



Introduction

John Bransford, Linda Darling-Hammond, and Pamela LePage

To a music lover watching a concert from the audience, it would be easy to believe that a conductor has one of the easiest jobs in the world. There he stands, waving his arms in time with the music, and the orchestra produces glorious sounds, to all appearances quite spontaneously. Hidden from the audience—especially from the musical novice—are the conductor’s abilities to read and interpret all of the parts at once, to play several instruments and understand the capacities of many more, to organize and coordinate the disparate parts, to motivate and communicate with all of the orchestra members. In the same way that conducting looks like hand-waving to the uninitiated, teaching looks simple from the perspective of students who see a person talking and listening, handing out papers, and giving assignments. Invisible in both of these performances are the many kinds of knowledge, unseen plans, and backstage moves—the skunkworks, if you will—that allow a teacher to purposefully move a group of students from one set of understandings and skills to quite another over the space of many months.

On a daily basis, teachers confront complex decisions that rely on many different kinds of knowledge and judgment and that can involve high-stakes outcomes for students’ futures. To make good decisions, teachers must be aware of the many ways in which student learning can unfold in the context of development, learning differences, language and cultural influences, and individual temperaments, interests, and approaches to learning. In addition to foundational knowledge about these areas of learning and performance, teachers need to

know how to take the steps necessary to gather additional information that will allow them to make more grounded judgments about what is going on and what strategies may be helpful. Above all, teachers need to keep what is best for the child at the center of their decision making. This sounds like a simple point, but it is a complex matter that has profound implications for what happens to and for many children in school.

The importance of preparing teachers to exercise trustworthy judgment based on a strong base of knowledge is increasingly important in contemporary society. Standards for learning are now higher than they have ever been before, as citizens and workers need greater knowledge and skill to survive and succeed. Education is increasingly important to the success of both individuals and nations, and growing evidence demonstrates that—among all educational resources—teachers’ abilities are especially crucial contributors to students’ learning (see, for example, Ferguson, 1991a; Rivkin, Hanushek, and Kain, 2000; Wright, Horn, and Sanders, 1997). Furthermore, the demands on teachers are increasing. Not only do teachers need to be able to keep order and provide useful information to students, they also need to be increasingly effective in enabling a diverse group of students to learn ever more complex material and to develop a wider range of skills. Whereas in previous decades teachers were expected to prepare only a small minority for the most ambitious intellectual work, they are now expected to prepare virtually all students for higher-order thinking and performance skills once reserved for only a few.

To meet the expectations they now face, teachers need a new kind of preparation—one that enables them to go beyond “covering the curriculum” to actually enable learning for students who learn in very different ways. Programs that prepare teachers need to consider the demands of today’s schools in concert with the growing knowledge base about learning and teaching if they are to support teachers in meeting these expectations. This volume was developed in response to this challenge: to summarize what is understood about how people learn and what teaching strategies support high levels of learning and to examine what approaches to preparing teachers can help them acquire this body of knowledge and skills.

The goal of preparing teachers who are equipped to help all students achieve to their greatest potential raises a number of important questions, for example:

1. What kinds of *knowledge* do effective teachers need to have about their subject matter and about the learning processes and development of their students?
2. What *skills* do teachers need in order to provide productive learning experiences for a diverse set of students, to offer informative feedback on students’ ideas, and to critically evaluate their own teaching practices and improve them?

3. What professional *commitments* do teachers need to help every child succeed and to continue to develop their own knowledge and skills, both as individuals and as members of a collective profession?

We focus especially on preparation for new teachers—knowing full well that it takes many years of experience to develop sophisticated expertise. We understand that teachers continually construct new knowledge and skills in practice throughout their careers rather than acquiring a finite set of knowledge and skills in their totality before entering the classroom. The goal for preservice preparation, then, is to provide teachers with the core ideas and broad understanding of teaching and learning that give them traction on their later development. This perspective views teachers' capacity not as a fixed storehouse of facts and ideas but as "a source and creator of knowledge and skills needed for instruction" (Cohen and Ball, 1999, p. 6). An important goal of this volume is to help teachers become "adaptive experts" who are prepared for effective lifelong learning that allows them continuously to add to their knowledge and skills (see, for example, Hatano and Inagaki, 1986; Hatano and Oura, 2003). Later chapters explore in more detail the concept of adaptive expertise as it is applied to teaching.

In addition to preparing teachers to learn throughout their lifetimes, we seek to describe the initial understandings that teachers need to serve adequately the very *first* students they teach. We believe that these students, like all others, are entitled to sound instruction and cannot afford to lose a year of schooling to a teacher who is ineffective or learning by trial and error on the job. This is especially important since beginning teachers—and those who are unprepared—are disproportionately assigned to teach students in low-income, high-minority schools and students in lower track classes who most need skilled teachers in order to succeed (National Commission on Teaching and America's Future, 1996).

So beginning teachers need to have a command of critical ideas and skills and, equally important, the capacity to reflect on, evaluate, and learn from their teaching so that it continually improves. We believe this is more likely if the essential knowledge for beginning teachers can be "conceptually organized, represented and communicated in ways that encourage beginners to create deep understandings of teaching and learning" (Barnes, 1989, p. 17). Although we focus on the conceptual map that novices need to begin to navigate the classroom landscape, we hope that the information in this volume will also be useful to veteran teachers. One of our major goals is to suggest frameworks for helping teachers organize their knowledge and their thinking so that they can accelerate their learning throughout their careers.

This report does not speak exclusively to traditional programs of teacher education organized for undergraduate college students. Its recommendations are

for initial preparation programs of all kinds, including alternative programs designed for midcareer recruits and others who prepare in postbaccalaureate programs based in universities or school districts. Although program qualities, and quality, vary widely across the many contemporary routes into teaching, these do not divide neatly across categories often used to describe them. Both so-called “traditional” and “nontraditional” programs can range from at best rudimentary to highly coherent and effective. Many programs that states have designated as “alternative” provide strong preparation that has the added advantage of connecting candidates to the districts that want and need to hire them (for examples, see National Commission on Teaching and America’s Future, 1996, p. 93). Many “traditional” undergraduate programs also have found ways to provide strong preparation for teaching, sometimes within the usual four-year parameters and sometimes by adding an additional year of study and clinical training (for examples, see Koppich, 2000; Merseth and Koppich, 2000; Miller and Silvernail, 2000; Zeichner, 2000). Our focus is not on the format, length, or location of teacher education but on its substance: what prospective teachers need to learn and how they may best be enabled to learn it.

THE CONTEXT OF TEACHING

If improvement in education is the goal, it is not enough to prepare good teachers and send them out to schools. If teachers are to be effective, they must work in settings where they can use what they know—where, for example, they can come to know students and families well; work with other teachers to provide a coherent, well-grounded curriculum; evaluate and guide student progress using information-rich assessments; and use texts and materials that support thoughtful learning. Unfortunately, given the patchwork of policies, the plethora of competing decision makers, and the fragmented design of factory-model schools, these conditions are not present in many, perhaps most, U.S. schools.

Many analysts have noted that there is very little relationship between the organization of the typical American school and the demands of serious teaching and learning (Darling-Hammond, 1997; Elmore, 1996; Goodlad, 1984; Sarason, 1993; Sizer, 1984). Unlike schools in many other countries, U.S. schools are typically not organized to keep students with the same teachers for more than one year or to provide extended time for teachers to plan and study teaching together. Furthermore, the systems that U.S. schools sit within rarely provide coherent curriculum guidance that includes supports for teachers to develop sophisticated lessons and teaching strategies. And, unlike those who attend schools in most other industrialized countries, students and teachers in relatively few U.S. schools are guided by challenging assessments that require the presentation and defense of ideas and the production of work that demonstrates how they can inquire, assemble and evaluate evidence, reason,

and problem solve. Finally, U.S. schools are struggling both to overcome the vestiges of societal and educational discrimination and to develop models of organization and methods of instruction that successfully provide access to challenging curriculum material to the full range of learners, rather than rationing such curriculum to a small subset of students.

Given these challenges of contemporary schooling, it would be naïve to suggest that merely producing more highly skilled teachers can, by itself, dramatically change the outcomes of education. We must attend simultaneously to both sides of the reform coin: better teachers and better systems. Schools will need to continue to change to create the conditions within which powerful teaching and learning can occur, and teachers will need to be prepared to be part of this change process.

Although the system changes that are needed go far beyond what individual teachers should be expected to effect, there are at least three ways in which teacher education is implicated in supporting needed systemic reforms. First, because working in professional learning communities is a key to changing school cultures, we argue that the teacher education curriculum should help teachers learn how to work on the improvement of practice as members of such collaborative communities (see for example, Fullan, 1993a; Lieberman, 1988; Louis and Kruse, 1995; McLaughlin and Talbert, 2001). Second, if prospective teachers are to support more equitable and powerful education for their students, they will need to develop a strong sense of moral purpose, and they will need to understand the change process in organizations so that they can be constructive contributors to school reform (Fullan, 1993b). Finally, teacher education programs need to consider how they can engage in partnerships with schools and districts that work to transform schooling and teaching in tandem. In this way, prospective teachers can be prepared for the schools they need in order to teach effectively, and they can learn firsthand how to work in and develop contexts that will support the learning of all of their students.

Beyond Cookie Cutters

Specifying what successful teachers need to know and be able to do is not a simple task. As is true with all professions, including medicine, the law, and the clergy, there is no single “cookie cutter” formula for being successful. There is no one right way to behave as a teacher. Some effective teachers are charismatic whereas others are more retiring. Some are emotional and some are reserved. Some have a stern demeanor whereas others are more nurturing. There are many different ways that successful professionals can vary and still be highly effective. Within this variation, however, there are common kinds of practices that draw on shared understanding of how to foster student learning. For example, a recent study of ninety-two highly effective elementary and middle school teachers found that they vary in their styles but have many teaching strategies in common. (See “Common Practices Among Highly Effective Teachers.”)

Common Practices Among Highly Effective Teachers

With funding from The Lyndhurst Foundation, the Public Education Foundation has been studying ninety-two elementary and middle school teachers identified as highly effective in Hamilton County, Tennessee. The teachers all had three-year average student scores in the top 25 percent of all teachers in the county on the Tennessee Value Added Assessment System (TVAAS) or, if they did not have a three-year TVAAS history, were nominated as highly effective based on other appropriate measures. The teachers were interviewed, surveyed, and observed over the course of a year. Although the teachers differed in their ages, backgrounds, and personalities, the researchers found that the teachers “offered a remarkably similar picture” of effective teaching—one that reflects many of the elements of teaching we describe in this volume. For example:

- Expectations for the students were clearly stated and exemplars of previous year’s assignments were shown to students as models of what to produce.
- Student work could be found everywhere: inside the classroom, out the door, and down the hall.
- The teachers did not stand still and lecture; they covered every part of the room and monitored every activity that took place.
- Multiple small group activities were often found, while the traditional arrangement of desks in rows was practically nonexistent.
- There were high levels of “instructional discourse”: Students were encouraged to ask questions, discuss ideas, and comment on statements made by teachers and other students.
- The organization of the rooms and the lessons was clearly evident. Materials were easily accessible when needed, and no class time was wasted from lack of preparation.

Source: Pamala Carter, Teacher Quality Initiative, Chattanooga-Hamilton County Public Education Foundation. www.pefchattanooga.org/www/docs/2-110. Reprinted with permission.

In any profession there are key elements that define what it means to be a professional, starting with the ethical pledge that members of professions make to the welfare of all of their clients. Thus a central part of being a professional teacher is a commitment to help all students succeed. Educators who have made such commitments to help all students succeed have demonstrated that it is indeed possible to do so, even in areas like mathematics, physics, and computer science where inequalities are longstanding (see “Supporting Student Achievement in Calculus”). But it has taken a great deal of work for these teachers to be successful. And they needed more than a basic desire to succeed. They needed to have knowledge and skills and access to other professionals to be able to follow through with their commitments rather than simply to try and fail.

Supporting Student Achievement in Calculus

Uri Treisman’s work in the Berkeley Mathematics Workshop and in the Emerging Scholars Program at the University of Texas at Austin is one example of a project that has helped underrepresented students succeed in college-level calculus. Based on a study that found a strong correlation between success in mathematics and participation in study groups, Treisman and his colleagues designed a program that reflects the belief that students, if given the necessary direction and support, can develop a

collective understanding of complex mathematical concepts (Garland, 1993). In his early work at UC Berkeley, Treisman noted that Asian American, African American, and Latino students experienced different success rates in calculus, even though they were all highly motivated, had families who were supportive of their education, and were well prepared academically. Treisman found that the Asian Americans who experienced success in calculus formed informal study groups through which they developed a collaborative understanding of the problems they studied and made public their conceptual understanding of complex mathematics. However, in response to their encounters with hostile institutions, African American students tended to separate their academic and personal lives and to engage in coursework on their own.

In response to those findings, Treisman created student workshops including intensive supplementary instruction, the creation of community study groups, orientation to the university, and academic counseling that is tied to the study sessions. The workshops provide a safe place for students to make their understandings of mathematics public and challenge their mathematical knowledge with rigorous work on hard problems. According to Treisman, moving student support programs from admissions-mandated, all-purpose tutoring centers to academic departments “demarginalizes” academic support. Rather than seeing tutors the day before an exam, the workshop is an ongoing, central part of students’ participation in the course and includes regular academic counseling. Academic counseling is a critical feature of the model, addressing some of the structural impediments to persistence.

More than 150 programs based on Treisman’s model can now be found at institutions across the country. A study of the mathematics workshop model at California State Polytechnic University (Pomona) found that the workshop model greatly improved the performance of women and Latino science, mathematics, and engineering majors taking calculus (Bonsangue and Drew, 1996). Participants in the workshop earned a grade 0.6 points higher on average than their classmates who did not participate. Women achieved the highest grades among all ethnic and gender groups. Similar success has been found in the University of Texas at Austin’s Emerging Scholars Program. Between 1988 and 1993, fewer than 33 percent of African American and Latino students not participating in this program earned an “A” or “B” in calculus, and only half of those with math SAT scores of 600 or more made such grades. In contrast, 90 percent of those participating in the Emerging Scholars Program earned an “A” or “B” in calculus.

Sources: May Garland, “The mathematics workshop model: An interview with Uri Treisman,” *Journal of Developmental Education*, 16 no. 3 (Spring 1993), pp. 14–16, 18, 20, 22; Martin Vern Bonsangue and David Eli Drew, “Increasing minority students’ success in calculus,” *New Directions for Teaching and Learning*, 61 (Spring 1995), pp. 23–33.

Analyses of programs for teacher preparation indicate that there is a great deal of variability in the information taught to teachers and the methods for doing so (Goodlad, 1984; Howey and Zimpher, 1989; Zeichner, Melnick, and Gomez, 1996) as well as in graduates’ feelings of preparedness for different aspects of teaching (Darling-Hammond, Chung, and Frelow, 2002). Our goal is to provide

a common framework for curriculum content and pedagogies in teacher education—a framework that is useful for preparing teachers with the knowledge, skills, and commitments that will enable them to help all students succeed. We do not propose a single curriculum for all programs; nor do we offer inflexible guidelines for a uniform approach. Given the range of different institutions serving distinctive missions and diverse students in different contexts, one could not imagine a highly specific curriculum that is the same in every detail for each institution. However, given the state of current research and consensus in the field, we can outline a set of core ideas that are addressed by all programs in ways that are appropriate for their students. Similarly, it would be impossible to develop curriculum recommendations for every type of teacher, field, or context. Instead, we address important considerations that influence curriculum decisions across teaching levels, subject matter areas, and kinds of teaching settings. Finally, the report includes suggestions about pedagogies and assessment strategies in teacher education that appear to help prospective teachers develop the capacities and dispositions they need to teach diverse children effectively and to help develop schools that support this work.

Similar Quests in Other Professions

The quest that we are undertaking is similar to ones previously pursued in other professions such as medicine, law, and engineering. For example, in the early twentieth century, medical schools consisted of a number of ad hoc apprenticeship systems and some university courses with little agreement about what was important to teach doctors or how to do so. The medical profession began to see the need to set standards for its professional community and develop a consensus about certain aspects of medical education. The Flexner Report (Flexner & Pritchett, 1910), a study of medical schools in North America conducted by Abraham Flexner between 1908 and 1910, documented the inconsistencies among different schools and indicated the need for developing a strong consensus about good medical education. The report argued that, ultimately, effective medical education should be grounded in research and teaching in the sciences coupled with systematic clinical instruction in teaching hospitals. This represented a major change from much of the existing medical school training of the day.

In his introduction to the Flexner Report, Henry Pritchett, president of the Carnegie Foundation for the Advancement of Teaching, noted that, although there was a growing science of medicine, most doctors did not get access to this knowledge because of the great unevenness in the medical training they received. He observed that, “Very seldom, under existing conditions, does a patient receive the best aid which it is possible to give him in the present state of medicine . . . [because] a vast army of men is admitted to the practice of medicine who are untrained in sciences fundamental to the profession and quite without a

sufficient experience with disease” (p. x). He attributed this problem to the failure of many universities to appreciate and incorporate advances in medical education into their curricula (p. xi). Medical education was transformed as a common set of curriculum ideas, was adopted and taken up by the accrediting bodies that approved all programs, and was incorporated into the requirements for licensing that were used to admit all candidates to practice.

Other fields like engineering, law, and architecture also worked to develop a consensus about professional education later in the twentieth century. As they did so, they considered what core content students should encounter and what intellectual capacities and dispositions they should develop in order to “think like a lawyer” or an engineer or a doctor and to meet the needs of their clients. New fields such as bioengineering are currently being formed and they, too, are in the process of trying to bring some consistency to the field and considering what effective beginning professionals need to know and be able to do to succeed (for examples, see Harris, Bransford, and Brophy, 2002; <http://www.Whitaker.org>).

Processes like those previously described have resulted in curricular conceptions that define major areas of understanding in various fields. Law students, for example, study torts, contracts, constitutional law, civil and criminal procedure, and so on, in law schools across the country (Margolis, Arnone, and Morgan, 2002). Medical students study anatomy, physiology, and biochemical sciences as well as immunology, pathology, and a number of specialties of practice. Most professions also use what have been referred to as signature pedagogies. In law school, students are expected to read and analyze cases, and they are introduced to the Socratic Method when answering questions and building arguments. In medical schools, case methods and clinical rounds are frequently used. Specific kinds of design projects are found in schools of engineering.

These shared understandings and practices in other professions evolved from a consensus about what professionals need to know and be able to do if they are to profit from profession-wide knowledge and if they are to have the diagnostic and strategic judgment to address the needs of those whom they serve. If teachers are to have access to the knowledge available to inform their practice, such consensus must become a reality for the teaching profession as well.

AN ORGANIZING FRAMEWORK

We noted in the Preface that this is not the first attempt to explore systematically the kinds of knowledge, skills, and commitments that should enable teachers to be effective. An important precursor to this book is a report produced in 1989 by the American Association of Colleges for Teacher Education (AACTE) titled *The Knowledge Base for the Beginning Teacher* (Reynolds, 1989). This book

makes careful arguments for what teachers need to know and why. Now, fifteen years later, new evidence about teaching and learning has accumulated that augments its findings. In addition, four generations of *The Handbook of Research on Teaching* and three editions of *The Handbook of Research on Teacher Education* are joined by specialized volumes like the *Handbook of Research on Reading*. These efforts to collect and codify research have supported the development of standards for teaching through the National Board for Professional Teaching Standards, the thirty-state Interstate New Teacher Assessment and Support Consortium, and professional associations like the National Councils of Teachers of English and Mathematics. This volume builds on these prior efforts and takes on the new question of how this knowledge, combined with a growing base of knowledge about how *teachers* learn, can inform the curriculum of teacher education.

One important feature of the current report is the effort to organize discussion around a conceptual framework that can help people organize the vast amounts of information relevant to effective teaching and learning. The framework we use is illustrated in Figure 1.1. It highlights three general areas of knowledge, skills, and dispositions that are important for any teacher to acquire:

- Knowledge of **learners** and how they **learn and develop** within social contexts,
- Conceptions of **curriculum content and goals**: an understanding of the subject matter and skills to be taught in light of the social purposes of education, and
- An understanding of **teaching** in light of the content and learners to be taught, as informed by assessment and supported by classroom environments.

The framework is reminiscent of Dewey's notion, outlined in *The Child and the Curriculum*, that the needs of the child and the demands of the curriculum are mediated by teachers (Dewey, 1902). It is similar as well to Ball and Cohen's representation of instruction as the interactions of teachers, students, and content, in environments that influence all of these (Ball and Cohen, 1999). The framework provides a set of lenses on any teaching situation that teachers can use to reflect on and improve their practice.

These interactions between teachers, learners, and content are framed by two important conditions for practice: first, the fact that teaching is a profession with certain moral as well as technical expectations and, second, the fact that, in the United States, education must serve the purposes of a democracy. This latter condition means that schools assume the purpose of enabling young people to participate fully in political, civic, and economic life in our society. It also means that education, including teaching, is intended to support equitable access to what that society has to offer. As we discuss in this volume, these goals for edu-

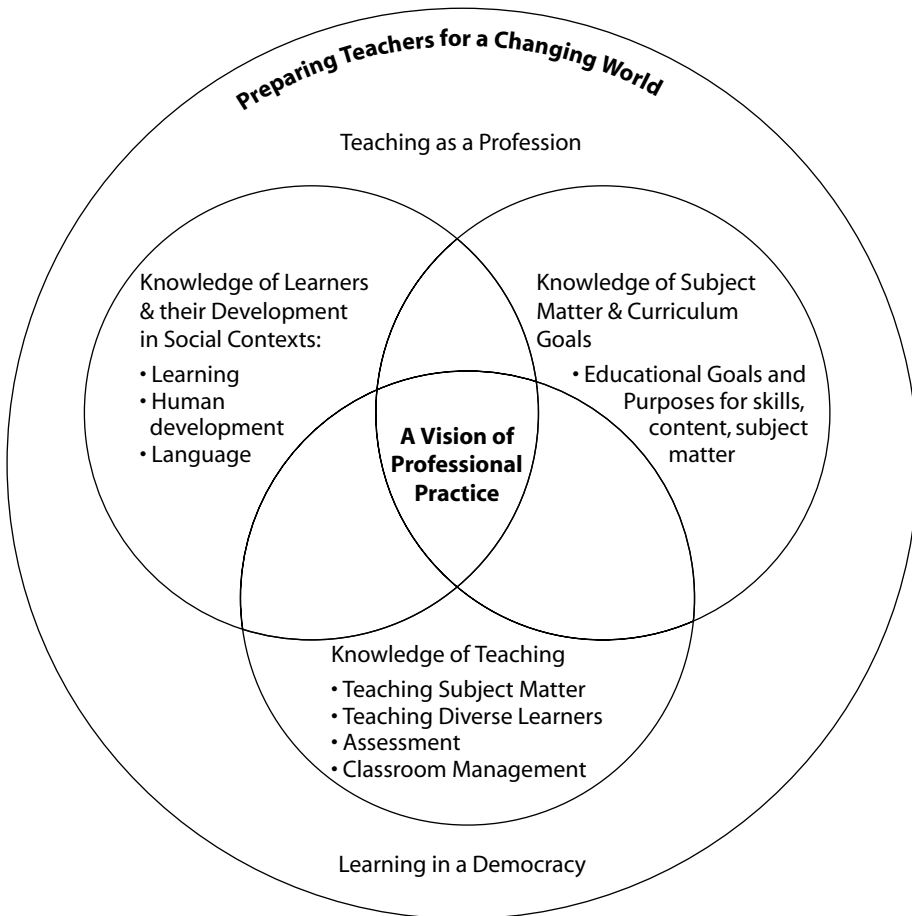


Figure 1.1 A Framework for Understanding Teaching and Learning

cation influence what teachers need to know and be able to do and what teacher education is expected to accomplish.

Teaching as a Profession That Serves Democratic Purposes

An especially important feature of Figure 1.1 is its emphasis on “teaching as a profession.” It is important for teachers to understand their roles and responsibilities as professionals in schools that must prepare all students for equitable participation in a democratic society. Toward this end, it is helpful for them to see commonalities with members of other professional groups.

Characteristics of Professions. A useful source of information for examining the concept of “professionalism” comes from the Carnegie Foundation for the

Advancement of Teaching's Preparation for the Professions study, which is currently studying law, engineering, teaching, and the clergy. Drawing from various professions, Shulman (1998) has suggested that "six commonplaces" are shared by all professions. These are:

1. *Service to society*, implying an ethical and moral commitment to clients;
2. *A body of scholarly knowledge* that forms the basis of the entitlement to practice;
3. *Engagement in practical action*, hence the need to enact knowledge in practice;
4. *Uncertainty* caused by the different needs of clients and the non-routine nature of problems, hence the need to develop judgment in applying knowledge;
5. *The importance of experience* in developing practice, hence the need to learn by reflecting on one's practice and its outcomes; and
6. *The development of a professional community* that aggregates and shares knowledge and develops professional standards. (p. 516).

Source: Reprinted with permission. *The Elementary School Journal* Volume 98, Number 5. L. Shulman "Theory, practice and the education of professionals," pp. 511–526. ©1998 by The University of Chicago Press.

What teaching has in common with a range of other professions is that the work serves others and, because of its social importance, must do so responsibly. Thus, preparation must help teachers to both understand and move beyond their own personal knowledge and experiences to bring to bear a wider set of understandings on the problems of helping others learn. Although all professions have a body of scholarly knowledge and a social calling that form the basis of the entitlement to practice, the emphases and warrants for practice differ. Teaching can be viewed as a field that sits at the intersection of these other professional fields. Teachers might be viewed as similar to women and men of the cloth, as teaching has elements of a vocation or a calling, and it has strong connections to values and commitments. At the same time, although teaching may be a calling, it is not only a calling. There are systematic and principled aspects of effective teaching, and there is a base of verifiable evidence or knowledge that supports that work. In that sense, it is like engineering or medicine. Like these fields, there are aspects of teaching that are scientific, in the sense that research on practices and outcomes suggests some principles that can guide the judgments practitioners must make. At another level, teaching is a body of tradition and precedent and organized experience. In that sense, it resembles the law.

For the beneficiaries of the profession to be well served, teachers also need to be able to work with other colleagues in creating organizations that support

learning. Unlike solo professionals such as architects and accountants who can, if they choose, hang out a shingle and practice their trade, the work of educators in schools is greater than the sum of the individual parts. As in clinics or hospitals where systems for providing good medical service must be created and norms of professional practice must be sustained, schools that provide healthy environments for learning and teaching require the common efforts of all of their members. Teachers must be able to function as members of a community of practitioners who share knowledge and commitments, who work together to create coherent curriculum and systems that support students, and collaborate in ways that advance their combined understanding and skill.

All of these features of professions are important because of the complexity of the work, which demands that professionals know a great deal about how to achieve their goals for clients in situations that are unpredictable and nonroutine, that they be able to enact what they understand in practice, and that they be able to continue to learn from their colleagues and their students about how to meet new challenges. Ultimately, Palmer (1998) sums it up nicely when he claims that good teachers must be truly present in the classroom, deeply engaged with their students and their subjects, and able to weave an intricate web of connections among themselves, their subjects, and their students, so that students can learn to weave a world for themselves.

The Social Importance of Teaching. The importance of developing a strong profession of teaching has been reinforced by recent research demonstrating how important teaching is to children's learning and life chances. Although conventional wisdom was based for many years on a conclusion widely attributed to the Coleman Report (Coleman and others, 1966)—that is, that schools make little difference beyond the influences of socioeconomic background—newer evidence based on different data and analytic methods suggests that schools do make a noticeable contribution to what children learn and that teachers are an important part of what matters (Ferguson, 1991a; Ferguson and Ladd, 1996; Greenwald, Hedges, and Laine, 1996; Strauss and Sawyer, 1986). For example, recent studies have found that a student's assigned teacher has a much stronger influence on how much she learns than other factors like class size and composition (see, for example, Sanders and Horn, 1994; Sanders and Rivers, 1996; Wright, Horn, and Sanders, 1997; Hanushek, Kain, and Rivkin, 1997). Students who are assigned to several highly effective teachers in a row have significantly greater gains in achievement than those who are assigned to less effective teachers; furthermore, the influence of each teacher has effects that spill over into later years (Sanders and Rivers, 1996). (See Figure 1.2.)

Several studies have found that differences in teacher qualifications across school districts can account for as much of the variation in student achievement as students' backgrounds or socioeconomic status. (See "How Teachers Matter.")

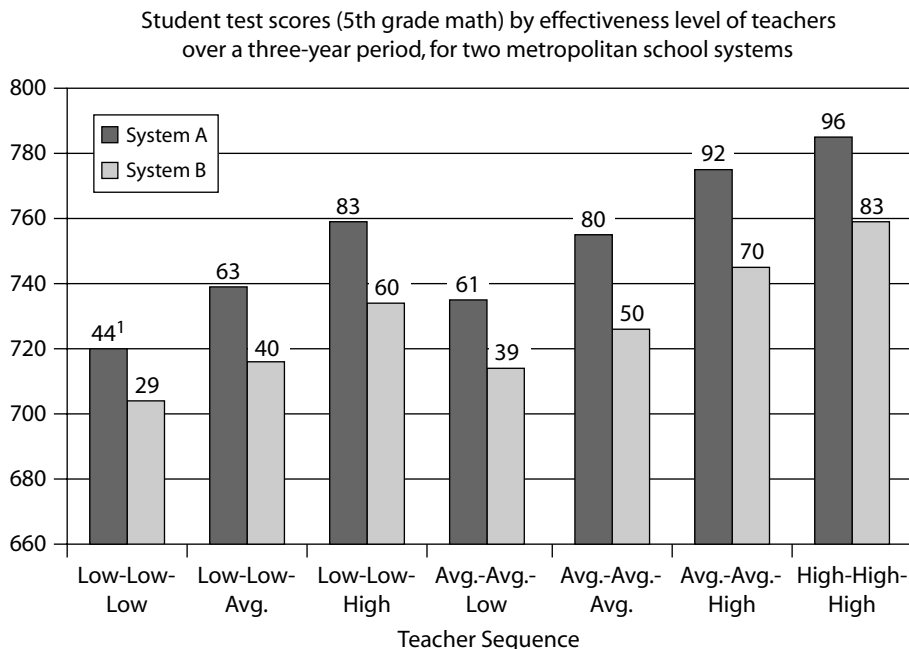


Figure 1.2 Cumulative Effects of Teacher Effectiveness

Source: Sanders & Rivers, 1996. Reprinted by permission of authors.

The authors of one of these studies emphasized the importance of investing in teachers as a means to support greater student success, especially for students who are educationally at risk:

Of the inputs which are potentially policy-controllable (teacher quality, teacher numbers via the pupil-teacher ratio and capital stock), our analysis indicates quite clearly that improving the quality of teachers in the classroom will do more for students who are most educationally at risk, those prone to fail, than reducing the class size or improving the capital stock by any reasonable margin which would be available to policy makers. (Strauss and Sawyer, 1986, p. 47)

How Teachers Matter

Although many have assumed that students' backgrounds—such as income, parent education, and other family factors—are the major reasons for wide differences in student achievement, some studies have found that the quality of teachers can have an effect at least as large.

For example, in an analysis of nearly 900 Texas school districts, Ronald Ferguson (1991a) found that teachers' expertise—scores on a certification examination, master's degrees, and experience—accounted for more of the interdistrict variation in students' reading and mathematics achievement in grades one through eleven than student

socioeconomic status. The effects were so strong and the variations in teacher expertise so great that, after controlling for socioeconomic status, the large disparities in achievement between black and white students were almost entirely accounted for by differences in the qualifications of their teachers. Ferguson also found that every additional dollar spent on more highly qualified teachers netted greater increases in student achievement than did less instructionally focused uses of school resources.

In a similar study in Alabama, Ferguson and Ladd (1996) found that, together, teachers' academic ability, education, and experience, when combined with class sizes, accounted for more of the predicted difference in student achievement gains in mathematics between districts scoring in the top and bottom quartiles than poverty, race, and parent education.

Still another study in North Carolina found that, after accounting for school and student background factors, teachers had a strikingly large effect on student achievement on the state competency tests: a 1 percent increase in teacher quality (as measured by National Teacher Examination scores) was associated with a 3 to 5 percent decline in the proportion of students failing the exam (Strauss and Sawyer, 1986). The authors of these studies concluded that thoughtful policymakers should pay more attention to investing in teacher quality as a way to improve student achievement.

Many kinds of teacher knowledge and experience appear to contribute to this effect, including teachers' (1) general academic and verbal ability, (2) subject matter knowledge, (3) knowledge about teaching and learning, (4) teaching experience, and (5) the set of qualifications measured by teacher certification, which typically includes the preceding factors and others (for reviews, see Darling-Hammond, 2000a; Wilson, Floden, and Ferrini-Mundy, 2001; Rice, 2003). There are, of course, many other attributes that matter for teaching, such as enthusiasm, perseverance, flexibility, and concern for children (see, for example, Schalock, 1979). And, as we discuss in the following sections, there are many specific teaching practices that influence student achievement that are related to what teachers have had an opportunity to learn (see, for example, Good and Brophy, 1994). In addition, the teaching context matters for teacher effectiveness, including such factors as class size, school size and organization, curriculum approaches, and opportunities for teacher collaboration (Howley, 1989; Lee, Bryk, and Smith, 1993; Lee and Smith, 1993, 1995; Newmann and Wehlage, 1995).

The findings that teacher knowledge matters are an important reason to treat teaching as a profession, so that, through strong professional education and widespread standards of practice, knowledge about effective learning and teaching is reliably made available to all practitioners. Being a professional involves understanding the social and legal obligations of one's job, including making decisions in the best interests of the client, based on profession-wide research and standards of practice. This commitment to practice based on what is known by the profession as a whole, rather than only one's own personal experience, is linked to the concept of "evidence-based practice," which requires of professionals that

they be aware of the current knowledge base in their field. A true story included in the preface of the *Knowledge Base for the Beginning Teacher* explains this obligation well:

A fascinating court case from the 1930s involv[ed] the *T.J. Hooper*, a tugboat. The *T.J. Hooper* and the ship it was guiding got into trouble in the Atlantic Ocean when a sudden storm blew up. The storm damaged the ship and caused injury and property loss to its clients, who promptly sued. At that time common practice among tugs was to get weather information via hand signals from shore. Although radio had been introduced it was not in common use. The *T.J. Hooper* did not use radio, but if it had, the tug master would have known of the danger and been able to take its client ship to shelter, thus avoiding damage to life, limb, and property. The case turned on the question of *T.J. Hooper's* responsibility: was adherence to common practice (e.g. hand signals) enough or did the situation demand “state of the art” (radio)? The courts ruled that, when important matters are at stake, the legal obligation is to use the state of the art. (Reynolds, 1989, p. ix, citing Gilhool, 1982)

State-of-the-art practice is typically reflected in professional standards for the kinds of evaluations professionals are expected to perform to figure out what is going on in a situation, the data they use to guide their decisions, and the kinds of strategies they then employ. These are not expected to be uniform across cases, but to be responsive to the specific needs of clients who differ in their needs and circumstances. The notion of evidence-based practice suggests that professionals be aware of what strategies are likely to be productive or unproductive for meeting particular goals, as well as what modifications are needed for certain situations. For example, although doctors routinely give vaccinations, they are expected not to do so in situations where their patients have certain allergies or have certain prior health conditions. Engineers may use certain standard protocols in designing particular kinds of buildings, but they are also expected to know how to vary those general approaches for steep inclines, earthquake-prone settings, or other special circumstances. A teacher may have a set of strategies for teaching reading to most 7-year-olds—strategies that are grounded in strong evidence about what is generally effective for the goals she is seeking—but she will need to know how to adapt these strategies for students with specific learning disabilities, those who are ready for more challenging tasks, or those who lack the prior linguistic knowledge or vocabulary anticipated by a particular approach.

The evidence base for professional practice includes both experimental studies of particular “treatments” or interventions and more naturalistic inquiries into how particular diseases progress, how earthquakes of various magnitudes affect different architectural and engineering design, or how children learn in different circumstances. Research by practitioners is also a source of evidence for practice. Careful observation and systematic collection of evidence can

inform both one's own practice and that of others. In medicine, for example, single case studies of patients and observations of small samples of individuals appear in the professional literature on a regular basis to provide data about problems, treatments, or diseases that are being documented and explored. (See "Using Research and Clinical Experience to Develop a Professional Knowledge Base.")

Using Research and Clinical Experience to Develop a Professional Knowledge Base

As in other professions, medical researchers and practitioners recognize that mixed methods of research serve complementary purposes in building an evidence base for practice. For example, the January 2002 issue of the prestigious *New England Journal of Medicine* included studies of the progress of a sample of eight patients who received cardiac transplants (Quaini and others, 2002) and of fifty-three children infected with *E. coli* (Chandler and others, 2002). These nonexperimental studies, which built on careful observations by practitioners, provided information about the different trajectories of different patients with different health histories under different kinds of treatments. The same issue also included a large correlational study of 750,000 Norwegian women whose birth outcomes were examined using medical records that provided much grosser measures of their health histories (Skjaerven, Wilcox, and Lie, 2002). This descriptive study suggested trends to be followed up with more carefully controlled research studies. The usefulness of any of these studies is in their contribution to a larger body of work from which evidence can be triangulated. An evidence base requires the development of many converging clues to inform professional research, practice, and judgment.

It is important to note that, in all areas, clinical judgment still plays a major role that links with evidence-based research. As Brown (1999), a strong advocate for research-based medicine, warns new doctors: "Although the benefits of research-based practice to patients are logically and intuitively compelling, definitive evidence is lacking. It is logical to expect that methods that have been found to produce better patient outcomes in research studies produce better patient outcomes when incorporated into everyday practice. However there are reasons why this may not be so" (p. 9).

These reasons include, among other things, the fact that (1) studies tend to show that one treatment is better than another *on average*; however, results for a given patient may differ depending on many other factors; (2) research findings from one setting may not transfer to different settings and contexts; and (3) the profile of the research participants in any given study may be different than that of a particular patient a professional is working with. The professional's responsibility is to know both the literature and his or her patients well enough to do what is in the best interests of that patient. Sometimes this means *not* applying the results of a single study if it does not apply to the case at hand, even if that study was well designed.

Other scholars agree that “Good doctors use both individual clinical expertise and the best available external evidence, and neither alone is enough. Without clinical expertise, practice risks becoming tyrannized by evidence, for even excellent external evidence may be inapplicable to, or inappropriate for, an individual patient. Without current best evidence, practice risks becoming rapidly out of date, to the detriment of patients” (Sackett, Rosenberg, Gray, Haynes, and Richardson, 1996, p. 71). These same doctors add that “Evidence-based medicine is not restricted to randomized trials and meta-analyses. It involves tracking down the best external evidence with which to answer our clinical questions” (Sackett and others, 1996, p. 72). Teachers need to be prepared both to seek out and use a range of current evidence about practice in their fields and to develop local knowledge about their own students as a basis for exercising professional judgment.

GOALS, CONTEXTS, AND EVIDENCE

It is especially important for teachers to understand that evidence about educational effectiveness must be evaluated with respect to a number of variables that can vary across teaching situations. This point is illustrated in a model developed by James Jenkins (see Figure 1.3). It helps educators see that the appropriateness of using particular types of teaching strategies depends on (1) the nature of the materials to be learned; (2) the nature of the skills, knowledge, and attitudes that learners bring to the situation; and (3) the goals of the learning situation and the assessments used to measure learning relative to these goals. One of the important points of the model is that a teaching strategy that works within one constellation of these variables may work very poorly when that overall constellation is changed. All the variables in the Jenkins model must be taken into account when analyzing evidence suggesting that a particular teaching strategy is “good” or “poor.” We have adapted the model slightly to fit the current discussion.

Attempts to teach students about veins and arteries can be used to illustrate the interdependencies shown in the Jenkins framework. Imagine that the materials to be learned include a text, which states that arteries are thicker than veins and more elastic, and they carry blood rich in oxygen from the heart. Veins are smaller, less elastic, and carry blood back to the heart. What’s the best way to help students learn this information? The Jenkins model helps us see how the answer to this question depends on who the students are, what we mean by “learning” in this context, and how we measure the learning that occurs.

If our goal were to ensure that students learn certain key facts about arteries, one strategy would be to use mnemonic techniques. For example, students might be taught to think about the sentence “*Art(ery)* was *thick* around the middle so he wore pants with an *elastic* waistband.” The Jenkins framework reminds us that the ability to use this particular technique presupposes specific types of knowl-

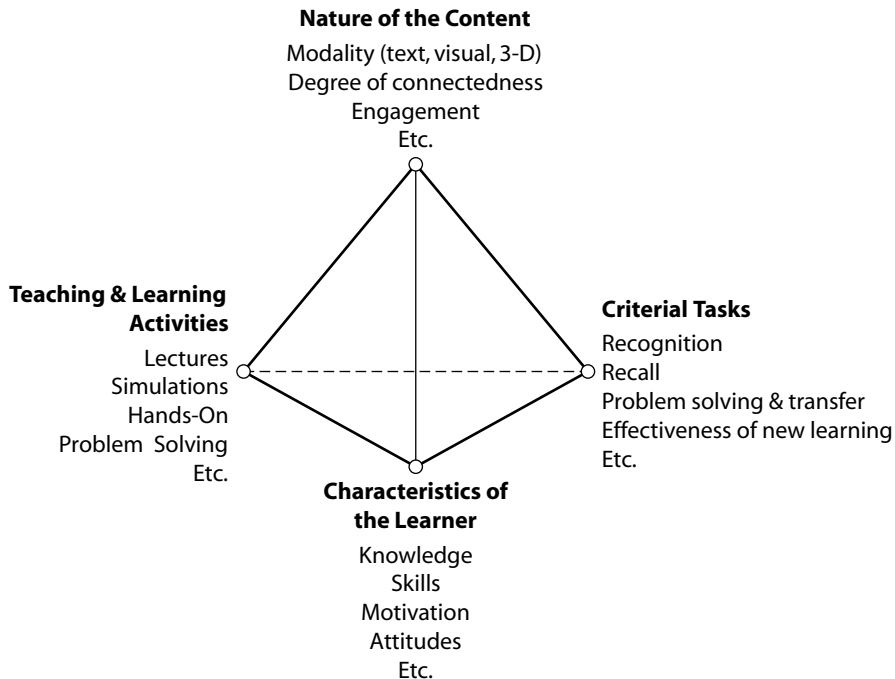


Figure 1.3 Jenkins' Tetrahedral Model

Source: Permission granted by National Academies Press.

edge and skills on the part of the learners (for example, that they understand English, understand concepts such as elasticity, and so forth.). Given the availability of this knowledge, mnemonic techniques like the one noted earlier “work” for remembering factual content. If asked to state important characteristics of arteries (for example, thick, elastic), the preceding statement about Art(ery) could be helpful. A number of studies show that memory is enhanced when people are taught to use mnemonic techniques rather than simply left to their own devices.

Suppose that we change the goal from merely remembering factual content to learning with understanding. In the context of the Jenkins framework, this involves a change in learning goals and assessments of learning. Changes in goals typically require a change in teaching and learning strategies as well.

To learn with understanding, students need to understand *why* veins and arteries have certain characteristics. For example, arteries carry blood from the heart, blood that is pumped in spurts. This helps explain why they would need to be elastic (to handle the spurts). In addition, arterial blood needs to travel uphill (to the brain) as well as downhill, so the elasticity of the arteries provides an additional advantage. If they constrict behind each uphill spurt, they help the blood flow up.

Learning to understand relationships such as why arteries are elastic should facilitate subsequent transfer. For example, imagine that students are asked to design an artificial artery. Would it have to be elastic? Students who have only memorized that arteries are elastic have no grounded way to approach this problem. Students who have learned with understanding know the functions of elasticity and hence are freer to consider possibilities like a nonelastic artery that has one-way valves (Bransford and Stein, 1993).

This example illustrates how memorizing versus understanding represent different learning goals in the Jenkins framework, and how changes in these goals require different types of teaching strategies. The details of one's teaching strategies will also need to vary depending on the knowledge, skills, attitudes, and other characteristics that students bring to the learning task. For example, we noted earlier that some students (for example, those in the lower grades) may not know enough about pumping, spurts, and elasticity to learn with understanding if they are simply told about the functions of arteries. They may need special support such as dynamic simulations that display these properties. As a different kind of example, imagine that we want to include mnemonics along with understanding and one of the students in our class is overweight and named Art. Under these conditions, it would seem unwise to use the mnemonic sentence about Art(ery) that was suggested earlier.

Research examining whether “something worked” should take into consideration each of the perspectives of the Jenkins framework. For example, was the content taught something that is worth having students spend their time learning? What were the goals for learning, and were the assessments of learning consistent with the goals? Who was being taught and how might teaching strategies need to change for people with different sets of skills and knowledge? A sophisticated understanding of evidence and its implications for practice is important for effective teaching. The Jenkins framework helps highlight some key relationships that affect how particular teaching and learning strategies impact individuals' abilities to learn.

GOALS AND EVIDENCE FOR OUR RECOMMENDATIONS

The Jenkins framework is useful for exploring the learning both of students and of teachers who must learn to help them. Our first goal for this book is to suggest what is known about *students' learning and its implications for teachers' knowledge and skills*. We then explore how to help teachers acquire this knowledge in a way that allows them to be optimally effective. In essence, we ask:

- What kinds of experiences do children need in order to grow and learn, to develop the confidence and competence they need to succeed in life?

- What kinds of knowledge do teachers need to have in order to facilitate these experiences for children and youth?
- What kinds of experiences do teachers need to have in order to develop these kinds of knowledge?

The report focuses not on what current institutions generally deliver, but on what *students* need for their teachers to know if the teachers are to do a responsible job of guiding student learning.

The recommendations for teacher education discussed in this volume represent the considered judgments of a large number of experienced practitioners and scholars in the field of education. Whenever possible we refer to research studies to support our conclusions. But just as was the case in the early days of forging new medical, law, engineering, and bioengineering programs (and is still true in all these fields today), our evidence for preparing new teachers also comes from consensus among experienced practitioners and researchers.

In most professions, empirical research cannot directly link everything that practitioners learn in preparation programs to client outcomes. It would be difficult to find a research study that examines whether doctors who have taken a physiology course have better patient outcomes than those who have not. Similarly, it would be nice to have direct evidence that passing a course in biomechanics produces more successful bioengineering graduates, but it would be well nigh impossible to partial out the effects of a biomechanics course from the effects of other areas of learning on a complex set of practices. Although few would argue that bioengineers should not study biomechanics or that doctors should not study anatomy, the understanding they gain from these kinds of courses does not translate immediately into successful practice. Instead, understanding the principles of mechanics or the way the body is put together is made useful by connecting it to many other kinds of knowledge that together translate into actions and decisions.

Similar situations exist in education. It would be very helpful to have direct evidence that teachers are better at promoting learning if they understand concepts like Vygotsky's "zone of proximal development" (ZPD) (Vygotsky, 1978) or issues of transfer and how it is facilitated by certain approaches to teaching and assessment. But carefully controlled studies that attempt to link each discrete element of a curriculum to eventual outcomes would not likely be the most productive way to spend research funds. We are more likely to find that teachers who can use a concept like the zone of proximal development to figure out what a student knows and is ready to learn *and* who know how to organize a structured learning experience for that student pegged to his level of readiness are more successful. It is the combination of several kinds of knowledge with practical skills that sets professionals apart and that makes the influences of narrow elements of professional knowledge difficult to study. No single

set of ideas is alone sufficient to produce the complex and changing array of judgments and activities that accomplished professionals demonstrate.

Even if we had direct evidence to guide all of the elements of a professional preparation program, fields change, and new insights and interpretations frequently replace old ones. We certainly see this in medicine: for example, in recent years we've heard that eggs are harmful to cholesterol levels and then that they are not; benefits were touted for hormone therapies and then some research found harmful effects, and so on. We expect our doctors to know enough to help us interpret these studies as they apply to our own health. In like fashion, among the major commitments and skills new teachers need to develop are the habits of mind to check continually the evidence base (both from their own practices and from the research literature) in order to evaluate their practices and work constantly to improve.

In addition to professional consensus, we have used four kinds of research evidence to support our recommendations. (See Figure 1.4.)

- The first is ***basic research on how people learn***, both generally and in specific areas like language, reading, or mathematics.
- The second kind of research looks at ***the influences of different conditions, including specific teaching strategies, on what and how people learn***.



Figure 1.4 Research Bases Supporting Teacher Education Recommendations

- The third kind of research looks at *what kinds of teacher learning opportunities are associated with teaching practices that, in turn, influence student learning*.
- The fourth kind of research examines *how teachers learn* to engage in practices that successfully support student development and learning.

Although each of these kinds of research comprises distinctive lines of study, they build upon each other conceptually. What we know about how students learn ought to influence teaching practices, and what we know about effective teaching practices, as well as teacher learning, should influence teacher education. At this point in our history, it is fair to say that the areas of the segments shown in the triangle in Figure 1.4 also approximate the depth of these research bases. That is, there is a very large body of research on how people learn (the base of the triangle), and a substantial body of research on what conditions and teaching practices support productive student learning. There is a smaller body of research on the relationship between teachers' learning opportunities and what they do in the classroom as well as what their students learn, and a small, but growing body of research on how it is that teachers learn to engage in the kinds of practices that research suggests are most successful for students.

In the area of *basic research on learning*, for example, are studies that examine processes such as attention, pattern recognition, memory, and transfer. All of these processes are involved in any complex act, hence their relationships must also be understood. For example, there is an informative body of research that analyzes changes in cognitive processes as people develop expertise in particular areas (for example, physics, chess, electrical engineering). Novices often find new tasks to be highly attention-demanding. A great deal of effort is required for novices to function—in part because they have not yet developed the necessary pattern recognition and memory schemas that help them cope with complexity. In contrast, experts learn to recognize familiar patterns with great fluency and little effort, and they have acquired memory schemas that make it easier to remember information that they see, read, or hear (National Research Council, 2000).

Research on basic learning processes also demonstrates the difference between successfully storing information in memory and being able to retrieve and use it later on. Recognition memory puts the least demand on retrieval processes—hence we can often recognize the name of a person, book, or movie even though we cannot generate it on our own. However, the ability to generate information without the help of recognition prompting is often extremely important, so learning theorists pay a great deal of attention to processes that support retrieval and use. Learning how ideas connect to one another and applying them to real-world problems enhances the probability that they will be remembered and usable later. Just as we saw with different approaches to learning about arteries, the kind of learning has a great deal to do with the uses

to which information can be put. Similarly, the kinds of tests one chooses to assess learning need to be considered in the context of recognition versus generation. Multiple-choice tests are closer to recognition memory than they are to generative memory. Assessments that call for performance and application place more of an emphasis on generation and retrieval. An important issue for teachers to consider is whether recognition is sufficient, or whether students must learn to generate information when they operate in the world.

In addition to studies on basic processes of learning are studies that explore *how specific teaching practices foster certain kinds of learning*. A substantial body of research has found, for example, that students are better able to acquire complex skills when their teachers help them understand the underlying concepts and patterns that tie together the ideas they are studying; provide models for how to approach the task and reason through problems; provide scaffolds or structured steps that support the learning process; and coach students as they apply their knowledge to real-world tasks. In addition, students become more proficient when their teachers help them learn to evaluate and regulate their own learning (Anderson, 1989; Good and Brophy, 1994). Teachers who have learned to use these cognitive strategies have produced increased student learning of complex skills in the areas of reading (Duffy and Roehler, 1987; Palincsar and Brown, 1984; Palincsar, 1989), writing (Englert, 1989; Englert, Raphael, and Anderson, 1992), mathematical problem solving (Carpenter, Fennema, Peterson, Chiang, and Loef, 1989; Peterson, Fennema, and Carpenter, 1991; Wood and Sellers, 1996), and science (Otto and Schuck, 1983; Ruben and Norman, 1992), among others.

Clearly, an important warrant for recommendations about the teacher education curriculum is evidence about how students learn and how teaching can support this learning. Much of this research undergirds standards for student learning developed by subject area associations and standards for teacher performance developed by professional associations like the National Board for Professional Teaching Standards. Standards for beginning teachers based on this research have been developed by a group of more than thirty states that compose the Interstate New Teachers Assessment and Support Consortium and now appear in most states' licensing and program approval standards.

Teachers who understand how learning occurs are more able to both select and develop curriculum that supports rather than undermines the learning process. Ensuring that teachers have access to what is known about specific teaching strategies that foster more productive learning provides them with critically important tools for success. Having a sense of what teachers should know and be able to do, however, does not tell teacher educators all that they need to know to construct a set of learning experiences that will ensure these skills will be learned. In the limited amount of time available to prepare teachers, there are many questions and trade-offs that must be considered about what the most productive ways are to help people gain the understanding they need to

enter the profession and become responsible teachers. We have a growing body of research to help inform these decisions, even though many questions must be answered in part through a combination of evidence, professional judgment, and consensus.

Research on the *relationship between teacher education, teaching practices, and student achievement* has looked at how various kinds of preparation relate to student learning. At the most general level, for example, a number of studies—conducted at the individual classroom, school, district, and state levels—have found that students’ achievement is significantly related to whether their teachers are fully prepared or certified in the field they teach, after other teacher and student characteristics are controlled (see, for example, Betts, Rueben, and Danenberg, 2000; Darling-Hammond, 2000a; Ferguson, 1991a; Fetler, 1999; Fuller, 1998, 2000; Goe, 2002; Goldhaber and Brewer, 2000; Hawk, Coble, and Swanson, 1985; Strauss and Sawyer, 1986). Although these findings are broadly useful in suggesting that what teachers know influences what students learn, they do not provide much insight to guide specific teacher education curriculum decisions, because certification includes a wide array of general academic, subject area, and pedagogical requirements.

More helpful are studies that look at various aspects of teacher preparation. Some studies suggest that strong subject matter knowledge, usually measured as a major relevant to the field to be taught, such as mathematics or mathematics education, is associated with teacher effectiveness (Goldhaber and Brewer, 2000; Wenglinsky, 2002). Another study has suggested that master’s degrees in relevant fields like mathematics or mathematics education contribute more to teacher effectiveness than master’s degrees in fields not related to teachers’ teaching fields (Goldhaber and Brewer, 1998).

Again, although helpful, this kind of research only scratches the surface of many important questions about what kinds of content knowledge teachers can benefit from and how they can best acquire it. For example, Liping Ma’s research (1999) on how elementary teachers learn to teach mathematics in China—by revisiting the foundations of arithmetic, engaging in deep study of number concepts, and playing out their concrete applications to classroom pedagogy—poses an alternative to the common approach in the United States of accruing college-level mathematics courses that bear little relationship to the curriculum that will be taught.

Other studies have found that content methods courses are equally important elements of teachers’ effectiveness. (See “Do Methods Courses Matter?”) These studies suggest the importance of learning content-specific strategies for teaching. The fact that this research has documented effects for methods coursework within a content field suggests the potential importance of having sustained, in-depth opportunity for this kind of subject-specific study rather than a generic approach. In fact, the evidence that teachers appear to benefit from

having taken a greater number of courses regarding methods of teaching in their content area also suggests that the tradition of offering only one subject area methods course in many preparation programs may be less than adequate. This is consistent with evidence that teachers often call for additional study of content-specific teaching methods both in preservice education and throughout their careers, wanting to explore in concrete ways the details of specific areas they are teaching—how to teach the theory of limits in calculus or the concept of place value in arithmetic, for example—rather than dealing with broad generalities (Ball and Cohen, 1999). This kind of finding is also consonant with evidence that professional development grounded in content-specific strategies can enhance teachers' effectiveness (Cohen and Hill, 2000).

Do Methods Courses Matter?

Using data on more than 2,800 students from the Longitudinal Study of American Youth (LSAY), David Monk (1994) found that the amount of college coursework mathematics and science teachers had taken in their content area and in subject-matter methods courses was positively related to student achievement gains. In mathematics, additional teaching methods courses had "more powerful effects than additional preparation in the content area" (p. 142). Similarly, Edward Begle (1979) found in his review of findings of the National Longitudinal Study of Mathematical Abilities that the number of credits a teacher had taken in mathematics methods courses was an even stronger correlate of student performance than was the number of credits a teacher had taken in mathematics courses. Goldhaber and Brewer (2000) found that, after teachers' content degrees in mathematics or mathematics education were taken into account, the additional effect of their full certification in the field—measuring the value added by pedagogical training—was a strong predictor of student achievement gains. The same trends were true to a somewhat smaller extent in science. All of these studies suggest that learning *how* to teach allows teachers to better use their knowledge of *what* to teach.

Some research has looked at how teacher preparation influences teachers' practices and student outcomes. For example, research as early as the 1960s found that teachers with greater methods training in science teaching were more likely to use laboratory techniques and discussions and to emphasize conceptual applications of ideas, whereas those with less education training placed more emphasis on memorization. Furthermore, teachers' coursework in science education was significantly related to students' achievement on tasks requiring problem solving and applications of science knowledge (Perkes, 1967). In a later review of sixty-five studies of science teaching, Druva and Anderson (1983) found that teachers' effectiveness, defined by both teachers' ratings and student achievement, was positively related to the teachers' course-taking background in both education and in science.

More recently, Wenglinsky (2002) examined the relationships between teachers' training, teaching practices, and student achievement using data from the National Assessment of Educational Progress (NAEP). After

controlling for student characteristics and other school inputs, he found that eighth-grade students do better on the NAEP mathematics assessments when they have had teachers with a major or minor in mathematics or mathematics education, teachers who have had more preservice or inservice professional training in how to work with diverse student populations (training in cultural diversity, teaching limited English proficient students, and teaching students with special needs), and teachers who have had more training in how to develop higher-order thinking skills. They also did better when their teachers organized more hands-on learning (work with real-world problems and use of manipulatives) emphasizing higher-order thinking. Similarly, students do better on the NAEP science assessments when their teachers have majored in science or science education, have had more training in how to develop laboratory skills, and engage in more hands-on learning. In a path analysis, Wenglinsky concluded that teachers' preparation in content and pedagogy appeared to be associated with teaching practices, which in turn influence achievement. He also found that the combined effects of the teaching variables he studied—teachers' content background, professional learning opportunities, and specific practices—outweighed the effects of students' socioeconomic status on student achievement. This suggests that the equity goals we outlined at the beginning of this chapter are achievable if we can figure out how to ensure that more teachers have access to these kinds of knowledge.

Similarly, a research review from the National Reading Panel of the National Institute of Child Health and Human Development concluded that a set of identifiable teaching practices are strongly associated with improvements in children's reading achievement. These include the systematic teaching of phonemic awareness, guided repeated oral reading, direct and indirect vocabulary instruction with careful attention to readers' needs, and a combination of reading comprehension techniques that include metacognitive strategies. The report concluded that "Teaching reading comprehension strategies to students at all grade levels is complex. Teachers not only must have a firm grasp of the content presented in the text, but also must have substantial knowledge of the strategies themselves, of which strategies are most effective for different students and types of content and of how best to teach and model strategy use . . . [Data from the studies reviewed on teacher training] indicated clearly that in order for teachers to use strategies effectively, extensive formal instruction in reading comprehension is necessary, preferably beginning as early as preservice" (National Reading Panel, 2000).

Studies of specific practices for teaching reading comprehension—for example, explicit strategy instruction (Duffy and others, 1987b; Duffy and Roehler, 1989) and reciprocal teaching (Palincsar and Brown, 1989)—have found that teachers can learn strategies that enable them to teach these complex comprehension skills and that specific teaching practices acquired through professional training enable teachers to improve student reading outcomes. These positive effects of

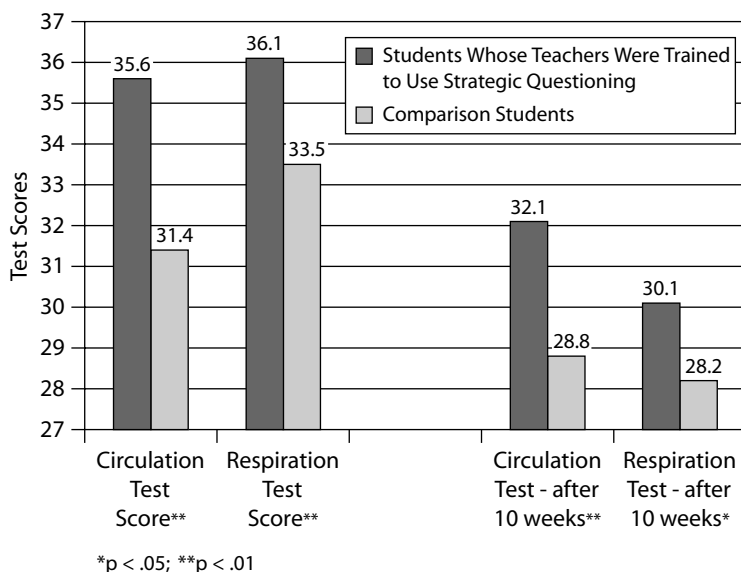


Figure 1.5 Achievement of Students Whose Teachers Were Prepared to Use Strategic Questioning in Science.

Source: Otto and Schuck, 1983.

strategy instruction have also been found in other fields, such as writing (see Chapter Seven) and science. (See “Linking Basic Research on Learning to Research on Teaching and Teacher Education” and Figure 1.5.) It is worth noting that many of these studies using experimental designs were conducted during the 1970s and 1980s when research funding favored this kind of inquiry. A recent resurgence of interest in such research designs has stimulated new research that is examining a wide range of teaching strategies and their effects on learning.

Linking Basic Research on Learning to Research on Teaching and Teacher Education

In science, learning theory suggests that certain kinds of questions can support strategic thinking on the part of students, particularly questions that ask students to develop hypotheses, make comparisons, analyze and synthesize data, evaluate possible solutions, and make judgments about what they have found. To translate these insights into teacher training and teaching practices, researchers randomly assigned ninety students from three rural junior high schools and six biology teachers to instructional groups of fifteen students each. Half of the teachers were taught questioning techniques through discussion, modeling, analysis of videotapes of teaching, and instructional planning supported by coaching. They were observed while teaching. Observers who did not know which teachers were assigned to which group found that the teachers who had received the training asked fewer managerial and

rhetorical questions and more higher-order questions that dealt with strategic thinking about data collection, analysis, and evaluation. Students taught by these teachers not only learned significantly more in tests after the units but also retained much more of what they learned when they were tested ten weeks later (Otto and Schuck, 1983).

Finally, *research on how teachers learn* to engage in successful practices is in many ways the newest area of research. Although there is foundational knowledge about teacher development and learning that parallels the basic learning research we talked about earlier, many of the applications of this knowledge are still being worked out (for a review, see Cochran-Smith and Zeichner, in press). So, for example, there is evidence that teachers' learning may also follow a developmental trajectory (Berliner, 1994; Feiman-Nemser, 1983; Richardson and Placier, 2001), that linking broad principles to concrete applications helps teachers understand more deeply and transfer what they are learning, and that reflecting on these attempts is as helpful to teachers in deepening their skills as it is to students (Cochran-Smith and Lytle, 1999; Feiman-Nemser, 2001a; Hammerness, Darling-Hammond, and Shulman, 2002; Shulman and Shulman, 2004). Figuring out how specific learning opportunities and teacher education practices can capitalize on these insights—and what the results are—is in some ways the most complex kind of research, because it requires tracking not only what and how teachers learn, but also how they use what they have learned and to what effect.

As one example of this kind of emerging research, a recent study examined the outcomes of preservice teacher education programs that have an intense focus on the teaching of reading and share critical curriculum features. The study found that their graduates were more able to construct rich, engaging literacy environments, and they more frequently produced classroom gains in reading achievement than a comparison group of beginning teachers (International Reading Association, 2003). (See “Strong Teacher Education Improves the Teaching of Reading.”)

Strong Teacher Education Improves the Teaching of Reading

Researchers from the International Reading Association (2003) followed 101 recent program graduates from eight teacher education programs that were selected because they have a strong emphasis on teaching reading. Among the program features identified as important were:

- A cohesive curriculum treating how students learn to read as well as effective teaching strategies,
- A variety of course-related field experiences in which excellent models for the teaching of reading are available,
- A clear vision of literacy, quality teaching, and quality preparation informing the program design,
- Responsive teaching that is adaptive to the needs of diverse candidates,

- An active learning community among faculty, mentor teachers, and students that supports shared norms of practice and continual learning and improvement,
- Continual assessment of candidates and the program to guide decisions, and
- Adequate resources tied to the mission of the program.

The programs were public and private, large and small, in communities across the United States. These teachers were observed on multiple occasions over three years, as were beginning teachers from programs without an emphasis on literacy and teachers who were fully certified from a range of other programs. Data were collected about student achievement gains in reading comprehension in the classrooms of a subset of these teachers. The researchers discovered that the 101 teachers from the selected programs were more likely to construct high-quality text environments—using a greater variety, quality, and quantity of children’s books and other texts in their classrooms. Furthermore, teachers from the eight selected programs had students who were more meaningfully engaged with texts and who showed greater growth in reading comprehension on a standardized test measure administered in the third year of the study. Beginning teachers from the eight teacher education programs performed like the experienced teachers: more of their classrooms experienced large gains and fewer experienced small gains than the comparison group of beginning teachers, whose classrooms generally gained little in achievement. (See Figure 1.6.)

Finally, some studies have begun to look at specific practices within teacher education programs and evaluate their influences on particular kinds of candidate learning and practice. A recent review of such studies considered teacher education pedagogies ranging from microteaching and various kinds of clinical experiences to the use of simulations, video cases, and other case methods

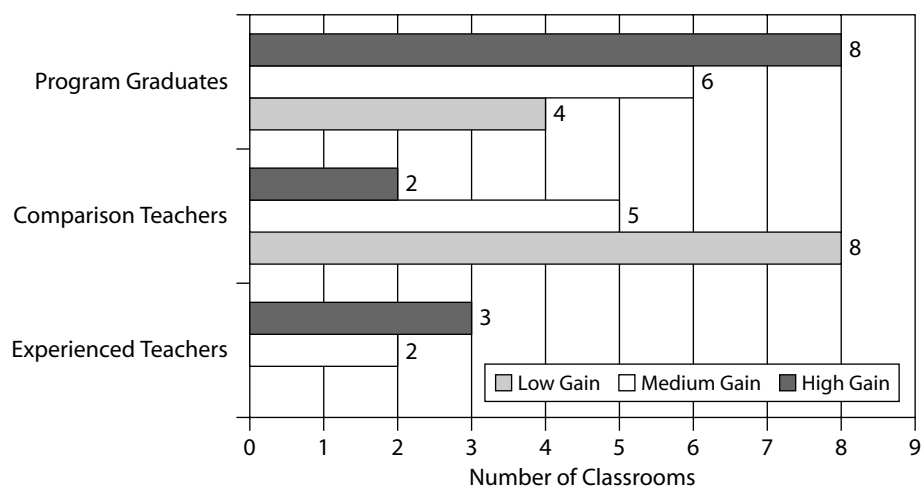


Figure 1.6 Student Achievement Gains in Reading Comprehension, by Classroom.

Source: Reprinted with permission from the International Reading Association.

(Grossman, in press). The review noted findings that suggest some promising directions for teacher education practice, as well as a need for greater consensus about measures and methods and greater reach of the research into practice.

This and other research suggests that *how* certain teacher education approaches are used may matter as much as the general approach itself. For example, a recent set of studies of the use of case methods in teacher education studied whether and how prospective teachers learned to analyze teaching and learning and how their success related to the pedagogy used by faculty. Some of these studies found evidence that, with careful scaffolding and feedback, as well as the skillful use of professional literature, teacher candidates could move from simplistic perspectives about the causes of classroom events to much more expert understandings of how aspects of teaching and students' development influence learning (Goodwin, 2002; Hammerness and others, 2002; Roeser, 2002). Others documented how, without specific teaching supports, the use of cases alone failed to move candidates decisively from novice ideas to more mature understandings of students and teaching (Whitcomb, 2002; Levin, 2002). As we gain greater knowledge about the effects of particular approaches to teacher education on teachers' knowledge, dispositions, and practices, and as we are able to follow these through to evidence about student learning, the consensus about what teachers should know and be able to do should be increasingly well connected to a consensus about how teachers can learn to do these things.

DOMAINS OF TEACHER LEARNING

Returning to our Figure 1.1, we describe here the ways in which knowledge of *learners*, conceptions of *curriculum*, and understanding of *teaching* might inform teacher education. These areas of teachers learning are developed further in Chapters Two through Nine.

Knowledge of Learners: Understanding Development and Learning in Social Contexts

The first area highlighted in Figure 1.1 involves teachers' knowledge and assumptions about learners' development in social contexts. Understanding how children develop and learn, as well as what they have learned during their early years and are continuing to learn outside of school, is critical for effective teaching. In particular, we focus on how people learn, how children develop over time, and how they acquire and use language.

Understanding Learners and Learning. People have speculated about how people learn for centuries. Based on research over the past thirty years, we organize our treatment of this vast literature using the *How People Learn* (HPL) framework

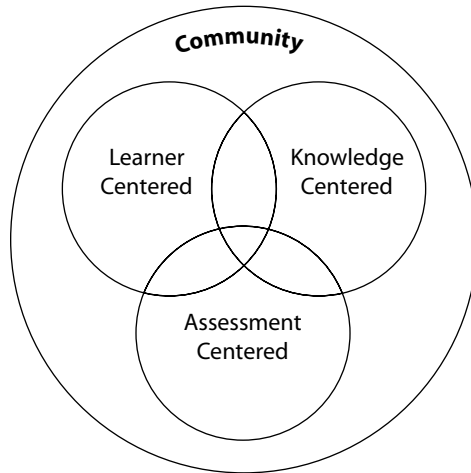


Figure 1.7 HPL Framework

introduced in several National Academy of Sciences reports, including *How People Learn: Brain, Mind, Experience and School* (National Research Council, 2000), and *How People Learn: Bridging Research and Practice* (Donovan, Bransford, and Pellegrino, 1999). As Figure 1.7 indicates, the framework provides a guideline for thinking about learning from the vantage point of

- The *learner* and his or her strengths, interests, and preconceptions;
- The *knowledge*, skills, and attitudes we want people to acquire and how they may be able to do so in order to transfer what they've learned;
- The *assessment* of learning that both makes students' thinking visible and, through feedback, guides further learning; and
- The *community* within which learning occurs, both within and outside the classroom.

Effective teachers know how to balance all four components of this framework. Teachers' knowledge of child development, language, cultural backgrounds, and special needs is important for being a *learner-centered* teacher. In the learning chapter we explore in more detail how connecting to students' knowledge and experiences helps them to learn. Furthermore, if they are to support learning that prepares students for life in a complex world, *knowledge-centered* teachers have to pay careful attention to what they teach and why. In addition to decisions about what is taught, which may be guided by national, state, and local standards, teachers must consider how specific topics and ideas may best be taught. The content to be learned shapes the learning process in

important ways, as do preexisting beliefs and experiences of different learners. Among other things, teachers need to be able to anticipate student understandings and misunderstandings in specific areas like fractions, wave theory, planetary motion, and phonics.

Effective teachers connect *knowledge* with *learners* by being *assessment-centered*. Assessments, and the feedback they engender, are actually another source of learning, not just an evaluation of it. Research in cognitive science has shown that *formative assessment*, assessment carried out during the instructional process that makes students' thinking visible and provides them feedback for revising their efforts, can be a powerful tool for learning.

Finally, the process of learning is *community-centered*, as it is influenced by the norms and modes of operation of the community in which it occurs. In a sense, all learning is culturally mediated; that is, it arises from cultural activity. An important implication of this perspective is that providing supportive, enriched, and flexible settings where people can learn from one another is essential. Having strong social networks within a classroom, within a school, and between classrooms and outside resources produces a number of advantages for learning. Students learn more effectively in contexts where they can use the resources of their peers and where they believe their efforts matter to the welfare of the group. Students also learn more effectively when teachers build upon the "funds of knowledge" that exist in their communities and link their experiences outside of school to those within the classroom.

Understanding Development. In addition to a general appreciation of how people learn, teachers need to be able to support children's development across many domains that interact with one another, including physical, social-emotional, moral, and linguistic, as well as cognitive. Furthermore, children's development unfolds in social contexts that influence what they experience and how they respond to and make sense of the world around them. Consequently, a deep understanding of diversity is also extremely important for teachers. The classes of most teachers today include students with a wide range of cultural, language, and racial/ethnic backgrounds, as well as prior experiences and interests. The heterogeneity in prior knowledge in today's general classrooms has also widened greatly, and this presents challenges for teachers.

Teachers need to understand general developmental progressions as well as individual differences in development, so that they are able to figure out when children are prepared to learn particular things in particular ways, and how to support them as they take on new tasks. Teachers also need to understand how instruction can support development. In addition to understanding stages of development, an effective teacher needs to understand what is required by the tasks she assigns, and she must be able to observe students carefully to gauge their readiness and the resources they bring to the activity. Teachers who are able

to evaluate a child's "zone of proximal development" can create tasks that address the things the child is ready to learn next, and they can provide the necessary supports for learning that will help children confront new challenges with confidence and growing competence. With that knowledge, teachers can help young children continue to feel successful and inspired to learn. Without it, they can stymie children's immediate learning and endanger their future success.

The Development and Use of Language. An especially important aspect of learners' development involves language. Virtually all school learning occurs through the medium of language. Not only do people need to acquire strong language skills to communicate with others, the very use of language enables people to acquire concepts and ideas and to sharpen their thinking. Teachers need to be aware of how language develops. They need to be concerned not only with developing students' general communication abilities in their first and second languages, they need to be able to help students engage in academic discourse, that is, to use the specialized language of the subject areas they are studying.

Furthermore, the language that children speak often affects teachers' and others' assumptions about students and their abilities. Teachers need to understand how "nonstandard" uses of English evolve and, while helping students learn to speak Standard English, avoid sending the message, either overtly or implicitly, that the language spoken by some groups of students is linguistically inferior to that spoken by others. The way students speak should be respected as something they learned effectively while growing up, with a recognition that children's linguistic differences are not a symptom of some inability to learn but a base of linguistic information to talk about, use, and build from.

Conceptions of Curriculum: Subject Matter, Skills, and Social Purposes of Schooling

In addition to understanding students as learners in social contexts, Figure 1.1 highlights a second area of professional knowledge that is important for teaching: the curricular understanding that enables teachers to organize the subject matter and skills they will teach in light of the goals they are aiming for. The focus here is on decisions about what to teach and why. Assumptions about the social purposes of schooling affect these decisions in important ways.

Guidelines about what to teach and why have been developed over the last decade by groups involved with setting national, state, and local standards. These new standards are a reflection of the changing purposes for education in our society and the implications these have for curriculum. It is beyond the scope of this volume to discuss all these content areas and standards; however,

a companion volume to this one discusses issues of reading because of its pervasive importance. Our focus is on what effective teachers need to know to interpret these general guidelines and standards, think about how the teaching of specific kinds of knowledge and skills “adds up” over time, create purposeful learning plans, and adapt them to the particular students whom they teach.

Developing a Curricular Vision. Even when teachers are provided with texts and other materials for their classrooms, they must still construct a curriculum for their students in response to broad statements of goals and standards, the particular needs and prior learning experiences of their students, and the resources and demands of communities. They must make a wide variety of curriculum decisions, ranging from the evaluation and selection of materials to the design and sequencing of tasks, assignments, and activities for students, based on their learning needs. These demands on teachers have grown with the advent of standards-based reforms that presume that teachers will use data about student learning to help students acquire skills they have missed or struggled to learn. A curricular vision for teachers rests in an understanding of learning and learners as these intersect with educational goals and purposes, principles of instructional design, and an understanding of teaching options and possibilities.

Teachers need to think about the subject matters they teach in a broader context that includes an understanding of the social purposes of education, including the many functions of schools—academic, vocational, social and civic, and personal—that must be balanced in classrooms every day. In a democratic society, teachers must also evaluate their teaching decisions against the goals of preparing students to be equitable participants in a society that relies on interdependence. An important component of preparing students to participate in democracy is to allow them to experience democratic classrooms and schools. This includes a commitment to eliminate disparities in educational opportunities among students, especially those students who have been poorly served by our current system. It also includes ambitious learning opportunities and, in today’s society, equitable access to the technological tools that citizens need to succeed.

Understanding Teaching: Designing Classrooms That Enable Diverse Students to Learn Challenging Content

The third area highlighted in Figure 1.1 involves the skillful teaching that enables learners to access the curriculum. The overall goal is to teach in ways that optimize learning for all students. This involves motivating and organizing students’ work in settings that provide access to challenging content and frequent assessments of their progress, coupled with feedback and opportunities to revise and improve. At least four areas of knowledge and skill are essential

for this process: the development of pedagogical content knowledge in the subject areas to be taught; knowledge of how to teach diverse learners; knowledge of assessment; and an understanding of how to manage classroom activities so that students can work purposefully and productively.

Teaching Subject Matter. To make content accessible to learners, teachers need flexible understanding of subject matter married to an appreciation for how students learn. Knowing how students understand (and sometimes misunderstand) their particular subjects and having a repertoire of strategies to help students engage ideas central to the discipline is at the core of pedagogical content knowledge. Teachers who understand the conceptual difficulties that students typically have with fractions, or metaphor, or acceleration—and who know how to diagnose these difficulties and provide strategies for overcoming them—have developed elements of the pedagogical content knowledge necessary to teach these aspects of their disciplines effectively. To build their understanding of students’ subject matter reasoning and understanding, teachers need to observe students and study the processes of learning within a field. With this understanding, they can develop a storehouse of representations and other strategies for teaching specific topics to the range of students they will teach.

Teaching Diverse Learners. Students in today’s classrooms pose a wide range of diverse learning needs that teachers must be prepared to address. Part of this process is learning how to understand and reach out to children who have a wide range of life experiences, behaviors, and beliefs about themselves and what school means to them. When teachers develop a “sociocultural consciousness,” they understand that individuals’ worldviews are not universal but are greatly influenced by their life experiences, gender, race, ethnicity, and social-class background (Banks, 1998; Villegas and Lucas, 2002a). This kind of awareness helps them better understand how their interactions with their students are influenced by their social and cultural location and helps them develop attitudes and expectations—as well as knowledge of how to incorporate the cultures and experiences of their students into their teaching—that support learning. In addition to constructing culturally responsive curriculum and teaching, teachers need to be prepared for learning differences and disabilities that are prevalent in the inclusive classroom. They need to understand how to evaluate students’ strengths and difficulties, construct appropriate tasks and supports, and use strategies that enable students to learn how to guide their own learning.

Assessing Learning. If the central task of teaching is enabling learners with very different experiences, learning styles, and starting points to acquire common, high-level knowledge and skills, teachers must have many tools for tapping into

what students think and adapting instruction to their needs. Assessment is a crucial element of the teaching and learning process. In addition to constructing thoughtful performance tasks and criteria for evaluating them that will guide students' learning and reveal what they have learned, teachers need a large repertoire of formative assessment strategies. These strategies need to be infused throughout the instructional process to help make students' thinking visible as they progress through a course of study, to give them feedback about their work that guides revisions in their thinking and performance, and to guide teaching so that it is responsive to what students need to know and how they learn. Helping students learn to self-assess is also important for learning. A number of studies show that achievement improves when students are encouraged to assess their own progress against internalized standards (National Reading Council, 2000; Lin and Lehman, 1999; White and Fredrickson, 1998). Finally, teachers need to learn how to use standards in constructing assessments and how to interpret standardized tests that their students will take, so as to make appropriate decisions about student learning and about their own teaching.

Managing Classrooms. Many beginning teachers, especially those who are underprepared, focus much of their concern on classroom management, especially as it pertains to what is generally thought of as student discipline. Organizing a classroom for learning is extremely important to safeguard valuable time and to create a positive environment for teaching and learning. However, effective classroom management extends far beyond rules for classroom conduct and procedures to deal with misbehavior. Research shows that effective classroom management starts with the creation of curriculum that is meaningful to students and with teaching that is engaging and motivating. Classroom management is further strengthened by the creation of learning communities that give students the opportunity to work together productively and to learn in a psychologically safe environment. It is critical for teachers to understand child development, motivation theory, and the management of groups as a starting point for constructing a successful classroom setting. In addition, teachers who know how to structure activities and interactions so that they are orderly, purposeful, and based on common understandings of what to do gain more learning time for their students and give students more opportunity to succeed because they understand what is expected of them. With these conditions in place, teachers will encounter less problematic behavior between and among students. However, teachers should be prepared with strategies to help students both attend to their learning and to repair and restore behavior respectfully. Psychological research on behavioral change and research on specific classroom management programs both provide insights for teachers about productive choices they can make. Finally, schools are expected to help students acquire basic moral values such as honesty, fairness, respect for others, and

responsibility. We discuss how teachers can organize the classroom community to support students in learning these values that are essential for later life and for the society as a whole.

Collaborating to Create Strong Schools. Throughout these chapters we emphasize how important it is for teachers to adopt a whole school perspective, to learn to collaborate with their peers and with parents, and to be prepared to contribute to school reforms that will strengthen the learning environment for their students.

OVERALL ORGANIZATION

The chapters that follow are organized into two major sections. In the first section, we use the framework in Figure 1.1 to elaborate on the knowledge, skills, and commitments that beginning teachers need in order to help their students succeed. Eight chapters present “core concepts” to guide the development of curriculum. These include (1) learning, (2) development, (3) language, (4) curriculum goals, (5) teaching subject matter, (6) teaching diverse learners, (7) assessment, and (8) classroom management (see Chapters Two through Nine).

The “core concepts” we identify are related to the structure of the fields under study. Just as the concept of “mutual consent” is central to the study of contracts in the law, so the ideas of “transfer” and “prior knowledge” are central to the study of learning and teaching. Thus we organize our discussion around major linchpins in our understanding of learning and teaching rather than around lists of topics or sets of courses. As Bruner (1960/1977) argued: “The curriculum of a subject should be determined by the most fundamental understanding that can be achieved *of the underlying principles* that give structure to that subject” (p. 31, italics added). This makes a subject more understandable because it (1) allows students to generalize and make sense of later information by helping them develop a working sense of the entire field; (2) aids students’ memory by helping them understand how information fits into a field; and (3) motivates students by focusing them on what is most worth knowing.

Furthermore, the domain areas used to define our chapters are not meant to represent courses. In fact, many of the core concepts in each of the domain areas might cut across many courses in a program. For example, at New York University, teacher educators use child development as a foundational base for the entire program. The content domain areas are integrated and the curriculum is conceptualized around a set of questions and “Inquiries” courses that are often tied to field experiences. In many of the programs highlighted in this report, faculty members have found innovative ways to integrate and deliver essential content.

In the chapters on these core concepts, we provide some examples of strategies used in teacher education programs that reflect widely used approaches and promising new methods to teaching these ideas, often in programs that have been found to be unusually effective. These examples are offered as illustrative, but not necessarily as superior to other potential strategies that are not discussed.

The second section of the book uses the same basic framework, but applies it to situations where *new teachers* are the learners. Many of the same assumptions about learning, development, assessment, and teaching are as relevant to teachers as learners as they are to students as learners. We discuss what is known about teacher development and learning, and we explore curriculum issues and promising pedagogies in teacher education that respond to what and how teachers need to learn. Finally, we treat questions of the policy context for teacher education and issues of institutional renewal and change. We focus especially on the need to improve the context within which teacher preparation programs operate, so that they, like their students, are optimally prepared to succeed.