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ABSTRACT

The Office of Educational Research and Improvement's new National Center for Research on Teacher Learning expects to include at least four elements: to accommodate public expectations for schools, to incorporate a theory of the teacher as a learner, to incorporate a theory of the teacher's task, and to build on a theory of the unique features of teaching practice. This report defines the direction of the center's work with respect to each of these points, reviews what is currently known, and derives the central questions that need to be addressed. The center's agenda is defined according to three important learning tasks: (1) teachers need to transform their beliefs about the nature of subject matter, about the teacher's role in facilitating learning, and about the pedagogical implications of diverse learning; (2) teachers must understand both subject matter and diverse learners; and (3) teacher learning requires a difficult balance between situating new concepts and criteria in the context of practice, on the one hand, and protecting teacher-learners from being overwhelmed by the demands of the situation on the other. The center is conducting three parallel programs of research based on these three tasks. The projects within these programs are listed. More than 100 references are cited. (IAH)

National Center for Research on Teacher Learning

Spring 1991





NCRTL Special Report

# An Agenda for Research on Teacher Learning



by Mary M. Kennedy, Director

*Teacher learning* is an unusual field for research because it is situated at the intersection of several fields of research and practice: research and theory on learning, on teaching practice, on the relationship between education and society, and on the nature of school subject matter. Productive research on teacher learning needs to take account of this unusual situation, capitalizing on various dependencies but framing a distinctive research program. One problem of previous research on learning to teach is that it often ignored many of these connections; another is that it often confused teacher learning with some other issue—teaching practice, for instance.

Simply by requesting a National Center for Research on Teacher Learning, the Office of Educational Research and Improvement (OERI) of the U.S. Department of Education has taken a significant step forward toward redefining this important area of research. Further progress will be made as the new center establishes a direction for the field. The new center will provide intellectual leadership not only through its research findings but through the way it frames its questions. The assumptions it makes and the questions it poses will help shape this emerging field of teacher learning. In fact, defining this new territory is one of the most important contributions the new center will make.

## Four Important Elements

If the new center is to establish an appropriate map of the territory, its work must include at least four important elements. First, it must set its work in the context of *public expectations for schools*. Second, it must incorporate a theory of the *teacher as a learner*.

Third, it must incorporate a theory of the *teacher's task*. And finally, it must specifically address the *unique features of teaching practice*.

### Public Expectations for Schools

We argue that research on teacher learning must situate itself in the context of *public expectations for schools*. It cannot confine its standards of teacher learning to what is currently typical. Although the practice of teaching is arguably better today than it was a century ago, we could hardly claim that the quality of current practice meets public expectations. Indeed, public expectations for teaching seem always to run far ahead of actual practice. So even if we were to succeed in helping all teachers gain the knowledge and skill that typical teachers now have, they would not be prepared for the inevitable press to improve their practice.

## Teacher Learning

With respect to *teacher learning*, we propose to build on the important recent advances in cognitive science. For centuries, pedagogues have assumed that learning consisted mainly of the passive accumulation of new knowledge: Students learned by listening to lectures or reading texts, and their progress was measured by their ability to recite back what they had heard or read. But research in the past two decades has made it clear that learning occurs through an active process of interaction between the learner and an experience. Learners *impose* meaning on the basis of their prior knowledge. This implies not only that a given experience may be interpreted by different people to mean different things, but also that people differ in the kind of experiences from which they learn.

This new understanding of learning has stimulated a great deal of interest in how teaching practices might be altered to better promote student learning. Many researchers are altering their ideas about how students in school learn. But the findings from cognitive science apply equally well to teachers. We can no longer assume that teacher learning occurs solely through receiving new knowledge. Teachers, like other learners, interpret new content through their existing understandings and modify and reinterpret new ideas on the basis of what they already know or believe.

To understand how teachers learn to teach, therefore, we need to extend findings about learning from students-as-learners to teachers-as-learners. We need to define teacher learning as a function *both* of the teacher-learner *and* of the learning experience itself. We must design research that examines *both* what teachers bring with them to new experiences—what they already know, believe, or value—*and* the experiences themselves—the features that are likely to promote learning the new ideas or practices offered to them. Such a shift constitutes an important new direction for research on teacher learning.

## Teacher's Task

With respect to the *teacher's task*, we argue that the central task of teaching is connecting diverse learners to important subject matter knowledge. The significance of this model can best be understood in relation to a contrasting model which portrays the teacher as someone who maintains order in the classroom while students absorb new knowledge. Our model builds on two bodies of research: research on learning and research on teaching subject matter. With respect to learning, it recognizes that students cannot learn as much from passively reading or listening to lectures as they could if they were actively engaged with the content. With respect to subject matter, it recognizes other important research findings indicating that different kinds of subject matter require different kinds of pedagogies.

The processes through which students learn about writing, for instance, are different from those through which they learn history. The processes through which they learn to decode letters and letter combinations are different from those they use to learn to follow an argument in an essay. The teachers' role, therefore, must extend beyond maintaining order while students absorb new ideas; it must center on presenting the subject matter in a way that enables students to engage it and understand it. Teachers, then, must not only beflexible in their ability to draw on the subject matter itself and in their strategies for working with the particular learners in their classrooms but must also be knowledgeable about the unique pedagogies that are associated with different content. Learning how to maintain order is not enough to foster subject matter learning in all students.

This model of the teacher's task complicates research on teacher learning because it suggests that such research must be situated in particular subjects and particular students. Teaching history

in Scarsdale is fundamentally different from teaching calculus in Watts, and teachers need to learn and understand these differences. We cannot examine either teaching or teacher learning without considering the role of subject matter and the role of diverse learners. We cannot gloss over the particulars of subject matter and the particulars of students, viewing these simply as contextual variables.

### Unique Features of Teaching Practice

To accommodate the *unique features of teaching practice*, we propose to build on, and move beyond, two important, but disparate, lines of work. One of these lines has examined teaching practice with an eye toward deriving general principles of good practice. The other has emphasized the highly situation-specific nature of teaching practice. Those who follow the latter line have illustrated the enormous complexity of teaching and the myriad ways teachers can and do learn to handle particular teaching situations. They have raised questions about the value of general principles on the ground that teaching and teacher learning are necessarily idiosyncratic. The disjunctions between these two lines of work has contributed to our understanding of teaching. We now recognize that teaching involves techniques that can benefit from social science while at the same time remaining a highly interpersonal, uncertain, and interactive enterprise. Yet we also recognize the limitations of each approach to research. The argument that teacher learning should center mainly on general principles overlooks the importance of adjusting to particular situations. But the argument that teacher knowledge is entirely situation-specific leaves it unclear what exactly teachers can or do learn that facilitates their work.

In sum, then, we argue that OERI's new center for research on teacher learning should define its terrain to accommodate public *expectations for schools*, to incorporate a theory of the teacher *as a learner*, to incorporate a theory of the *teacher's task*, and to incorporate a theory of the *unique features of teaching practice*. The work we propose to do responds to these demands in the following ways:

- With respect to public expectations, we concentrate our work on how teachers can learn to teach in more powerful and demanding ways than teachers have been asked to teach in the past
- With respect to teachers as learners, we ask how teachers can transform the understandings they bring with them into better ways of understanding teaching
- With respect to the teacher's task of connecting subject matter to diverse learners, we ask what teachers need to learn about both subject matter and learners, and how they learn about both
- With respect to the unique features of teaching practice, we ask how teachers can learn both the intellectual and the logistical aspects of managing ambiguous, dynamic and complex learning environments

In the following pages, we define the direction of our work with respect to each of these points, reviewing what is currently known and deriving from that the most central questions that need to be addressed.

## Accommodating Public Expectations for Schools

The first essential element for a center for research on teacher learning is a recognition of the social and political context in which teacher learning occurs. The history of education is a history of reform efforts, most of which have left teaching almost unchanged (Cohen, 1988; Cuban, 1984). One reason for these discrepancies is that, despite the growth in school bureaucracy, teaching

is still a highly decentralized enterprise. Individual teachers are still largely responsible for what happens to children (Wise, 1979). New ideas are accepted, rejected, or modified by individual teachers working in their own classrooms (Cohen and Ball, in press; Hawley, 1990; Lipsky, 1980). Progress and change depend on what over two million teachers, working in relative isolation, know and are able to do in their own classrooms. Another reason is that good teaching is easier to talk about than to do.

While we recognize this difficulty, we also recognize that teachers face numerous pressures to improve their practice (Sikula, 1990). Hawley, Austin, and Goldman (1988) have argued that the current reform, more than any other, has "defined the quality of teachers as both the problem and the solution" (p. 4). Reform, then, is heavily dependent on teacher learning. And, although schools and teachers routinely face demands for change, they are now facing a greater demand than they have for some time. Four demands are particularly important.

## Workplace

One demand derives from fears that, as the United States enters an Information Age, schools are not adjusting to new workplace requirements. Reformers argue that the current structure of schools meshes with a factory model of employment, but that future jobs will require different skills (see, e.g., the Carnegie Forum on Education and the Economy, 1986). Since the beginning of the industrial revolution, factories needed employees who could follow directions and who could work on fixed, repetitive tasks. But the new economy will include more jobs that require teamwork, joint problem-solving ventures, and the ability to work on complex, open-ended problems (Bailey, 1990). In addition, because work itself will change more rapidly than it has in the past, workers will need to continue to learn and adapt throughout their careers (e.g., for the auto industry, see Clark, Chew, and Fujimoto, 1987). These projected changes in the work environment place demands on the schools to produce graduates who are more flexible and adaptable, more able to solve problems and to work in ambiguous situations, and more able to work collaboratively with others (Bartel and Lichtenberg, 1987; Griffin, 1988; Schultz, 1975; U.S. Congress Office of Technology Assessment, 1988).

## Learning in Academic Subjects

A second but related demand comes from the keepers of the academic disciplines who argue that American students are not receiving an adequate grounding in most subject areas. These demands are bolstered by national and international assessments of student progress, which suggest that students are learning basic skills but not deep understanding and that they are not learning how to reason and analyze ideas (American Association for the Advancement of Science, 1989; Applebee, Langer, and Mullis, 1986; McKnight et al., 1987; Rothman, 1990a, 1990b). They are also bolstered by studies of classroom practices that indicate heavy reliance on lectures, supplemented by small amounts of watered-down discussion (Goodlad, 1984; Powell, Farrar, and Cohen, 1985; Sizer, 1984; Stodolsky, 1988). School subjects often consist mainly of rudimentary facts, often learned in isolation from one another so that they lack meaning for students. Like the comic strip character who knew that the Declaration of Independence was signed either in 1796 or 1492, but couldn't remember which, students often learn discrete facts, dates, and names, with very little purpose or meaning to them.

Virtually every discipline has reviewed the state of precollegiate education in its area and found it wanting, and virtually all of them want to see teaching that yields more powerful understanding of subject matter among students. The National Center for Improving Science Education, for instance, has identified several important scientific concepts it believes should be taught in elementary school classrooms—concepts such as systems, causality, and models—but also concludes that

"there is clear evidence that [good] science teaching does not occur in elementary classrooms, with significant consequences for both students and our country as a whole" (Loucks-Horsley et al., 1989, p. 3). The National Council of Teachers of Mathematics (1989) recently published draft standards for mathematics teaching in which it argues, among other things, that "the goal of teaching mathematics is to help all students develop mathematical power" (p 10). Paulos (1990) has written an entire volume arguing that American adults cannot reason about quantitative situations such as the probability of rain or the relative magnitude of large numbers. Ravitch and Finn's (1987) proposal for improving history teaching asks that teachers:

> Teach history in context so that people and events are seen in relation to consequential social and economic trends and political developments. A richly drawn portrait of a given time and place must also include a sense of the life of the times: the ideas that influenced people's behavior; their religious, philosophical, and political traditions; their literature, art, and architecture; the state of their knowledge and technology; their myths and folk tales; their laws and government. (p. 205)

These keepers of the academic disciplines, then, are now demanding that teachers produce students who have deeper and broader knowledge of school subjects, who can draw on their knowledge in a variety of contexts and can reason about important substantive ideas. The academic expectations for schools, then, have increased. (See also Aldridge, 1989; Anderson, Hiebert, Scott, and Wilkinson, 1985; Bradley Commission on History in Schools, 1988; National Commission on Social Studies in the Schools, 1989; National Council of Teachers of English, 1986.)

## National and International Politics

Yet a third demand comes from changes in national and international politics. As world events move rapidly toward a new world society—Europe moving into a common market, the Iron Curtain coming down, and the shift to a global economy—we find American voters more apathetic than ever. We find American citizens lacking the knowledge they need to participate in our government and lacking the knowledge of other languages and other cultures that they need to participate in a global economy. These changes place demands on teachers to produce students who are more politically, economically, and socially aware and who take a more active interest in these spheres of life.

## Composition of Student Body

Finally, a fourth demand on teachers comes from demographic changes in our student body. Teachers are encountering more and more of the very students whom they have traditionally had most difficulty serving: students whose families are poor, whose language is not English, whose race or cultural background differ from their teacher's. In 1984, 29 percent of the school population was non-white; by 2000, the figure will be close to 40 percent; 25 percent are poor; 20 percent come from single parent homes; increasing numbers speak Spanish or an Asian language. But the teaching force is predominately white and female, and becoming more so (Grant and Secada, 1990). Schools have always served diverse groups of students and have never been able to serve them all equally well. There are many reasons for this, one of which is that teachers tend to come mainly from small, homogeneous white communities, and many have little experience with students who differ from themselves. As a nation, however, we are reaching a point where we can no longer afford to miss large segments of our youth.

Contrary to predictions (e.g., Braverman, 1974; Bright, 1958; Levin, 1987) that the advent of

technology would lead employers to "de-skill" their workers, more recent studies show that the actual changes are moving in the opposite direction. Close studies of changes in the organization of work in several key industries (Bailey, 1990; Bertrand and Noyelle, 1988; Noyelle, 1989) suggest that the current climate of international competition, changing demand, and rapid change will lead to uses of technology requiring greater numbers of intellectually capable employees and fewer unskilled and semiskilled laborers. Unless those conditions change, technology will change the workplace by "upskilling" jobs, reducing the number of lower level jobs and making middle-level jobs more demanding.

Teachers, then, are facing numerous demands to improve their practice—demands reflecting changes in the workplace, changes in expectations for learning in the academic subjects, changes in national and international politics, and changes in the composition of their student body. The reform demands add to the already difficult nature of teaching by requiring that academic tasks be rendered more true to the discipline, that they require more reasoning and understanding from students, that they connect subject matter to other aspects of life, and that they incorporate more and more diverse students.

All of this suggests that a center for research on teacher learning cannot be satisfied with efforts to help teachers learn to be as good as typical teachers of today, but must, in addition, consider those new demands that are now being made, for these demands will increase the complexity of the practice of teaching. This has significant implications for research on teacher learning, for much of it is based on the premise that the central questions of teacher learning have to do with helping novice teachers, or relatively less-proficient teachers, become as good as most teachers are. That is, it uses *current* practice to establish the norm for teacher learning. But if research on teacher learning enables all teachers to be only as good as typical teachers now are, it will not have advanced practice in ways that accommodate public expectations.

We accommodate this need to respond to reform in two ways. First, we incorporate its demands into our formulation of the issues that need to be addressed. When we address the issue of *teacher as learner*, for instance, we are especially interested in the teacher as a learner of practices that differ from those which the teacher may have encountered in the past. When we define the *teacher's task* as connecting subject matter to diverse learners, particularly learners who are different from the teacher, we do so because this task defines public expectations for teachers. When we consider the *unique features of teaching practice*, we consider not only those features that characterize ordinary teaching, but those that would characterize new directions in teaching as well. The second way we accommodate these demands into our formulation is by selecting sites for research that are trying to help teachers learn these more demanding and more complex forms of teaching.

## The Teacher as Learner With Prior Knowledge

The second essential element for a center for research on teacher learning is a theory of the teacher as a learner. Research on teacher learning is a relatively new field, but it has yielded some important knowledge that is relevant to our proposed center. (For reviews from several different perspectives, see Carter, 1990; Feiman-Nemser, 1983; Feiman-Nemser and Floden, 1980, 1986; Zeichner and Gore, 1990; Zeichner, Tabachnick, and Densmore, 1987.) One important finding is that teachers develop strong conceptions of the practice of teaching while they are still children. From their experiences as students they form views about the nature of school subjects, about the teacher's role in facilitating learning, and about the pedagogical implications of learner diversity. These views constrain their ability to

grasp alternative views. More than any other profession, the profession of teaching socializes new members from childhood on (Lortie, 1975). Teachers have spent over 3000 days as children and as young adults observing teachers (Kennedy, 1990a). Their experiences are tantamount to an apprenticeship of observation, and it is one which is invested with emotion, given the students' dependence on the teacher.

Teachers' backgrounds are often also limited with respect to the kinds of people they have encountered. Most teachers come from small, homogeneous, lower middle-class communities. They attend college in nearby communities and hope to return to their home town or to a neighboring town to teach. Their exposure to students who are even marginally different from themselves is often close to nonexistent. Teachers from Christian communities, for instance, may not know about Jewish holidays, teachers from white communities may not understand Black dialect, and teachers from working class communities may have never encountered wealthy or socially ambitious students. Consequently, many teachers are ill-equipped to connect subject matter to the diverse range of pupils now attending K-12 schools in the United States.

In our earlier work, for instance, we found that many teacher candidates had never considered that there might be learners who respond to school subjects differently than they themselves did (Floden, in press). The pervasiveness of teachers' experiences during their apprenticeship of observation, both across grade levels and across subject areas, coupled with the sheer volume of time spent observing, yields in teachers (and in other adults, for that matter) a deeply entrenched *and tacit* set of beliefs about what can and should happen in schools: about the nature of intellectual work and the nature of school subjects, about the teacher's role in facilitating learning, and about the pedagogical implications of student diversity.

## Relevant NCRTE Findings

Though sociologists have recognized the importance of the apprenticeship of observation for some time, the details of teachers' ideas, and the constraints they place on teachers' ability to entertain new ideas about teaching, was one of the most important findings of recent work here at the National Center for Research on Teacher Education (NCRTE). For the past three years, we have been following teacher candidates through preservice programs and following practicing teachers through a variety of induction and inservice programs. We found that, despite the diversity of approaches to teacher education that we studied, many of these programs were unable to alter substantially the ideas teachers had when they arrived. Moreover, we found that teachers' initial ideas were often limiting, and that they constrained teachers' ability to understand new ideas about teaching—about how students learn, for instance, or about the teacher's role in connecting subject matter to diverse learners.

With respect to *their views about subject matter*, for instance, we found that many teachers perceive school subjects not as bodies of knowledge that might be uncertain or worthy of debate nor as relating to everyday life. Instead, many teachers perceive the two subjects we studied, mathematics and writing, as collections of fixed rules and procedures with few connections among them and even fewer connections to events or purposes outside the classroom. When defining their goals for their students, for instance, they were inclined to defer to a textbook or to what students needed to know in preparation for the next grade, rather than to identify ideas or content that could increase students' understanding of the world in which they live (Kennedy, 1990a).

With respect to *teaching and learning*, we found that undergraduates who enter teaching almost universally hold a limited view of their role as teacher, thinking that learning entails absorbing and that teaching entails telling students what they know and assessing students' recall of that

knowledge (Ball, 1988a; Feiman-Nemser, McDiarmid, Melnick, and Parker, in press; McDiarmid, in press-a). When asked what they might do if their students did not understand a particular concept, their sole recourse was to "go over it again." They simply could not envision any alternative teaching strategies.

With respect to *the pedagogical implications of student diversity*, we found that many teacher-education candidates were unable to move beyond the two moral imperatives of teaching—the imperative to treat all students equally and the imperative to accommodate individual differences (Paine, 1988). They recited both of these values almost as if they were mantras, unaware of the contradiction and unaware of how to implement either one. Moreover, when asked to evaluate teaching situations involving student diversity, they attended only to social and personal issues of pedagogy and not to differences in the content that different students were being taught (McDiarmid, in press-b).

## Importance of Conceptions and Beliefs to Practice

The presence of such a priori beliefs is important, for teaching practices are substantially influenced by what teachers think (e.g., Clark and Peterson, 1986; Clark and Yinger, 1987; O'Laughlin and Campbell, 1988; Rich, 1990; Trumball, 1987). In fact, teachers' beliefs influence not only their own practices, they influence what students learn as well. Peterson, Fennema, Carpenter, and Loef (1989), for instance, found that teachers who believed it was important for students to understand ideas rather than merely to be able to follow rules did in fact produce students with far more problem-solving ability than other teachers. Other research indicates that, while teacher assessments of student ability are relatively accurate (Hoge and Coladarci, 1989), their assumptions about the pedagogical implications of student diversity often yield counterproductive instructional strategies with low-achieving students (Good, 1987).

## Implications for Learning to Teach: How to Transform Beliefs

Learning a new version of teaching requires teachers to expand their views of the possibilities in classrooms for intellectual life, for grappling with academic subject matter, and for engaging a broader range of students in these activities. Such an expansion is, apparently, no simple task. Some 1200 institutions of higher education offer teacher education programs and the vast majority of currently practicing teachers have participated in one of these programs. Many of the teacher education programs participating in the NCRTE's recent study of teacher education[1] had a reform agenda: They wanted to expand their candidates' beliefs about their role in teaching or to enhance their candidates' understanding of learners who were different from themselves. But their strategies for achieving these ends continued to treat teachers as passive learners. They offered courses on how students learn, on what students from different cultures are like, or on alternative pedagogies (McDiarmid, in press-b). But the TELT data indicate that candidates' views about teaching rarely changed as a result of participation in such programs; that is, most teacher-education graduates continued to believe that teaching entails little more than telling students what they know and measuring their ability to recite it back.

[1]For the past three years, we have been engaged in a multisite study of teacher learning in teacher education programs. The programs we have been studying include preservice, inservice, alternative routes and induction programs. In each site, we have been following a sample of teachers, documenting their knowledge and beliefs prior to participating in the program, during the program, and after it. We refer to this study as the Teacher Education and Learning to Teach, or TELT study.

Why are these beliefs so resilient? One reason is that, because teachers have logged over 3000 days as classroom participant observers, they have not only developed strongly entrenched beliefs about teaching and learning but have also developed a strongly entrenched belief that they already know what teaching is all about and that they have little to learn. A second reason is that, when faced with conflicting information, teachers (and others, for that matter) are more likely to distort or ignore the conflicting information than they are to question their own initial beliefs (Duffy and Roehler, 1986; Kennedy, 1983; Michelson, LaSovage, and Duffy, 1984; Pintrich, 1990). The resiliency of initial beliefs is well documented in the psychological literature on subject matter learning (for examples in science, see Anderson and Smith, 1984, 1987; Roth and Anderson, 1988) and has fostered much of the theoretical work on schemata and conceptual change (e.g., Anderson and Smith, 1984, 1987; Carey, 1986; Floden, in press; Posner, Strike, Hewson, and Gertzog, 1982).

**Provoking questions.** If teachers are to transform their current beliefs, they need to be provoked to question their own experiences and to question the deeply entrenched beliefs that derive from these experiences (Ball, 1988b; Feiman-Nemser et al., in press; Hollingsworth, 1989; McDiarmid, in press-a; Zeichner and Liston, 1987). Their willingness to raise questions about the meaning of their prior experiences is an essential prerequisite to expanding their perspectives. Conceptual change theory (e.g., Posner et al., 1982) suggests that significant change will require confrontation with a discrepancy such as teachers might see, for instance, in an alternative model of teaching and learning. But the success of such exposure would still depend on certain conditions: The alternative must be perceived as plausible, for instance. Research on human judgment also indicates that change will be more likely if the alternative portrait is vivid, concrete, and detailed enough to match the credible and believable examples teachers have encountered throughout their childhoods (Nisbett and Ross, 1980). We might, therefore, expect videotapes of teaching to be more vivid than written accounts and expect examples of teaching in which candidates participate as learners to be more vivid than videotapes. One kind of example that would be particularly vivid, for instance, would be one that engaged the teacher as a learner *and* exposed the teacher to subject matter knowledge *and* required the teacher to reason and to solve complex problems in the context of the subject.

**Provoking change.** The second important criterion for provocation is that the alternative example of teaching would have to force teachers or teacher candidates both to recognize that this example deviated from their experiences and to discern the various ways in which it deviated (Posner et al., 1982); that is, the potency of the example by itself would not necessarily provoke thought, but a potent example accompanied by some analytic commentary or challenging questions might. Our research on the transformation of teachers' beliefs, then, is guided by a theory of learning that stresses the active role of prior beliefs in learning and the difficulty of changing firmly held prior beliefs. Our principal hypotheses are as follows:

- Teachers need to be provoked to question their experiences and to question the beliefs that are based on those experiences
- Provocation is most likely to occur in conjunction with

  Vivid portraits of alternative models of teaching

  A stimulus that focuses teachers' attention on the difference between this example and the teachers' tacit model of teaching

## The Teaching Task as Connecting Subject Matter Knowledge to Learners

The third important element for a center for research on teacher learning is its position regarding the central task of teaching. In recognition of public expectations for schools, we propose to define the teaching task as that of connecting important substantive ideas to diverse learners. While such a definition may seem self-evident, it has not been the sole, or even the principal guide, of much research on teacher learning. The complexity of how this task is achieved has often led both researchers and policymakers to focus on side issues such as classroom management and discipline. While these issues are important, they need to be considered not by themselves but rather in relation to the ultimate task of connecting subject matter to diverse learners. This ultimate teaching task requires teachers to understand both their subjects and their students as learners. With respect to the subject matter, teachers need to be aware of numerous connections among ideas, to be able to draw on subject matter in a variety of contexts, and to be flexible in their ability to draw on subject matter knowledge (Buchmann, 1984; Glaser, 1984; Shulman, 1986, 1987). In short, they need richly elaborated knowledge of their subjects and of the different ways these can be perceived and understood. With respect to their diverse learners, they need to know what their students already understand or think about the content they are teaching, the kinds of misunderstandings they are likely to form, the kinds of representations they would understand, and enough about their interests and backgrounds to make these representations interesting to students.

### Relevant NCRTE Findings

Prior NCRTE research, which focused on mathematics and writing, revealed that the majority of teachers and teacher candidates, including those who had majored in the subjects they will teach, had only a limited understanding of these two school subjects. When asked to generate a story problem that would illustrate the mathematical sentence, 1¾ divided by ½, for instance, most of our sample could not do so, even if they had majored in mathematics in college (Ball, 1990a). In fact, many of them made an error which, in teaching would actually confuse rather than help students understand division by fractions: They divided by 2 rather than by ½. They created illustrations such as, "My roommate and I want to share 1¾ pizzas. How much pizza can each of us have?" When they calculated the answer, correctly deriving 3½, they assumed this number meant that each of them could have 3½ pieces of pizza, and assumed this must refer to *quarters* of the pizza. In fact, the number 3½ represents the *number of halves* that are in 1¾.

Similar problems were found in the area of writing, where we found that few of our candidates could explain such fundamental language conventions as the principle of pronoun/verb agreement in a sentence like, "None of the books _____ in the library." Virtually none was able to recognize and diagnose systematic error patterns in student writing, and only a few could identify and diagnose structural problems in student's writing. Consequently, they could only respond to student writing by listing usage and grammar errors or by asking the student some general questions about purpose. To represent ideas to students requires an understanding of those ideas. These problems do not illustrate lack of understanding of pedagogy: They illustrate lack of understanding of fundamental ideas within these subjects. To respond constructively to students' writing requires an understanding of what makes some texts better than others and of how one goes about improving text. Moreover, these are not advanced-level issues of the academic disciplines but rather issues that arise regularly in elementary and secondary school classrooms.

The findings should not be surprising. When teachers in the TELT study were students themselves, they learned mathematics and writing

by reading books and listening to teacher lectures. They had few, perhaps no, opportunities to engage with these subjects, or to think actively about them in a way that would develop their own understanding. Furthermore, the content of *school subjects*, the things teachers teach in their K-12 classes are often not taught at the college level, so that majoring in a particular subject in *college* would not alter students' understanding of K-12 subject matter. Although many reformers hope that teachers' knowledge of these subjects will be enhanced through their college-level arts and sciences courses, the evidence that they may not has become compelling (Boyer, 1987; McDiarmid, 1990).

For these reasons, then, many teachers have not themselves acquired a deep understanding of school subjects. Sometimes their limited understanding is further complicated by emotional blocks toward these subjects. For instance, when knowledge of mathematics is limited to computations and procedural rules, with little or no ability to reason mathematically, and when these procedural rules fail, the would-be problem solver can feel helpless and conclude that mathematics is an unfathomable field (Schoenfeld, in press).

The TELT study also examined teachers' understanding of the pedagogical implications of learner diversity. We mentioned earlier that most teacher candidates had vague and contradictory ideas about this issue and that they attended to social and personal aspects of pedagogy rather than to how different students might be helped to learn subject matter. In his literature review on teacher expectations, Good (1987) indicated that teachers' perceptions of student ability, instead of triggering improved pedagogy for those students having most difficulty, triggered instead counterproductive instructional strategies.

This finding should not be surprising, for we also found that teacher education programs did not provide explicit statements about the pedagogical implications of diversity. Instead, many provided courses that informed teachers about the nature of various cultures or about the history of race relations in the United States or about categories of handicapping conditions. This knowledge could help teachers identify diversity but could not help them respond to it. Yet, if teachers are to connect important substantive ideas to students and provide them with representations and assignments that help them understand subject matter, they must understand the pedagogical implications of diversity.

## Nature of Subject Matter Knowledge and Pedagogical Subject Matter Knowledge

The importance of teachers' subject matter knowledge has become increasingly apparent in recent years (Ball and McDiarmid, 1990; Grossman, Wilson, and Shulman, 1989; Kennedy, 1990b, in press; McDiarmid, Ball, and Anderson, 1989; Shulman, 1986, 1987). Why it matters is illustrated in Lampert's (1988) review of Good, Grouws, and Ebmeier's efforts to train teachers to engage in "Active Mathematics Teaching." While Good and his colleagues were able to instill in their teacher-learners many of the behaviors that were deemed important to active mathematics teaching, they found that their teachers could not implement the behavior called "concept development." Lampert argues that teachers could not engage in concept development as a pedagogical device if they did not comprehend the concepts themselves. Teachers, after all, cannot teach what they do not know.

But the questions of what teachers need to know about school subjects have proved to be extremely difficult to answer. Clearly every teacher must know the content she or he is teaching. But how well, and in what ways, in what depth, and to what ends, are all unknowns. One interpretation of the fraction problem we described above is that teachers do know fractions, for virtually all of them could compute a correct answer to it. Another is that they do not, for they confused division by 2 with division by ½.

Beyond knowledge of the specific ideas they teach, teachers need to know which ideas in a subject are most important. If a teacher is choosing between two assignments, both of which presumably help students learn about fractions, he or she should be able to distinguish between an assignment that emphasizes the algorithm of "invert and multiply" and one that emphasizes division by fractions as an extension of the general concept of division. To choose a worthwhile task, then, teachers need to have enough understanding of the subject to know which ideas are central, which are peripheral, how different ideas relate to one another, and how these ideas can be represented to the uninitiated.

Recent findings from cognitive science offer a second avenue for trying to learn more about connecting subject matter to students. We know, for instance, that many of the concepts teachers must learn to teach are *indexical* (Brown, Collins, and Duguid, 1989): They index, or refer to, concrete phenomena, and are best understood if they are learned in the context of those phenomena. Portraying subject matter concepts in the context of the situations to which they refer facilitates what these authors call *situated learning*. Such learning enables the student to construct actively the abstract concept through the situations to which it refers. To the extent that concepts in school subjects are indexical, their meaning is best understood within the context to which they refer. To the extent that they are taught entirely as abstractions, without indexing them to situations, students will not understand what fractions really mean or how they relate to ordinary life experiences. In fact, a surprising number of prospective teachers told us that fractions do not relate to the real world. The chances are then increased that students either will forgot them, because they have no meaning, or will misconstrue them in their efforts to place the concepts in an imaginary context. Since many of the most important concepts teachers teach are indexical, teachers should learn to teach these ideas in the situations to which they refer (Bransford and Vye, 1989; Cohn, 1981; Klinzing and Floden, in press).

These considerations suggest, then, that teachers need to understand the school subjects they teach within the context of larger substantive domains from which they are drawn. Teachers need to see that the substantive ideas they teach are connected to one another and that some are more fundamental while others are more peripheral. They need to see that there is a logic to the domain as a whole, that there are rules of evidence and of argument that bear on how knowledge is developed, tested, and shared. Teachers are more likely to develop such knowledge in situations that allow them to encounter ideas within the context of the domain as a whole.

Although the nature of subject matter understanding varies from one subject to another, cognitive researchers now recognize some common features of "understanding" that cut across subjects. Three important features are the *connectedness* among ideas within the subject, *flexibility* in using subject matter knowledge, and *perceived meaningfulness* of the knowledge.

**Connectedness** refers to the number and variety of connections among ideas within a subject. Knowledge is more easily accessible when it is connected to other knowledge by means of multiple webs or networks of meaning. The extent to which a given idea is embedded within larger networks of knowledge will influence when and how that idea can be recalled and used. For example, facts learned in isolation from other knowledge will be difficult to access when they are needed (Anderson and Bower, 1973; Bransford, 1979; Floden, in press; Glaser, 1984; Nickerson, 1985; Prawat, 1989; Resnick, 1987a).

**Flexibility** refers to the ability to draw on ideas from the subject in a variety of contexts. Among the many connections teachers and students need to make as they learn school subjects are those between substantive ideas and a variety of life situations. Connecting subject matter knowledge to multiple contexts gives the knower flexibility to perform many intellectual tasks with the knowledge, rather than yoking knowledge to

discrete, limited problems or situations (Bransford and Vye, 1989; Brown et al., 1989; Perkins and Salomon, 1989; Prawat, 1989). Flexibility is particularly important for teachers, not only as a matter of understanding the subject but also as a matter of finding multiple ways to represent the subject to diverse learners (McDiarmid et al., 1989).

**Perceived meaningfulness.** Finally, subject matter knowledge that is connected and flexible is more likely to enable learners, including teacher-learners, to *perceive meaning* in the content. It enables the learner to see history, literature, the arts, and the natural and social sciences not as arcane bodies of disconnected facts of limited use but as important and meaningful bodies of knowledge that can help them understand and appreciate their place among human beings and to appreciate the workings of the natural and social worlds.

## Nature of Knowledge About the Pedagogical Implications of Learner Diversity

Just as there is considerable debate about what teachers need to know about subject matter, there is considerable debate about what they need to know about diverse learners. There are three aspects of learners that seem particularly important for teachers to take into consideration when they are teaching: the knowledge students bring with them, and the ways that knowledge might influence what they learn; their interests and inclinations; and their cultural backgrounds.

**Knowledge.** The research on learning that we cited earlier suggests that classroom tasks should be designed in a way that enables students to connect new substantive ideas to other knowledge they already have. Hirsch (1987) has brought to public awareness the importance of connecting new knowledge to knowledge students already have. He argues that students need a strong foundation of knowledge in order to continue learning and to interpret the world around them. It follows that teachers need to carefully construct learning opportunities so that new knowledge can build on old. By building on existing knowledge we do not refer only to the "building blocks" model of learning, in which students need to know the meanings of constituent words in a sentence before they can learn the meaning of the sentence as a whole, we refer to broader ideas and understandings that students bring with them to a new lesson—ideas that can cause them to distort or misunderstand the new material. Such misconceptions are particularly apparent in science where young people form, often independently of their school lessons, naive models of how things work. Unless teachers are aware of these models and adapt their lessons accordingly, students can apply new ideas to their naive misconceptions, thus completely missing the point of the new ideas.

**Interests and motivation.** A second important pedagogical implication of learner diversity has to do with what the students themselves consider to be worthwhile classroom tasks. If a task introduces critical content but does so in a way that confuses or alienates students, we might not judge it to be a worthwhile academic task. The Civil War, for instance, could be represented to students as a distant event, with no apparent bearing on contemporary life; it could be contrasted with contemporary events in Lithuania and presented as illustrating a central dilemma in nations formed from multiple states; or it could be taught as an event whose aftermath can still be seen today in cultural differences between the South and the North and in contemporary race relations. How the teacher portrays the Civil War will affect the extent to which students perceive this content as meaningful, relevant, important, and worth attending to. Teachers need to know, then, a great deal not only about what students already know about the subject but also about the interests and inclinations they bring to school.

**Cultural backgrounds.** A third aspect of learners that can have pedagogical implications is their cultural backgrounds. We already mentioned that

most teachers come from relatively homogeneous communities and that they tend to assume all students will respond to school subjects in the same way that they themselves responded as students. Yet students' perception of school and its relationship to the rest of their lives depends largely on the attitudes and views of those in their families and communities. Two hypotheses have been generated from this. One is that teachers need to understand the cultural backgrounds of all their students well enough to know what these students value, what they strive for, what they take for granted. The other is that such information may serve only to reinforce teachers' stereotypes and may not help them actually teach better.

Instead of giving them knowledge of a variety of other cultures, it would make more sense to help teachers understand the limitations of their own biographies, to realize that not all students are as interested or bored by particular ideas as they were, and that not all students are as outgoing or as shy as they were. Such an understanding would at least enable teachers to see the need to examine their own students more closely rather than assume that they have particular interests or dispositions. Knowledge of students' cultural background is particularly salient when teaching socially controversial topics such as biological reproduction and evolution, but it plays a more subtle role as well. A teacher may, for instance, decide to actively engage students through classroom debate, not realizing that public argument is considered inappropriate in some cultures.

Philip Jackson (1986) has argued that the degree to which teachers need to know about their students is a function of the cultural distance between the teacher and the student. Julia Child, for instance, can teach to an audience she has never met in part by assuming that this audience is very much like her: it is largely adult, largely people interested in cooking and people with extensive experience cooking. A teacher of college students, in contrast, must adapt to the differences between him or herself and the audience. A teacher of young children must adapt even further. And a teacher of students from other cultures must adapt even further. If this is true, then the most significant pedagogical implications of learner diversity are those that appear when teachers must teach students who are most different from themselves.

All of these aspects of students, then, their cognitive makeup, their interests, and their cultural background, have pedagogical implications. And since misunderstandings in any of these areas could lead to ineffective teaching, the very fact that learners differ from one another and that they differ from the teacher has implications for pedagogy, for teachers must continually monitor their students' responses to learning tasks. Ideally, teachers should be able to create learning opportunities that both foster student learning and at the same time unveil student thinking and understandings as students work on these tasks, so that teachers can monitor student understanding and provide help and direction as needed.

**Linking subject matter to students**. The foregoing suggests that there is a great deal to be learned about both subject matter and students as learners. Moreover, each of these poles of the teaching task are linked to larger domains. School subjects exist in the context of larger domains of inquiry and students exist in the context of cultures and communities. These two domains come together in teachers' classrooms. The teacher's task is to build on what students bring in a way that introduces them to particular substantive domains. This requires some bending of the subject, to adapt it to students, and it requires some bending of students, to adapt them to the subjects. The former task requires a sufficient understanding of the subject to enable teachers to understand the substantive implications of the representations they use; the latter requires an understanding of the social and ethical implications of the tasks students are asked to do.

Very little is known about how teachers can manage the inherent dilemma of linking subject matter to students. In fact, we lack a good way

even of defining the task. One recent idea is to define a special kind of knowledge that is particular to teachers. This knowledge, called *pedagogical subject matter knowledge*, refers to the specific ability to *represent* substantive concepts to students. In order for teachers to decide how to represent content to students, they must be able to judge *both* how well the concept in question is portrayed *and* how meaningful it is to the particular students in the class (Wilson, Shulman, and Richert, 1987). Moreover, even apart from choosing these representations, teachers make numerous decisions about the *importance* of various topics they could teach. A teacher may decide, for instance, not to spend time on one topic because it is a minor issue but to emphasize another topic that provides a foundation for many other ideas that will come later. Only a strong grounding in subject matter knowledge will enable teachers to make this judgment.

This phrase, "pedagogical subject matter knowledge," recognizes that, when teaching a new idea, teachers may draw on analogies, metaphors, models or other devices to represent the new idea so that it is comprehensible to students (Wilson et al., 1987). These various representations derive in part from the teachers' understanding of the subject matter itself, in part from the teachers' understanding of students, and in part from the teachers' ability to connect the knowledge to a variety of life situations. The notion of pedagogical subject matter knowledge, then, is especially important if we recognize that the central task of teaching is finding ways to connect subject matter to diverse learners: It indicates the need for an equal consideration of both within a single act of teaching.

But learning how to make such connections remains problematic. Much of the content in school subjects involves abstract concepts—numbers, democracy, or mass, for instance—and a common way for teachers to represent these is to illustrate them with everyday events. Yet any concrete representation will carry with it some additional meaning that is not intended, so that each representation runs the risk of engendering misconceptions about the abstract concept. The teacher who illustrates 7/8 by referring to 7 members of a 8-member team conveys a different meaning to fractions than the teacher who indexes 7/8 to a portion of a pie. When the fraction is used to rffer to a team, the numbers have literal meaning, and it would make no sense to talk of 7/8 of a 10-member team. The latter, on the other hand, offers a broader and more general representation of the concept of a fraction, for it could refer to a pie that had a 5" diameter or a 20" diameter. On the other hand, the former representation is something most young children would readily understand, whereas the latter might be obscure to them.

**Implications for learning to teach: Helping teachers connect subject matter knowledge to learners.** We know little enough about this elusive task of connecting subject matter knowledge with diverse learners and less still about how to help teachers learn it. Moreover, at the preservice level, the problem is complicated by the fact that most subject matter knowledge is provided to teachers through arts and sciences courses, and we cannot expect to alter the entire arts and sciences curriculum in order to test alternative methods for enhancing teachers' subject matter knowledge. And even if we could, we would not necessarily find a way to enhance *elementary* teachers' subject matter knowledge, for elementary teachers cannot possible major in all the subjects they will teach.

The NCRTE findings, however, do offer some suggestions for how to proceed. We mentioned earlier that teacher education programs that presented teachers with explicit knowledge about different cultural groups did not help teachers connect subject matter to diverse learners. Instead, it seemed to reinforce their tendency to accept stereotypes. In contrast, we found that some approaches to helping teachers better understand subject matter did better enable them to link subject matter to diverse learners. One of the preservice programs we observed, for instance, provided a three-term mathematics sequence

specifically for elementary teachers. Graduates of the program did appear to differ from graduates of other programs in their ability to reason through our questions about teaching mathematics and to articulate their understandings in pedagogically appropriate ways. An inservice program we observed approached teaching writing within the context of diverse classrooms so that both issues were continually present. Still, the program encouraged teachers to examine their students through the eyes of the subject more than it emphasized examining the subject through the eyes of the students.

Three plausible hypotheses could be drawn from these findings. One is that the issue of understanding learners who are different from the teacher is more a matter of beliefs and dispositions than it is a matter of new knowledge per se; that is, teachers may profit more from understanding the ways in which their own biographies may influence their assumptions about learners than they will from learning more about the special character of other groups. Another is that better understanding of subject matter promotes the teacher's ability to bend the subject to meet diverse learners. Yet a third hypothesis is that none of the programs or courses we studied did an adequate job of *situating* knowledge of diverse learners; that is, they tended to provide already packaged knowledge about a variety of cultures outside the context of the cultures themselves and outside the teaching context.

These hypotheses seem equally plausible, and each needs further examination. Therefore, in our investigations of how teachers' entering conceptions about teaching and learning can be altered, we will be particularly interested in attempts to alter teachers' conceptions of learners who are different from themselves. In addition, given the apparent success of those efforts that concentrated on improving subject matter knowledge, we are especially interested in further pursuing the potential of alternative arts and sciences courses. To what extent do individual courses or course sequences that are designed to enhance teachers' subject matter knowledge influence their ability to link subject matter to diverse learners, and what features of these courses seem to matter? Given our own and others' research findings, we expect the key ingredients of such courses to be similar to the key ingredients of any course designed to engage learners as participants in the learning process: The learning tasks would introduce teacher-learners to important substantive ideas and would, concurrently, provide tasks that were perceived as relevant and meaningful to them as learners.

Moreover, these tasks would be presented in a way that enabled teacher-learners to connect new ideas to ideas they already had, and would, over time, enable them to situate substantive ideas in a variety of contexts. We hypothesize that such experiences will have a dual effect on teacher learning in that they will simultaneously enhance subject matter understanding and, at the same time, increase the teachers' ability to represent subject matter in alternative ways, thereby increasing their ability to respond to diverse learners. Finally, with respect to our third hypothesis, we are interested in seeking examples of programs or courses that are designed to give students new knowledge about diverse learners but which attempt to do so by situating this knowledge in its appropriate cultural context.

The principal premises that will guide our research on how teachers can enhance their understanding of subject matter and of diverse learners, then, are these:

- That teachers need to learn both subject matter knowledge and knowledge of learners who are different from themselves in the context of the domains in which they reside; that is, the domains of inquiry from which school subjects are drawn and the cultures and communities in which students reside

- That such learning will enhance teachers' ability to connect subject matter knowledge to learners.

## The Unique Features of Teaching Practice

The fourth essential element in a center for research on teacher learning is that it recognize the unique features of teaching practice as important contributors to what and how teachers can learn that practice. Teaching requires a careful balancing of multiple concerns—about subject matter, about diverse learners, about the teacher's role in facilitating learning—and it requires the capacity to reason about these concerns in the dynamic context of particular situations (Clark and Peterson, 1986). The former task, balancing numerous concerns, can be thought of as the *intellectual* management of classroom events. The latter task, responding in the context of particular situations, could be thought of as the *logistical* management of classroom events.

### Intellectual Management

The intellectual side of teachers' work entails interpreting classroom events as they occur, making sound pedagogical decisions, and judging the outcomes of those decisions. The logistical side entails managing the work as it progresses—bringing off-task students back on task, redirecting students who are heading in the wrong direction, posing fruitful questions and responding appropriately to student comments or questions, and so forth. These two sides of classroom practice work in tandem, for the choice of a question to pose is based on the teacher's understanding of the subject matter and an interpretation of what students know, don't know, or may be confused about, and the interpretation of classroom events is influenced by the teacher's knowledge of his or her own logistical capabilities.

The intellectual management of teaching draws on the teacher's knowledge of general principles of good practice, but it also draws on the teacher's ability to reason from those principles to the particular situations he or she encounters. There are no fixed rules for the intellectual management of complex learning activities. Even teachers who are committed to giving all their students a deep and multifaceted understanding of academic subjects do not necessarily know what they should do from moment to moment to accomplish that goal (see, e.g., Ball, 1990b; Lampert, 1985). They don't necessarily know how to interpret classroom events, how to respond to student conjectures, what questions to pose to push student thinking, what kinds of assignments will be most conducive to the outcomes they want, or how to orchestrate the full range of learners they find in their classrooms. To illustrate this point, consider the number of criteria a teacher must take into account simply to choose a worthwhile learning task. A teacher may need to consider all of the following when selecting an appropriate learning opportunity for students:

- The task should introduce students to one or more important ideas in the subject matter
- It should enable students to connect new substantive ideas to other knowledge they already have
- It should be perceived as worthwhile to the particular students in this class
- It should not be routine or predictable but instead be complex enough that students have to think about what knowledge is most appropriate to use
- It should create opportunities for students to reveal their thinking while working on the task, thus providing a way for the teacher to monitor student responses
- It should provide multiple openings for diverse learners to respond appropriately
- It should contribute to a collection of tasks that represents a variety of situations in which critical substantive ideas can be used, so that the students' subject matter learning

will be connected to a broad set of situations.

Not every academic task must meet all these criteria, of course; indeed, there may be occasions when teachers, for other reasons, may abandon many of them. Still, the intellectual management of complex learning activities demands that the teacher be *aware* of all of these criteria and know how to *apply* them individually as criteria for assessing the merits of particular academic tasks. The teacher must also be able to *balance* them when they pull in conflicting directions and must be able to *maximize* the learning potential of any given task by satisfying as many criteria as possible. There are no ready prescriptions, then, for selecting worthwhile academic tasks. No formula can tell teachers how to do this (Floden and Clark, 1988; Floden and Klinzing, in press; Klinzing and Floden, in press). They must be able, intellectually, to reason about teaching and learning and they must possess relevant and valid criteria for reasoning about these things (Buchmann, 1986; Feiman-Nemser and Buchmann, 1986).

## Logistical Management

Now consider the logistical management of complex classroom activities. Teachers must be able to interact from moment to moment with students; orchestrate whole groups of learners, rather than individual learners; and monitor student progress and student setbacks (Doyle, 1977; Jackson, 1968; Lampert, 1985). Each of their logistical moves depends, of course, on the teachers' evaluation of the situation, which in turn depends on the teachers' criteria for evaluating classroom events. If, for example, a novice teacher's response is based on a need to survive a traumatic event, rather than on a need to push students forward on a worthwhile task (Feiman and Floden, 1980; Feiman-Nemser and Floden, 1986), that response will not productively contribute to learning. But logistical management entails, in addition to intellectual management, *quick* diagnosis and *quick* response. And it requires the *skill to maneuver* through activities and through a roomful of students in ways that promote, rather than hinder, the intellectual goals.

Moreover, research on teaching practice indicates that complex learning activities—the kind most likely to get students actively engaged in their own learning—are particularly difficult to manage in the classroom. Teachers tend to avoid thought-provoking work in favor of routine tasks, in part because students are easier to manage and student outcomes easier to control (Doyle, 1983, 1986; Doyle and Carter, 1984) in part because teachers strike tacit bargains with students (Sedlak, Wheeler, Pullin, and Cusick, 1986), and in part because their own goals for students are often exposure rather than understanding (Porter, 1989). These tasks are especially difficult for teachers to develop and to manage in the classroom, for student responses to such tasks are difficult to predict. Many such tasks require students to engage in *both* problem definition *and* problem solution, rather than requiring only a solution to a predefined problem (Resnick, 1987b).

A closely prescribed writing task, for instance, might have students writing a paragraph about clouds in which they begin with a main idea, list three supporting ideas, and close with a summary. An open-ended writing task, in contrast, might ask students to correspond with pen pals in another state. Students need to decide for themselves what their pen pals would be interested in reading about, how much to write, how to formulate their ideas, and so forth. If the learning task is too open, students may flounder and be unable to respond at all. If the task is too closed, students do not have the opportunity to develop their own reasoning ability.

Open-ended tasks always contain the possibility that students will move in a direction the teacher is not prepared for or does not know how to respond to. Students may begin to explore ideas that they are not really ready to learn, that the teacher does not understand, or that are simply not productive. Thus, to devise academic tasks

that can challenge students and can give them multiple avenues for growth requires a substantial understanding both of the subject matter and how it can be drawn on to solve a problem and of the relationship between the students and the subject matter—that is, how these particular students are likely to respond to the task, given their current understandings of the subject.

Moreover, if teachers are to pose more challenging and more ambitious problems, they need to find ways to monitor student thinking constantly so that they can assure a reasonable fit between the task and the student's capacity to work on the task. Teachers will not learn as much if student reading assignments are monitored through short-answer written worksheets, with questions such as, "Who was the main character?" as they would learn from an oral discussion which included questions such as "Which character is braver, and why?" The monitoring criterion suggests that teachers need to devise tasks that require students to write or to speak and that they need to construct, both in writing and in speech, not just short answers to factual questions but also arguments or essays that reveal their thoughts. In addition, it suggests that teachers need to be able to monitor and interpret these student products with respect to what they reveal about the students' subject matter understanding.

## Implications for Learning to Teach: Conditions That Facilitate the Management of Complex Learning Activities

The unique nature of teaching practice presents two special problems for the teacher-learner. On one side, the concepts and criteria teachers need in order to manage learning tasks intellectually are highly indexical (Brown et al., 1989): They refer to teacher, student, or classroom activities and consequently cannot be understood outside the context of practice. In the past, researchers and teacher educators have assumed that teachers needed to learn such concepts *before* they learned to apply them to their practice. However, more recent work suggests that, because these concepts are indexical, their meaning cannot be understood outside of the context to which they refer. So when teacher-learners take such courses as Educational Psychology or Methods for Teaching Mathematics and learn such concepts as "wait time" or "metacognition," they are unlikely to understand how these terms bear on their practice. This may account for the tendency of teachers to say that their teacher education courses were too theoretical or even that they had nothing to do with practice (Katz, Raths, Mohanty, Kurachi, and Irving, 1981). Since many of the most important concepts and criteria teachers need to learn are indexing terms, it follows that teachers should learn these ideas in the context of practice (Bransford and Vye, 1989; Cohn, 1981; Klinzing and Floden, in press).

But the other important feature of teaching is that classroom events are so multifaceted and dynamic that novices often miss important clues and, consequently, may misinterpret what has happened and what needs to be done about it (Carter, Sabers, Cushing, Pinnegar, and Berliner, 1987). Many novice teachers, especially, are so overwhelmed by the logistical management of learning tasks that they tend to evaluate learning tasks by whether the tasks went smoothly or whether they managed to survive them. Thus, many efforts to situate teacher learning in the context of practice actually misfire, and teachers learn the very things their mentors want them to avoid. This problem is evident in research on the clinical component of conventional teacher education. Though this component seems intuitively to be the most necessary of all components, the evidence for its benefits are lacking (Evertson, 1990). Feiman-Nemser and Buchmann (1985) hypothesize that student-teaching may be *mis*educative rather than educative if it distorts or arrests students' thinking about teaching and learning. (See also Dewey, 1904/1965.)

The dilemma of how to help teachers grasp important yet indexical concepts and criteria is apparent in other research findings as well. Studies of efforts to teach teachers specific skills often conclude that teachers cannot learn these skills without also learning the associated concept (e.g., Copeland, 1977; Fullan, 1985; Gliessman and Pugh, 1981; Wagner, 1973), while studies of efforts to teach teachers concepts often conclude that teachers cannot grasp these concepts in the absence of concrete experiences (Haberman, 1978; Roberts, 1985).

One strategy for resolving this dilemma is to devise simulations of teaching that enable teachers to freeze the frame—to stop the action for a moment so that they have time to digest everything that is happening and to formulate a more sophisticated interpretation of it. The use of cases in teacher education, for instance, offers such an opportunity, for novices can examine a case at leisure, can interpret and reinterpret its sequence, can consider alternative hypotheses that could account for the observed events. Cases can be useful devices both for situating the meaning of relevant concepts and criteria and for giving teachers practice in slow-motion pedagogical reasoning. If they provide these opportunities to teacher-learners, cases can help teachers learn to manage, at least intellectually, classroom learning activities.

Still, cases by themselves are unlikely to further teachers' intellectual management of academic tasks. To succeed, they must be accompanied by something or someone who prompts the teacher-learners to construct a situated understanding of relevant concepts and criteria and who coaches them in their reasoning about the relative merits and trade-offs among these criteria (Brown et al., 1989). One role for mentors, then, might be to point out specific examples of relevant concepts, so that teachers can begin building a database of examples of that concept. Another role would be to raise questions when a teacher-learner seems satisfied simply because a lesson went smoothly, because children seemed interested, or because children were well behaved.

A similar argument can be made with respect to learning to manage the logistics of complex learning activities. Logistics are often assumed to be learned from experience, especially experience with a mentor. However, we have no reason to believe that experience alone, or even experience with the assistance of a mentor, will substantially enhance a teachers' ability to manage complex learning activities unless the experience forces teacher-learners to see relationships between their own behaviors and the concepts and criteria they use to interpret and evaluate learning activities and to see relationships between their own behaviors and those of their students (Feiman-Nemser, Parker, and Zeichner, 1990).

## Relevant NCRTE Findings

Our Teacher Education and Learning to Teach study examined several programs that relied on mentors to help teachers learn to teach. Two of these were inservice programs, one was an induction program and two others were alternative routes. These programs varied considerably in the amount of time mentors could devote to teacher-learners, in their ability to situate ideas in specific practices, and in the extent to which they guided teacher-learners to reason about their own practice. We found that all of these dimensions made a difference to teacher-learners. They learned more from mentors who could spend more time with them, from mentors who could situate their ideas in concrete teaching practices, and from mentors who could discuss the management of complex learning activities from both intellectual and logistical perspectives (Feiman-Nemser and Parker, in press). Still, teachers had tremendous difficulties learning to teach meaningful subject matter to all students. Though all teachers changed, the kinds of changes we observed were often slight and often came slowly (McCarthey, 1990). We sense that their new teaching practices are still fragile and could be abandoned in the face of even modest adversity.

The reason for this, we suspect, is that even though experienced teachers have mastered many

aspects of classroom management and pedagogical reasoning, they may still not have freed themselves from the habits and beliefs they acquired through a lifetime spent in conventional classrooms. And they may not have acquired an adequate knowledge of the subjects they are teaching. In other words, these teachers may have had to accomplish simultaneously all three of the learning tasks we have described here: They had to alter their beliefs about the nature of subject matter, about the teacher's role and about the pedagogical implications of diverse learners; they had to enhance their own subject matter knowledge; and they had to learn to manage complex learning activities, both logistically and intellectually. That they have had experience, in other words, does not necessarily remove any of these three learning tasks. They may still face essentially the same learning challenges as novices face, but complicated by the fact that their experiences may provide even further resistance to learning.

### Learning to Manage Complex Learning Tasks

The process of learning to teach, then, is a difficult one. Teachers must, on one hand, learn valid concepts and criteria for choosing and evaluating learning tasks, and these concepts and criteria can only be understood in the context of teaching situations. On the other hand, these very situations are so complex and dynamic that they can inhibit attention to the very things teachers must learn. The principal hypotheses that will guide our research on how teachers learn to manage complex learning activities are these:

- The intellectual management of learning tasks requires situated understanding of relevant concepts and criteria

- Learning to manage complex learning activities, both intellectually and logistically, requires at least the following conditions:

  Opportunities to stop the action so that slower and more detailed deliberation is possible

  Opportunities to see explicit connections between relevant concepts and criteria and teaching situations

  Opportunities to see connections between relevant concepts and criteria and teachers' own behaviors

## Conclusion: An Agenda for Research on Learning to Teach

At the outset of this proposal, we argued that the multiple knowledge bases that contribute to teacher learning require that a center for research on teacher learning must feature four essential elements: a recognition of public expectations of schools, a theory of the teacher as a learner, a definition of the central task of teaching, and a recognition of the unique features of teaching practice. Our analyses of these elements leads us to believe that research on teacher learning must examine three important learning tasks.

- First, because teachers' beliefs about teaching are often limited by their own experiences with conventional teaching practices, teachers need to transform their beliefs about the nature of subject matter, about the teacher's role in facilitating learning, and about the pedagogical implications of diverse learners. The highly resilient beliefs that most teachers bring with them make this difficult.

  **We hypothesize that, in order for teachers to alter these resilient beliefs, they must be introduced to an idea that is plausibly better and must be provoked to question their own experiences and to question the beliefs that are founded in those experiences.**

- Second, since the ultimate teaching task is connecting subject matter to diverse learners, teachers must understand both subject matter and diverse learners. This is difficult to do because both of these need to be understood in the context of the domains from which they derive. School subjects must be understood in the context of their larger domains of inquiry and students must be understood in the context of the communities and cultures in which they live.

  **We hypothesize that, in order to enhance their subject matter knowledge, teachers need to encounter substantive ideas within the context of the domain as a whole and need to learn substantive ideas by participating in worthwhile academic tasks. We also hypothesize that, in order to learn how to connect subject matter to diverse learners, teachers need to learn about diversity in its cultural and community contexts.**

- Third, because of the unique features of teaching, teacher learning requires a difficult balance between situating new concepts and criteria in the context of practice, on one hand, and protecting teacher-learners from being overwhelmed by the demands of the situation, on the other. The concepts and criteria that guide their practice can only be understood through situated learning; yet teaching situations, by their very nature, prevent the critical reflection necessary for learning.

  **We hypothesize that teacher learning can best occur when teachers have opportunities to stop the action so that slower and more detailed deliberation is possible, opportunities to see explicit connections between relevant concepts and criteria and teaching situations, and opportunities to see connections between relevant concepts and criteria and their own behaviors.**

Each of these three learning tasks poses its own challenge to teacher-learners and to teacher educators. The first suggests a need to transform existing views into more expanded views, the second a need to understand the materials of teaching within their larger contexts, and the third a need to connect knowledge to practical actions in a dynamic system. Thus, these three learning tasks do not merely indicate different content to be learned but different forms of knowledge as well. And these differences in content and form, in turn, suggest different learning processes and different learning contexts.

We have hypothesized, for instance, that beliefs are most likely to be transformed in the *context* of particular alternative examples of teaching and through a *process* in which something or someone who provokes thought about the meaning of the example. We have hypothesized that subject matter ideas can best be acquired in the *context* of the subject matter domain and through a *process* of engaging with worthwhile academic tasks. And we have hypothesized that concepts and criteria that are used to guide teachers in practice must be learned in the *context* of practice, through the *process* of situated learning, and that pedagogical reasoning must be learned in *contexts* in which teachers can stop the action for closer analysis, through a *process* of coaching. Each learning task, then, requires its own context and processes.

We suspect that all three learning tasks are necessary in learning to teach; none is sufficient alone. If teachers could successfully transform their entrenched beliefs, we would not necessarily see changes in their subject matter knowledge nor in their ability to manage more complex classrooms. If they learned the sophisticated pedagogical reasoning needed to manage complex learning activities but did not alter their views of the nature of subject matter or of their role in promoting learning, they would not necessarily be able to choose more worthwhile learning activities for students. The centrality of all of these learning tasks suggests that all three must be addressed in a center for research on teacher learning.

Defining the center's agenda according to these learning tasks poses two problems. One problem is that, if each condition is necessary but none sufficient, we cannot test our whole model of learning to teach until we find ways to satisfy *all three conditions*. This is unlikely to occur soon: We know very little even about how to promote them individually and much less about how to promote them collectively.

The second problem for this research agenda is that the exact nature of teaching that would be deemed responsive to public expectations is not clear, and neither is it clear whether we can reasonably expect very many teachers to learn all of the things we have laid out here. One of our research agendas, therefore, must be to examine which of these aspects of teacher learning can occur under which sets of conditions and then to define the kind of teaching that results from these partial packages of learning. In this sense, our work attempts to link this model of teacher learning with a model of teaching.

The research is designed to address these three important issues and to test the hypotheses we have described above. We are conducting three parallel programs of research:

- Linda Anderson coordinates our research on transformation of beliefs in learning to teach
- G. Williamson McDiarmid coordinates research on connecting subject matter to diverse students
- Deborah Ball coordinates research on learning to reason pedagogically and to manage instruction

The projects within these programs and the staff are found on page 28.

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# National Center for Research on Teacher Learning

Center Director
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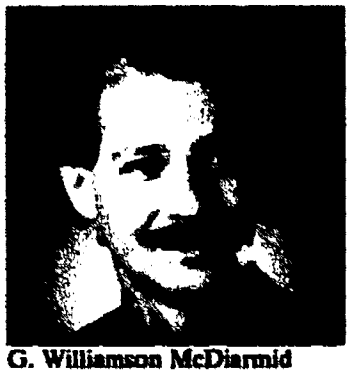
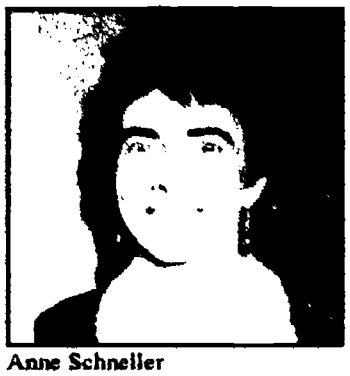

G. Williamson McDiarmid


Cassandra Book


Anne Schneller

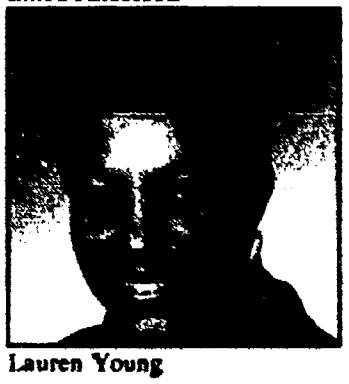
## Research Projects

### Transforming Beliefs About Teaching and Learning

Linda Anderson
Thomas Bird
Lauren Young


Linda Anderson


Thomas Bird


Lauren Young

## Connecting Subject Matter to Diverse Learners

### Learning From Arts and Sciences Courses

G. Williamson McDiarmid
Diane Holt-Reynolds


Diane Holt-Reynolds

### Learning to Teach Culturally Diverse Students

Kenneth Zeichner
Susan Melnick


Kenneth Zeichner


Susan Melnick

## Learning to Reason Pedagogically and Manage Instruction

### Learning From Cases
### (A cross-professional study)

Mary Kennedy
Gary Sykes


Gary Sykes

**Learning From Hypermedia**
(with additional funding from the National Science Foundation)

Helen Featherstone
Deborah Ball
Magdelene Lampert


Helen Featherstone


Deborah Ball


Magdalene Lampert

**Learning From Mentors**
**(A cross-national study)**

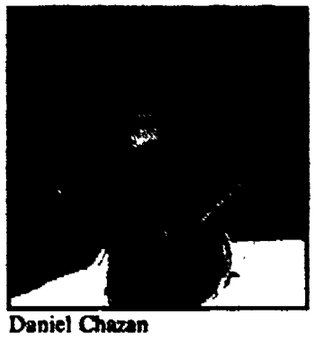
Sharon Feiman-Nemser
Lynn Paine


Sharon Feiman-Nemser


Lynn Paine

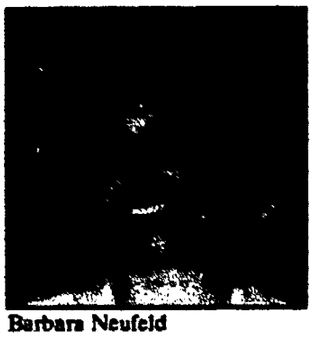
**Learning From Collaboration and Study Groups**

Daniel Chazan
(A Dow Corning Clinical Fellow in Education)


Daniel Chazan

## Learning From the Work of Restructuring Schools

Barbara Neufeld


Barbara Neufeld

## Learning From State Policies (A cross-state study)

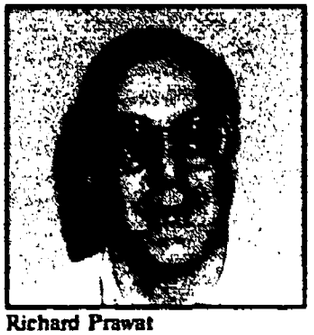
(in collaboration with the Center for Policy Research in Education)

Suzanne Wilson
Deborah Ball
David Cohen
Penelope Peterson
Richard Prawat
Ralph Putnam
Gary Sykes


Suzanne Wilson


David Cohen


Penelope Peterson


Richard Prawat

## Learning When Policies Are Discrepant

Kenneth Zeichner
Susan Melnick

## Teachers With a Vision Learning on Their Own

Linda Anderson
Deborah Ball
Sharon Feiman-Nemser
Mary Kennedy
G. Williamson McDiarmid
Suzanne Wilson


Ralph Putnam

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