though Barnett Clarke is an experienced professional developer, her comments reflect the need for continual growth and refinement of skills and abilities, no matter how experienced the professional developer. She and her colleagues have used their reflections on their own development as case facilitators to mentor and develop new facilitators and leaders.

### Commentary

Becoming a professional developer is a process that includes developing expertise as a teacher, as a coach and supporter of other teachers' learning in a particular content area or program, and as a leader, facilitator, evaluator, and negotiator. Effective professional developers, like effective

teachers, are continuous learners who are constantly seeking new ideas, trying them, and making adjustments to meet the needs of their clients and colleagues. They require time and a commitment to ongoing learning. This combination is often hard to find in schools. Teachers are busy people who face many demands and pressures. Some people believe that professional development would be better left to consultants and outside experts. They argue that teachers should focus on good teaching and that professional developers require a different set of skills from those of good teachers. Because teachers are expected to align their practices with one another and collaborate on new initiatives, however, they need the skills of good professional developers. As Katzenmeyer and Moller (1996) state, "Teachers who are leaders lead within and beyond the classroom, influence others toward improved educational practices, and identify with and contribute to a community of teacher leaders" (p. 6). Schools and districts must create the opportunity for teachers to take on these roles and create communities of learners.

Quality control is a key concern as schools and projects develop professional developers from among the teaching staff. New professional developers need ongoing coaching, networking, and support to develop their expertise. Pairing a developing professional developer with a veteran is one strategy for ensuring quality. Engaging professional developers in debriefing sessions after they conduct workshops, model lessons, or work with a team helps professional developers learn from their experience and increase their effectiveness. Feedback from participants in professional development activities can be used to assess quality and make continuous improvements in the professional development.

As teachers and others become professional developers, they also must establish their "credentials" so that they have the respect and support of their colleagues. It is said that it is difficult to be a prophet in your own land. Effective professional developers demonstrate their skills, are a source of useful information and resources, and value and respect the contributions of their colleagues. They share the credit for the programs they support. Their success comes from building support among their colleagues and sharing the credit when they reach key milestones.

The role of professional developer is demanding and often thankless. The professional developer must juggle schedules, negotiate with school administrators and the community for resources and support, and stay current in areas of expertise. These demands, coupled with a teaching or administrative position, can lead to the professional developer becoming overextended and overwhelmed. Although developing local staff who have the expertise and abilities of professional developers is a beneficial strategy, these individuals need support to balance their multiple roles.

### Resources

Guskey, T. R. (2000). *Evaluating professional development.* Thousand Oaks, CA: Corwin.



Illinois Mathematics and Science Academy & Teachers Academy of Mathematics and Science. (2000). *Quality criteria for selecting or designing school-wide professional development in mathematics and science: Tools you can use.* Chicago: Author.

Lambert, L. (1998). *Building leadership capacity in schools.* Alexandria, VA: ASCD.

Miller, B., Moon, J., & Elko, S. (2000). *Teacher leadership in mathematics and science: Casebook and facilitator's guide.* Portsmouth, NH: Heinemann.

## Technology for Professional Learning

*Jessica and Hannah, two teachers in a rural elementary school, had each read* The Teaching Gap *and engaged in many afterschool discussions regarding the book. They were intrigued with the ways in which classrooms differed around the world and wanted to learn more about how teachers in other countries taught science. Through the district's e-mail and listserv system, they started a chat room to share their thoughts and questions with other teachers in the district. By the end of the semester, 15 additional teachers had read the book and were routinely discussing ideas and sharing experiences from their own classrooms. Jessica and Hannah rotated the role of facilitator for the threaded discussions, but realized that they needed more knowledge about effective online moderation. Through the state university—located 200 miles away—they were able to recruit a science educator with online experience to facilitate their chat room discussions. By the end of the school year, the teachers, with the guidance of the university facilitator, had read and discussed several books and articles devoted to examining student work and thinking to expand their understanding of the ways in which different teaching approaches impact student learning.*

*Through an Internet search, Jessica learned about an online workshop offered by a national learning center for science teachers from around the world to examine student work online. The rest of the teachers were eager to join the workshop and they spent six weeks during the summer engaged in discussions with teachers from Japan, Australia, and throughout the United States. Each teacher posted a selection of student work on an online database and a description of the context (the students, the school, the curriculum), the assignment that resulted in the student work, and their own questions about the student thinking based on the work. For example, Hannah posted an assessment item from one of her students and posed the question, "How do I know if the student's response reflects real understanding of the concept of electric circuitry or just rote memorization?" Her question elicited a response from a Japanese teacher who asked about how Hannah taught the content of electric circuits. Others joined in the analysis of the student's assessment response, and the dialogue focused on teaching strategies, student thinking, and assessment.*

*By the end of the six weeks, Hannah and Jessica decided to extend their examination of student work to include looking at mathematics with other teachers in their school. In the fall, many of the teachers in the school joined an in-person study group to focus on the mathematics concepts they taught across the grade levels. They continued their chat room discussions and added video footage of classrooms to their repertoire of online discussions.*