8

Teacher Learning

The findings from research on learning suggest roles for teachers that differ from their roles in the past. Education reform efforts in the United States cannot succeed without an effort to help teachers and administrators assume these new roles (Darling-Hammond, 1997:154):

> If teachers are to prepare an ever more diverse group of students for much more challenging work—for framing problems; finding, integrating and synthesizing information; creating new solutions; learning on their own; and working cooperatively—they will need substantially more knowledge and radically different skills than most now have and most schools of education now develop.

This chapter considers the kinds of learning opportunities available to teachers and analyzes them from the perspective of what is known about ways to help people learn.

Teacher learning is relatively new as a research topic, so there is not a great deal of data on it. But the research that does exist, generally in the form of rich case studies, provides important information about teachers as they attempt to change their practices. Our discussion of these cases is based on the assumption that what is known about learning applies to teachers as well as to their students.

We begin our discussion by examining opportunities for teacher learning that are available to practicing teachers. Some are formal; many others are informal. Understanding teachers' opportunities for learning—including the constraints on teachers' time—is important for developing a realistic picture of possibilities for lifelong learning. In some cases, teachers' opportunities for learning have been consistent with what is currently known about ways to facilitate learning; in other cases they have not (Koppich and Knapp, 1998).

After discussing opportunities for learning, we examine the topic of teacher as learner from the perspectives used in Chapter 6 to characterize effective learning environments. We end with a discussion of learning op-

portunities for preservice education—for college students who are in programs designed to help them learn how to teach.

OPPORTUNITIES FOR PRACTICING TEACHERS

Practicing teachers continue to learn about teaching in many ways. First, they learn from their own practice. Whether this learning is described as the monitoring and adjustment of good practice or analyzed more completely according to a model of pedagogical reasoning (Wilson et al., 1987), teachers gain new knowledge and understanding of their students, schools, curriculum, and instructional methods by living the practical experiments that occur as a part of professional practice (Dewey, 1963; Schön, 1983). Teachers also learn from their own practice through different types of teacher research or "action research," such as creating journals, essays, classroom studies, and oral inquiry processes (Cochran-Smith and Lytle, 1993).

Second, teachers learn through their interactions with other teachers. Some of this occurs during formal and informal mentoring that is similar to apprenticeship learning (Lave and Wenger, 1991; see also Little, 1990; Feiman-Nemser and Parker, 1993). Formal mentoring occurs when an experienced teacher takes a new teacher under his or her wing to provide insight and advice, sometimes for state programs (Feiman-Nemser and Parker, 1993); informal mentoring occurs through conversations in hallways, teachers' rooms, and other school settings. Novices also learn through supervision by department chairs, principals, and other supervisors.

To a small but increasing degree, teachers are teaching other teachers through formal inservice education. Administrators are beginning to recognize expertise in their schools and districts and are encouraging teachers to share that expertise as inservice presenters to their colleagues. Some states, such as Massachusetts, even recognize the preparation for these inservice programs as a form of professional learning for the presenters and award them with "professional development points" for time spent in preparing to teach, as well as time spent teaching their colleagues.

Teachers also teach teachers outside of schools. Meetings of professional associations and teachers' unions include numerous workshops and presentations in which teachers share their knowledge with other teachers. Other examples include the Physics Teacher Resource Agent Project of the American Association of Physics Teachers and the Woodrow Wilson Fellows, in which teachers are trained to provide workshops in instructional methods and materials, as well as content, for other teachers (Van Hise, 1986).

Third, teachers learn from teacher educators in their schools, in degree programs, and in specific teacher enhancement projects that are often provided by consultants. In the 1960s, teachers were trained in this way to use

behavioral objectives; in the 1970s, they were taught Madeline Hunter's lesson structure; and currently, they are offered such topics as constructivism, alternative assessments, and cooperative learning. Teacher enhancement programs funded by federal agencies, such as the National Science Foundation and the U.S. Department of Education, tend to organize training by subject area and are often tied to innovations in curriculum or pedagogy.

Fourth, many teachers enroll in graduate programs. Some states require a master's degree or continuing education to maintain certification, and most school districts tie teachers' salaries to their level of education (Renyi, 1996). For the most part, teachers take graduate courses in education rather than in the subject matter of their teaching because of the lack of disciplinary graduate courses that are offered after school hours or during the summer.

Finally, teachers also learn about teaching in ways that are separate from their formal professional work. They learn about intellectual and moral development in their roles as parents. They learn about nondidactic forms of instruction through such activities as coaching (Lucido, 1988) and other youth-related work in their communities.

Because of the wide variety of ways in which teachers continue to learn about teaching and learning, it is difficult to generalize about or judge the quality of the teachers' learning experiences. One fact is clear, however: there are relatively few opportunities available if measured in financial terms. Overall, there is minimal public investment in formal opportunities for professional development for practicing teachers. Most school districts spend only between 1 and 3 percent of their operating budgets for professional development, even with salaries factored in. This lack of investment in personnel is unheard of either in leading corporations or in schools in other countries (Kearns, 1988).

QUALITY OF LEARNING OPPORTUNITIES

Even when resources are formally provided for teachers' continued development, opportunities for effective learning vary in terms of quality. In this section we analyze the quality of teachers' learning experiences from the perspectives on learning environments discussed in Chapter 6—namely, the degree to which they are learner centered, knowledge centered, assessment centered, and community centered (see Figure 6.1 in Chapter 6).

Learner-Centered Environments

As noted in Chapter 6, environments that are learner-centered attempt to build on the strengths, interests, and needs of the learners. Many efforts to facilitate teacher learning fall short in this regard; they often consist of required lectures and workshops that are not tailored to teachers' needs.

Two-thirds of U.S. teachers state that they have no say in what or how they learn in the professional development opportunities provided to them in schools (U.S. Department of Education, 1994).

The importance of learner-centered instruction can be illustrated by considering the case of Ellen and Molly, two teachers at a progressive urban high school. Ellen is a 25-year seasoned English teacher, a master at teaching writing, opening doors to literature for all students, and creating high standards for her students and ensuring that they achieve them. She is a strong mentor to beginning teachers. For her continuing professional growth, she craves meetings with other faculty members to develop curriculum. This is how she experiences strong intellectual camaraderie and maintains the interest and challenge she needs to keep vital in the classroom. Ellen wants the stimulus of talking about the big ideas with colleagues. She needs the adult interactions to balance and enhance her student interactions.

In contrast to Ellen, Molly is a second-year science teacher whose primary professional concerns involve classroom management and how to develop and maintain it. Molly must master these fundamentals before she can implement any new approach to curriculum, instruction, and assessment. She needs to see how to coordinate work on curriculum and assessment with the development of norms and responsibilities in the classroom that help all students learn. Obviously, Ellen and Molly have very different needs for professional growth, for becoming better teachers.

It can be difficult to meet the different needs of Ellen and Molly and all their colleagues. In a study of the development and implementation of *Minds on Physics* (Leonard et al., 1999a-f), it quickly became apparent to the development team and the evaluators that they did not have the resources available to tailor professional development to the needs of the individual teachers (Feldman and Kropf, 1997). The 37 teachers in the project taught at different levels (high school and community college), in different settings (urban, suburban, and rural), had different undergraduate majors and different amounts of graduate studies, and ranged from new teachers to 30-year veterans.

Some projects provide professional development opportunities that include different stages of participation. The Wisconsin Teacher Enhancement Program in Biology (WTEPB) provides teachers with multiple roles that change as they become more expert in teaching science. Betty Overland, an elementary teacher in Madison, went from avoiding the teaching of science to being "an enthusiastic missionary for reform in science in the elementary schools" (Renyi, 1996:51). She began by participating in a 2-week workshop. This led to her involvement with the members of the biology department at the University of Wisconsin, and she then borrowed their equipment and invited their faculty to visit her class. The next summer she was a facilitator for one of the classes offered to teachers by WTEPB,

and she continued to participate in other workshops and served as a facilitator for others. Eventually, she found herself on a panel as an advocate for a new science education program (Renyi, 1996).

Other ways of dealing with diverse needs include encouraging teachers to form interest groups around particular topics and projects (see, e.g., Cognition and Technology Group at Vanderbilt, in press). New technologies provide opportunities for communication and on-line learning that can connect teachers with others who share their interests and needs (see Chapter 9).

Knowledge-Centered Environments

As discussed in Chapter 6, effective learning environments are knowledge centered as well as learner centered. Ideally, opportunities for teacher learning include a focus on pedagogical content knowledge (Shulman, 1966; see also Chapters 2 and 7), but many fall short of this ideal. For example, the "knowledge" taught by teachers to teachers and supplied by consultants is often not supported by research about learning (Barone et al., 1996). In addition, workshops for teachers often focus more on generic pedagogy (e.g., cooperative learning) than on the need to integrate pedagogy with the content of various disciplines.

A case study of Mrs. O illustrates the importance of helping teachers rethink their disciplinary knowledge as well as their teaching strategies. She attended several summer workshops that used the mathematics curriculum *Math Their Way* (Baratta-Lorton, 1976); the workshops introduced her to new teaching techniques. After the workshops she saw the transformation of her practice as complete as she made some changes in her teaching at the elementary school level that reflected the then-new California mathematics framework. However, she stopped short of rethinking her knowledge of mathematics and saw no need for additional education.

Mrs. O's lack of interest in continued learning seemed to be related to the nature of the workshops that she attended (Cohen, 1990). For Mrs. O to accept the new reform on a deeper level, she would have had to unlearn old mathematics, learn new concepts of teaching mathematics, and have a much more substantial understanding of mathematics itself. The workshops that Mrs. O attended provided her only with teaching techniques, not with the deep understanding of mathematics and mathematics teaching and learning that she would need to implement the reform as envisioned by policymakers.

Preliminary attempts to educate teachers to use *Minds on Physics* (Leonard et al., 1999a-f) also illustrate the difficulty of getting teachers to rethink the nature of their disciplines. Teachers were provided with an in-depth summer workshop, three academic year follow-ups, and contact with the curriculum developers through mail, electronic mail, and telephone. Even though

the teachers changed their understanding of concepts, such as constructivism, and learned new teaching methods, such as collaborative group work, many of their fundamental beliefs about their students and about the purpose of high school physics did not change. For example, while the new curriculum focused on content organized around big ideas as a way to engender deep conceptual understanding of physics, the teachers believed that the purpose of their courses was to provide their students with an overview of all physics because their students would never take another physics course (Feldman and Kropf, 1997).

Several professional development projects for teachers use subject matter as the primary vehicle for learning; teachers learn how to teach a subject by focusing on their own experiences as learners. Examples include SummerMath (Schifter and Fosnot, 1993), the Bay Area and National Writing Project (Bay Area Writing Project, 1979; Freedman, 1985a, b), and the Chicago Teachers Academy for Mathematics and Science (Stake and Migotsky, 1995). In SummerMath, teachers solve mathematics problems together or actually participate in authoring texts. Teachers also write cases about their children's mathematics learning; this engages their own subject-matter knowledge—or lack thereof—which leads them to struggle with their own mathematics learning (Schifter and Fosnot, 1993).

In Project SEED (Science for Early Education Development), elementary school teachers in Pasadena were provided with opportunities to learn about science content and pedagogy by working with the curriculum kits that they would be using in the classroom. Teachers were introduced to content by experienced mentor teachers and scientists, who worked with them as they used the kits (Marsh and Sevilla, 1991).

It can be difficult for teachers to undertake the task of rethinking their subject matter. Learning involves making oneself vulnerable and taking risks, and this is not how teachers often see their role. Particularly in areas like mathematics and science, elementary teachers often lack confidence, and they worry about admitting that they don't know or understand for fear of colleagues' and administrators' reactions (see, e.g., Heaton, 1992; Ball and Rundquist, 1993; Peterson and Barnes, 1996; Lampert, 1998). In addition, teachers generally are accustomed to feeling efficacious—to knowing that they can affect students' learning—and they are accustomed to being in control. When they encourage students to actively explore issues and generate questions, it is almost inevitable that they will encounter questions that they cannot answer—and this can be threatening. Helping teachers become comfortable with the role of learner is very important. Providing them with access to subject-matter expertise is also extremely important. New developments in technology (see Chapter 9) provide avenues for helping teachers and their students gain wider access to expertise.

Assessment-Centered Environments

Environments that are assessment centered provide opportunities for learners to test their understanding by trying out things and receiving feedback. Such opportunities are important to teacher learning for a number of reasons. One is that teachers often don't know if certain ideas will work unless they are prompted to try them with their students and see what happens; see Box 8.1. In addition to providing evidence of success, feedback provides opportunities to clarify ideas and correct misconceptions. Especially important are opportunities to receive feedback from colleagues who observe attempts to implement new ideas in classrooms. Without feedback, it is difficult to correct potentially erroneous ideas.

A report from a group of researchers highlights the importance of classroom-based feedback (Cognition and Technology Group at Vanderbilt, 1997). They attempted to implement ideas for teaching that had been developed by several of their colleagues at different universities. The researchers were very familiar with the material and could easily recite relevant theory and data. However, once they faced the challenge of helping teachers implement the ideas in local classrooms in their area, they realized the need for

BOX 8.1 "Exceptional Kids"

Mazie Jenkins was skeptical when first told that research shows that first-grade children can solve addition and subtraction word problems without being taught the procedures. When she saw videotapes of 5-year-old children solving word problems by counting and modeling, Mazie said they were exceptional kids because they could solve "difficult" word problems, such as:

> You have five candy bars in your Halloween bag; the lady in the next house puts some more candy bars in your bag. Now you have eight candy bars. How many candy bars did the lady in the next house give you?

Then Mazie tried out this problem with her first-grade class at the beginning of the year, and she excitedly reported, "My kids are exceptional too!" Mazie learned that, while she herself saw this problem as a "subtraction" problem—because she had been taught the procedure for doing the problem that way—her first graders solved the problem spontaneously, typically by counting out five unifix cubes (to represent candy bars), adding more cubes until they had eight, and then counting the number they had added to get to eight. Mazie's kids then proudly reported the answer as "three" (Carpenter et al., 1989).

much more guidance. They knew many facts about the colleagues' programs, but did not know how to translate them into action (see Chapter 2 for discussions of conditionalized expert knowledge). Without extended opportunities for more information and feedback, the researchers did not know how to proceed.

After several months, the researchers and their teacher collaborators began to feel comfortable with their attempts at implementation. The colleagues who had developed the new programs visited the classrooms in the researchers' city and provided feedback. There were numerous errors of implementation, which could be traced to an inadequate understanding of the new programs. The experience taught all participants a valuable lesson. The colleagues who had developed the programs realized that they had not been as clear as they should have been about their ideas and procedures. The researchers experienced the difficulty of implementing new programs and realized that their errors would have remained invisible without feedback about what was wrong.

Certification programs are being developed that are designed to help teachers reflect on and improve their practice. Suggestions for reflection help teachers focus on aspects of their teaching that they might otherwise have failed to notice. In addition, teachers preparing for certification often ask peers to provide feedback on their teaching and their ideas. Billie Hicklin, a seventh-grade teacher in North Carolina, was one of the first teachers to participate in the National Board certification process (Bunday and Kelly, 1996). She found that the structured reflection that was required for certification resulted in her making significant changes in her teaching practices and in the ways that she interacts with colleagues (Renyi, 1996).

Community-Centered Environments

Community-centered environments involve norms that encourage collaboration and learning. An important approach to enhancing teacher learning is to develop communities of practice, an approach that involves collaborative peer relationships and teachers' participation in educational research and practice (Lave and Wenger, 1991). Examples include the Bay Area Writing Project (1979); the Cognitively Guided Instruction Project (Carpenter and Fennema, 1992; Carpenter et al., 1989, 1996); Minstrell and Hunt's (Minstrell, 1989) physics and mathematics teacher group; the Annenberg Critical Friends Project; and Fredericksen and White (1994) "video clubs," where teachers share tapes of lessons they have taught and discuss the strengths and weaknesses of what they see.

As part of these communities, teachers share successes and failures with pedagogy and curriculum development. For example, the Annenberg Institute's critical friends groups are led by a teacher/coach, trained in pro-

cess skills and diverse ways of looking at student work. The groups can be anything to which the teachers agree, but usually involve issues of student achievement, such as, "What is good work?" "How do we know?" and "How do we develop shared standards for good work?"

Some communities of practice are supported by school districts. For example, at the Dade Academy for the Teaching Arts (DATA) in Florida, "extern" teachers spend a 9-week sabbatical working with resident teachers, who have reduced teaching assignments at neighboring Miami Beach High School. The externs design their own programs, do research projects, and participate in group seminars. In DATA, the community of practice is supported by providing the extern teachers with sabbaticals, supporting the resident teachers through reduced loads, and by giving the program a home—portable classrooms next to Miami Beach High School (Renyi, 1996).

The notion of bringing teachers together to review student work in a nonjudgmental fashion is also embodied in the "Descriptive Review" (Carini, 1979). Again, the central questions involve looking deeply at student work, not trying to provide reasons (psychological, social, economic) that the student might not be producing strong academic work. This approach often uses student artwork to help teachers identify student strengths. Project Zero's "collaborative review process" (Perkins, 1992) for teachers builds on the descriptive review approach and adds some new elements as well, such as a variety of computer networks for teachers. Examples of computer networks include BreadNet, out of the Breadloaf Writing Project, LabNet (Ruopp, 1993), and Mathline (Cole, 1996). Other ways to foster collaboration include opportunities to score and discuss student essays or to compare and discuss student portfolios (Wiske, 1998).

Collaborative discussions become most valuable when two teachers are jointly involved in sense-making and understanding of the phenomena of learning (e.g., Peterson et al., 1989). For example, in creating a new functions-based approach to algebra teaching for all students, teacher colleagues at Holt High School report how important for learning it was for two teachers to "team" together in the same classroom and share decisions (Yerushalmy et al., 1990). Every day these two algebra teachers had to discuss and agree on what to do next. This joint decisionmaking required reflection and discussion on the texts of specific algebra problems, as well as discussion of students' understanding of functions, as reflected in the classroom discussions and in students' writings. Coming to joint decisions required these teachers to wrestle with issues of mathematics and mathematics learning around their own specific problems of practice as teachers, such as what constitutes valid evidence for students' understanding in the specific day-to-day situation.

Overall, two major themes emerge from studies of teacher collaborations: the importance of shared experiences and discourse around texts and

data about student learning and a necessity for shared decisions. These findings are consistent with analyses of situated learning and discourse (Greeno et al., 1996); empirical studies of high school teachers' use of information in their work (Natriello et al., 1994), and models of assessment as situated discourse around texts (Case and Moss, 1996).

ACTION RESEARCH

Action research represents another approach to enhancing teacher learning by proposing ideas to a community of learners. Action research is an approach to professional development in which, typically, teachers spend 1 or more years working on classroom-based research projects. While action research has multiple forms and purposes, it is an important way for teachers to improve their teaching and their curricula, and there is also an assumption that what teachers learn through this process can be shared with others (Noffke, 1997). Action research contributes to sustained teacher learning and becomes a way for teachers to teach other teachers (Feldman, 1993). It encourages teachers to support each other's intellectual and pedagogical growth, and it increases the professional standing of teachers by recognizing their ability to add to knowledge about teaching. Ideally, active engagement in research on teaching and learning also helps set the stage for understanding the implications of new theories of how people learn.

The teachers of the Physics Teacher Action Research Group (PTARG) in the San Francisco Bay area practice a form of collaborative action research called enhanced normal practice (Feldman, 1996). In regular group meetings, the teachers discuss their students' work. Between the meetings they try out pedagogical and curricular ideas from the group. They then report to the group on successes and failures and critically analyze the implementation of the ideas. In addition to generating and sharing of pedagogical content knowledge, the PTARG teachers came to deeper understandings of their subject area (Feldman, 1993; see also Hollingsworth, 1994, on work with urban literacy teachers).

Action research can also be tailored to the level of expertise and the needs of the teachers, especially if the teachers set the goals for the research and work collaboratively. Because action research is a constructivist process set in a social situation, teachers' beliefs about learning, their students, and their conceptions of themselves as learners are explicitly examined, challenged, and supported. When action research is conducted in a collaborative mode among teachers, it fosters the growth of learning communities. In fact, some of these communities have flourished for as many as 20 years, such as the Philadelphia Teachers Learning Cooperative and the Classroom Action Research Network (Feldman, 1996; Hollingsworth, 1994; Cochran-Smith and Lytle, 1993).

Unfortunately, the use of action research as a model of sustained teacher learning is hampered by lack of time and other resources. Teachers in the United States are generally not provided with paid time for such professional activities as action research. To provide that time would require financial resources that are not available to most school districts. As a result, teachers either engage in action research on their own time, as part of credit-bearing courses, or as part of separately funded projects. Typically, when the course is over or when the project ends, teachers' formal action research ends. While teachers have claimed that they have incorporated action research into their practice in an informal manner, there is little research that has examined what that means.

The sustainability of action research is also hampered by the difference between practitioner research and academic research. If academicians are to encourage teachers to do action research, they need to have models that fit the temporal flow of school teaching (Feldman and Atkin, 1995) and rely on forms of validity that are appropriate to research in the practical domain (Feldman, 1994; Cochran-Smith and Lytle, 1993).

PRESERVICE EDUCATION

Preservice programs that prepare new teachers will play an especially important role during the next few decades (Darling-Hammond, 1997:162):

> The United States will need to hire 2 million teachers over the next decade to meet the demands of rapidly rising enrollments, growing retirements, and attrition that can reach 30% for beginning teachers in their initial years . . . . [All] will need to be prepared to teach an increasingly diverse group of learners to ever-higher standards of academic achievement.

Most of the nation's new teachers will come from teacher education programs that have considerable structural variation. First, teacher education can be an undergraduate major or a program that is in addition to an academic major. Second, there can be an expectation that the program can be completed within the traditional 4 years of undergraduate study or that it is a 5-year or masters degree program as advocated by the Holmes Group (1986). Third, programs for initial teacher preparation can be university or college based or located primarily in the field. Finally, programs can differ as to whether they are primarily academic programs or whether their main purpose is certification or licensing.

While programs can vary in these ways, they tend to have several components in common: some subject-matter preparation, usually liberal arts or general education for prospective elementary teachers and subject-matter concentration for prospective secondary teachers; a series of foundational courses, such as philosophy, sociology, history, psychology of education;

one or more developmental, learning, and cognitive psychology courses; methods ("how to") courses; and a sequence of field experiences (see Goodlad, 1990). What differs among the programs is the primacy of the different components, the instructors' goals for their program and their courses, and the attitudes and beliefs that students bring to them.

Four philosophical traditions of practice have dominated teacher education in the twentieth century (Zeichner and Liston, 1990:4):

1. an academic tradition that emphasizes teachers' knowledge of subject matter and their ability to transform that subject matter to promote student understanding;
2. a social efficiency tradition that emphasizes teachers' abilities to apply thoughtfully a "knowledge base" about teaching that has been generated through research on teaching;
3. a developmentalist tradition that stresses teachers' abilities to base their instruction on their direct knowledge of their students—their mental readiness for particular activities; and
4. a social reconstructionist tradition that emphasizes teachers' abilities to analyze social contexts in terms of their contribution to greater equality, justice, and elevation of the human condition in schooling and society.

Although these traditions can act as useful heuristics for understanding the guiding principles of particular teacher education programs, it is important to realize that most programs do not fit neatly within the categories (Zeichner, 1981). And even though these traditions underlie teacher education programs, students are often not aware of them explicitly (Zeichner and Liston, 1990). The actual experiences of many prospective teachers often obscure the philosophical or ideological notions that guide their preparatory years, which color evaluations of the quality of preservice experiences (see below).

The components of teacher education programs—collections of courses, field experiences, and student teaching—tend to be disjointed (Goodlad, 1990); they are often taught or overseen by people who have little ongoing communication with each other. Even when the components are efficiently organized, there may be no shared philosophical base among the faculty. Moreover, grading policies in college classes can undercut collaboration, and students rarely have a chance to form teams who stay together for a significant portion of their education (unlike the team approach to problem-based learning in medical schools (see, e.g., Barrows, 1985). Political factors have strong effects on teacher education. Many "misguided regulatory intrusions" (Goodlad, 1990:189)—from schools, colleges, accreditation boards, and state and federal departments of education—have a negative effect on teacher education programs. The regulations often interfere with attempts

to develop coherent and innovative programs that can prepare teachers to teach. The majority of teachers are educated in state colleges and universities, the budgets of which are controlled by state legislators and governors, and they teach in public schools that are affected by local politics through school boards, as well as by the same statewide influences (Elmore and Sykes, 1992). It is not surprising that these many forces do not lead to the most innovative teacher education programs.

The National Commission on Teaching and America's Future (1996) identified several problems with current preservice teacher preparation programs:

- Inadequate time: 4-year undergraduate degrees make it difficult for prospective elementary teachers to learn subject matter and for prospective secondary teachers to learn about the nature of learners and learning.
- Fragmentation: The traditional program arrangement (foundations courses, developmental psychology sequence, methods courses, and field experiences) offers disconnected courses that novices are expected to pull together into some meaningful, coherent whole.
- Uninspired teaching methods: Although teachers are supposed to excite students about learning, teacher preparation methods courses are often lectures and recitation. So, prospective teachers who do not have hands-on, "minds-on" experiences with learning are expected to provide these kinds of experiences for students.
- Superficial curriculum: The need to fulfill certification requirements and degree requirements leads to programs that provide little depth in subject matter or in educational studies, such as research on teaching and learning. Not enough subject-matter courses are included in teachers' preparation.

The effects of these problems can be seen in the complaints that preservice teacher education students have about foundations courses that seem disjointed and irrelevant to practice, or are "too theoretical" and have no bearing on what "real" teachers do in "real" classrooms with "real" students. They also complain that methods courses are time consuming and without intellectual substance. When methods courses explore the theory and research bases for instructional methods and curricula, the students complain that they are not oriented enough toward practice.

These problems in preservice education impede lifelong learning in at least two ways. First, a message is sent to prospective teachers that research in education, whether on teaching or learning, has little to do with schooling and, therefore, that they do not need to learn about the findings from research. Second, the importance of viewing themselves as subject-matter experts is not emphasized to teachers—especially teachers in the early and middle grades: they fall into believing the old saw that "those who can, do;

those who can't, teach." Teachers are not encouraged to seek the knowledge and understanding that would allow them to teach academically rigorous curricula.

Even teachers who attend institutions that provide a strong preparation for teaching face major challenges after they graduate. They need to make the transition from a world dominated primarily by college courses, with only *some* supervised teaching experiences, to a world in which they are the teachers; hence, they face the challenge of transferring what they have learned. Yet even with strong levels of initial learning, transfer does not happen immediately nor automatically (see Chapter 3). People often need help in order to use relevant knowledge that they have acquired, and they usually need feedback and reflection so that they can try out and adapt their previously acquired skills and knowledge in new environments. These environments—the schools—have an extremely important effect on the beliefs, knowledge, and skills that new teachers will draw on. It is the difficult transition, in Lee Shulman's (1986) terms, from expert learner to novice teacher.

Many of the schools that teachers enter are organized in ways that are not consistent with new developments in the science of learning. The schools often favor "covering the curriculum," testing for isolated sets of skills and knowledge, and solo teaching, with limited use and understanding of new technologies (National Commission on Teaching and America's Future, 1996). When student teachers enter their first classrooms, the instructional methods, curricula, and resources can be very different from the ones they learned about in teacher education programs. So although prospective teachers are often anxious to begin their student teaching and find it the most satisfying aspect of their teacher preparation (Hollins, 1995), the dissonance between this experience and their course work supports the belief that educational theory and research have little to do with classroom practice.

Most new teachers are required to "sink or swim" in their initial teaching placement (National Commission on Teaching and America's Future, 1996:39). New teachers are often given the most challenging assignments—more students with special educational needs, the greatest number of class preparations (some outside of their field of expertise), and many extracurricular duties—and they are usually asked to take on these responsibilities with little or no support from administrators or senior colleagues. It is not surprising that turnover among new teachers is extremely high, particularly in the first 3 years of teaching.

CONCLUSION

Teachers are key to enhancing learning in schools. In order to teach in a manner consistent with new theories of learning, extensive learning opportunities for teachers are required.

We assume that what is known about learning applies to teachers as well as their students. Yet teacher learning is a relatively new topic of research, so there is not a great deal of data about it. Nevertheless, there are a number of rich case studies that investigate teachers' learning over extended time periods and these cases, plus other information, provide data on learning opportunities available to teachers from the perspective of what is known about how people learn.

Much of what constitutes the typical approaches to formal teacher professional development are antithetical to what research findings indicate as promoting effective learning. The typical workshops tend to occur once, deal with decontextualized information, and often do not resonate with teachers' perceived needs. By contrast, research evidence indicates that the most successful teacher professional development activities are those that are extended over time and encourage the development of teachers' learning communities. These kinds of activities have been accomplished by creating opportunities for shared experiences and discourse around shared texts and data about student learning, and focus on shared decisionmaking. The learning communities of teachers also allow for differing kinds of background training and for variations in their readiness to learn. Successful programs involve teachers in learning activities that are similar to ones that they will use with their students.

Many learning opportunities for teachers fall short when viewed from the perspectives of being learner, knowledge, assessment, and community centered. But there are examples of successful programs that appear to fit these conditions quite well. Many programs for preservice teachers also fall short of providing the kinds of learning experiences suggested by new developments in the science of learning. They need well-defined goals for learning, beliefs about how people learn that are grounded in theory, and a rigorous academic curriculum that emphasizes depth of understanding.

While the flaws of preservice and inservice programs have serious consequences for how well teachers are prepared to begin teaching, they may also significantly affect teachers' lifelong learning and development as professionals. In particular, the dissonance between what is taught in college courses and what happens in classrooms can lead to later rejection of educational research and theory by teachers. This is due, in part, to the ways in which they have been taught in the disciplines and how their colleagues teach. Although teachers are urged to use student-centered, constructivist, depth-versus-breadth approaches in their education classes, new teachers often see traditional teaching approaches in use at the college level and in the classroom next door. Beginning teachers are especially influenced by the nature of the schools in which they begin their teaching.

Successful learning for teachers requires a continuum of coordinated efforts that range from preservice education to early teaching to opportunities for lifelong development as professionals. Creating such opportunities, built out of the knowledge base from the science of learning, represents a major challenge, but it is not an impossible task.