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14 Working on the Inside: Using One's Own Practice as a Site for Studying Teaching and Learning

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This chapter examines benefits and pitfalls inherent in studying teaching and learning *from the inside*, where the teacher is also the principal investigator of the research. Such "first-person" writing about teaching is situated in the much wider domain of "inquiry in teaching" and includes such genres as action research, teacher narratives, teacher research, as well as multiple forms of research on teaching.[1] Although first-person approaches to inquiry vary, they overlap and share many similar aims, methods, questions, standards, and perspectives. They focus on issues of practice. They seek to probe beneath the surface of the obvious and taken for granted. Grounded in practice, with tools that can transcend the boundaries of practice, these approaches to inquiry aim to produce knowledge that can contribute to the improvement of teaching and learning.

Of course, most research on teaching shares these aims. What most clearly distinguishes first-person inquiry from other approaches to the study of teaching and learning is that it deliberately uses the position of the teacher to ground questions, structure analysis, and represent interpretation. In contrast, other research on teaching deliberately divides the work of

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[1] For examples of each of these, see: reflection in and on teaching (e.g., Schön, 1983, 1991), action research (Rosenthal, 1994), teacher narratives (Kohl, 1967, 1984; Paley, 1979, 1981, 1995; Schifter & Fosnot, 1993, 1996a, 1996b); teacher research (Cochran-Smith & Lytle, 1993), researcher-teacher (Ball, 1993a, 1993b, 1995, in press; Chazan, 1992, 1996; Heaton, 1994; Lampert, 1986, 1990, 1992, in press; Osborne, 1993; Wilson, 1990, in press).

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practice from the undertaking of inquiry. Researchers bring questions into a classroom, sit on its periphery, or move into its flow. They watch and talk with teachers. They sit near and listen to students. Equipped with theories, questions, and yellow-lined pads, they seek as outsiders to understand, analyze, and explain what goes on there. As participant–observers, they inherit an inherently ambiguous role of outsider trying to understand inside. On one hand, their outside perspectives as psychologists, anthropologists, or simply adult nonmembers of the context, offer them perspective that insiders lack. As outsiders, they can see and hear things that insiders take for granted. On the other hand, as outsiders they cannot completely understand local meanings, language, norms, and practices. They miss nuances, make faulty connections, and inappropriately infer motives. They ask questions of their own making, questions insiders might not think to pose. But also they miss questions that lie at the heart of the puzzles of practice.

Whereas conventional research on teaching looks *in at* teaching and learning, the work in this chapter seeks instead to examine teaching *from the inside*, from what Lampert (1998) called "the perspective of practice." Those who do this kind of work blend the construction of practice with its analysis. They do so in ways that offer special possibilities of insight and understanding, viewed through the firsthand experience of the teacher. Looking from inside, they probe aspects of the enterprises of teaching and learning often invisible to outsiders. For example: What are the special anxieties and issues entailed in changing one's practice? What is it like to try to excite and engage first-graders in studying abstractions of number theory? What content and pedagogical dilemmas arise in teaching a heterogeneous high school algebra class (Chazan, 1992, 1996)? What struggles inhere in trying to unlearn pedagogical habits and to learn to teach differently (Heaton, 1994)? What is it like to be a White woman teacher working with children of color, leaning into and across divides of social class, race, gender (Paley, 1979, 1981, 1995)? What are some of the challenges of trying to teach a mathematics methods course in ways that depart sharply from the usual "cover the curriculum" approach, focusing deeply instead on the mathematics itself, and on children's thinking (Ball, 1990; Suzuka, 1996)?

Different as they may be from other forms of research on teaching, "inside" approaches to inquiry in teaching nevertheless differ from one another significantly in both purpose and method. For example, "reflection" in and on teaching has as its primary goal to heighten deliberation in and about practice, to consider alternative interpretations, to seek information for next steps as a teacher of the class or child at hand. It is a form of inquiry most closely tied

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to the ongoing work of teaching. It pays least attention to the production of insights, ideas, or theories to be shared broadly with others. It also need have no special design or conjecture. "Action research," although tied closely to one's own ongoing work as a teacher, is typically more planful. With a focal question in mind, the teacher investigates an issue, designs and tries a new method or new materials, and seeks to examine it or them systematically. Some forms of inquiry make communication with others central—teacher narratives, for example. Teachers writing about their teaching concentrate on representing the experience—problems, puzzles, excitements—of practice to themselves, to close colleagues, and sometimes to a wider audience.[2]

Within this arena, practitioners examine their practice thoughtfully with the goal of learning about teaching and learning and ultimately, improving it. Some write about teaching after the fact, offering narrative, analysis, or commentary. Others set out with a project to write about their teaching. Moreover, across all of these approaches to inquiry in teaching, communication with others about teaching is usually an aim, thereby working to change the traditional isolation of practice. The agendas may vary, from representing teachers' experiences to asserting the primacy of teachers' perspectives to contributing to scholarship and theory.

To probe what is entailed in "working on the inside," I have organized this chapter in three sections. I begin with a first-person account of my own trajectory: initially, using inquiry as a means of practice and later using practice as a medium for research. I turn next to examining three cases of researcher-teachers' work. All three focus on mathematics teaching and learning, but differ in question, in design, and in what is afforded by the first-person perspective. I first describe and analyze each case, then appraise comparatively the nature of these inquiries and their yield. In the third section, I consider three special challenges of

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[2] I draw here on Lampert's (1992) notion of the "continuum of justification" in doing mathematics. She argued that, in proving a mathematical claim, one faces the challenges of (a) convincing oneself that something that one thinks *might* be the case, *is*; (b) convincing others with whom one is closely connected—colleagues with similar commitments and orientations; and (c) convincing others working in other paradigms who may not share the same assumptions. In constructing knowledge in and for teaching, a similar continuum may be conceived (see Lampert, 1998)—talking with oneself about one's work, sharing with colleagues who belong to the same community, and communicating with broader audiences concerned with teaching and learning.

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first-person research. The chapter concludes with issues crucial to the ongoing development of this approach to the study of teaching and learning.

LOOKING AT FIRST-PERSON RESEARCH FROM A FIRST-PERSON PERSPECTIVE: A NARRATIVE

When I began teaching in 1975, I was given an extraordinary but significantly formative teaching assignment for a first-year teacher: four sections of elementary school science (two third-grade classes, one fourth-grade, and one fifth-grade) and one section of language arts in a departmentalized elementary school. Equipped with three grade levels worth of *Science Curriculum Improvement Study* (SCIS) materials, I set out, bravely, to begin teaching (Karplus, 1974). I could not have been less prepared for this assignment. In college, I had majored in French and minored in English, and I had not studied any science other than the two basic courses required for my teaching certificate. Hence, by necessity, my teaching was an investigation into science and how to engage children in learning science. Not unimportant, the materials that I was using to construct my teaching used an investigative design for children's learning. They set out lessons that set the children to exploring, experimenting, and discussing what they saw. The teacher was to guide these discussions gently.

The simultaneous reality of my own pedagogical experiments and my early efforts to engage children in scientific investigation intertwined for me the learning of my students and my own learning as a teacher. I had no real alternative than to design my lessons, drawing heavily from the curriculum materials, and to work with my students on those lessons. Afterwards, it was useful to stand back to see what I and they had done, where we had veered off unproductively, where I had made a fortuitous move, where we needed to head. The iterative process of design, experimentation, and analysis was etched into my work during these first two years, mostly as a matter of survival. Quite likely, the guidance I received from the curriculum materials, with their heavy emphasis on guiding my students to explore, conjecture, design, experiment, and analyze, oriented me strongly in this way. My pedagogical inquiries ran in parallel with the children's scientific ones.

In the ensuing years, I continued to work in this way. I examined my students' learning and work, and generated alternative ideas about ways to help them learn. I designed different strategies and curriculum units, tried them with the children, and watched closely what happened. I revised and revamped what I did. Although I would not have known the term, I

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was developing what we now call a "reflective stance" as a teacher, and I was designing little "action research" projects, although there were no formal structures to my approach. I would not have been able to imagine teaching in any other way. My students came from over 30 countries, spoke languages I had never heard of, and I had five different teaching assignments in the first 6 years of my career: multigrade science (1975–1976), second–third grade combination (1976–1977), second grade (1977–1978), first–, second–, third–grade team room with another teacher (1978–1980), and fifth grade (1980–1981). There was a great deal I had to learn, and no opportunity to learn what I needed other than to try to develop ways to learn in and from my own teaching.

I hit a critical point in my work after 6 years of teaching. I was teaching fifth grade, and mathematics suddenly emerged as a problem for me. Despite my good intentions and careful, step-by-step, conceptual explanations, long-division and complex work with fractions loomed as an impenetrable curricular wall for many of my students. Alex, one of my students, would go home on Friday able to solve a long division problem and, on Monday, no longer seem to remember how to begin. Neither he or his classmates could explain what we were doing despite my efforts to model and explain the procedures I so desperately sought to teach them. When I graded papers, students got many answers wrong. Merely reexplaining and then asking them to correct their papers—a common pedagogical strategy—seemed futile. All the imagination and cleverness in the world was not helping my students grasp the material. Studying their errors did not help. I was at a loss. For the first time, neither my own resources nor those of my colleagues were adequate to help me figure out what to try. It was 1980—the year that the National Council of Teachers of Mathematics (NCTM) published *An Agenda for Action*, the forerunner of the coming wave of mathematics reform. But there was little available to help me examine what was happening in my room, or to help me improve my teaching.

My long-term investigation into the improvement of mathematics education had its root that year, as I struggled, less successfully than in my previous work, to increase my effectiveness with those students. My intense interest in mathematics teaching and learning, my own and my students', began to grow, and expanded into increasingly formal inquiry. As my questions multiplied, my strategies of investigation expanded. I engaged other teachers in my inquiry and began to pay attention to both my own and others' learning. I realized that I needed to learn more mathematics myself, for unlike the other areas in which I was developing my teaching, I was inadequately educated in mathematics. At that point I had taken no

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mathematics since my first year of college, when I passed out of the required course for elementary teachers and took an independent study with a professor in the mathematics department. I remembered little from that study and realized that, in order to develop my capacities to help my students, I would need to know more mathematics myself. I did not know what I was seeking, only that I needed to have the kind of fluency with mathematics that I had with language. That fluency had been a crucial resource in the development of my teaching of reading and writing.

Perry Lanier, a professor at Michigan State University where I was enrolled in a master's degree program, introduced me to the Comprehensive School Mathematics Program (CSMP) curriculum (Central Midwest Regional Educational Laboratory, 1982). It was a stroke of good luck. Profiting from his wise experience and from conversations with him, I began experimenting with CSMP in my classroom, and the next year, teaching first grade, I used the materials as the primary mathematics curriculum. The materials were structured in a completely unfamiliar way, and the central mathematical ideas were big ones, as in SCIS: structure of number, functions and their composition, classification. A few powerful representational tools, all pictorial, were used and encouraged. Intertwined on a ground of curriculum, there was a lot for me to learn, both mathematics and about pedagogy.

Following the CSMP curriculum produced a classroom full of 6-year-olds talking about mathematical ideas. I was astonished at the serious intellectual work in which the children could engage. Although I did not yet appreciate sufficiently what of their work was significant mathematically, I began to see connections between the way I had learned to teach science several years earlier and what teaching mathematics might be like. My own and my students' mathematical learning began to grow, and it developed into increasingly formal inquiry. If I was going to be able to hear my students' mathematical bundles of insights and confusions, stumbles and leaps, I had mathematics to learn. My journey took me into mathematical coursework. I also became involved in "staff development" in mathematics. So weak were the infrastructure and resources for teacher development that someone like me who was both learning and interested was quickly catapulted into leadership roles. For me, professional development and teacher learning soon became new arenas for puzzling, experimenting, and analyzing domains of intertwined practice and inquiry.

When I entered the world of formal educational research as a graduate student, I became increasingly interested in teacher learning. The years I had spent so far as a teacher, developing my own knowledge and skills, trying to improve my teaching, working with colleagues, had

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piqued my interest in what teaching entails and how teachers learn to change what they do, assume, know, or believe. My dissertation research grew from my wonderment at the lack of attention to teachers as learners in the literature I had been exploring. Although, in the mid-1980s, it was widely believed that students' prior experiences and ideas shaped what they learned from instruction, this perspective was not applied in the context of teacher learning. Teachers, it seemed, could be filled up with information and techniques, with little regard for what they currently believed or did or knew. I designed a study to explore what teacher education students brought with them to their formal preparation to teach mathematics. I studied both prospective elementary teachers and prospective secondary mathematics teachers and interviewed them about mathematics, mathematics teaching and learning, and students as learners of mathematics. What I learned was the vast extent to which these prospective teachers already had ideas about all of these issues. And what they believed was often at odds with what teacher educators wanted them to think or know. For example, many believed that mathematical ability is innate and that many people simply cannot be good at mathematics. Most thought of mathematics as a cut-and-dried area of truths to be memorized and procedures to be practiced, and they thought of good math teaching as that which makes its dry material "fun." I began to glimpse possible new explanations for the ineffectiveness of teacher education. If teacher educators designed their curriculum with little sense of what their students already knew or believed, then they were unlikely to meet their students' current thinking. It was easy to imagine that students could pass through their professional education with their entering ideas both unchallenged and unchanged.

When I was writing my dissertation, I realized that readers would need a sense of the kind of mathematics teaching that teacher educators were hoping to prepare beginners to do. Without that image, interpreting what prospective teachers knew made little sense. Knew in relation to what goal? Three years prior to the emergence of the NCTM *Standards*, I wondered how to provide such an image as a grounding for the reader. Instinctively, I reached into my own experience and wrote a description of a recent day in a third-grade class I was teaching, in which the children and I were exploring a contextualized, area-perimeter problem. Although I used my own teaching as the source for the detailed description, the reader could have had no clue about this in the way I wrote it. I began with an entirely detached explanation:

> To illustrate concretely what a mathematical pedagogy might look like, I use an example from a third grade classroom in which students are learning about perimeter and area and the relationship between these two measures.

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On the day that I will describe, students were presenting their solutions to the following problem which the teacher had posed the day before:

> Suppose you had 64 meters of fence with which you were going to build a pen for your large dog, Bozo. What are some different pens you can make if you use all the fence? Which is the pen with the *most* play space for Bozo? Which pen allows him the *least* play space?

The students have worked on this problem in a variety of ways, using tools and strategies which they have acquired: graph paper for drawing alternative dogpens, rulers for drawing constructions of dogpens on plain paper, making tables of the possible combinations of dimensions that total 64 and calculations of area using $L \times W$ (length times width). Some students have worked together on the problem; others have worked alone.

The teacher opens discussion by asking who would like to present a solution to the problem of finding the most play space for Bozo. A girl comes up to the board and carefully draws a 18×14-inch rectangular pen on the board. Turning to face the class, she announces that this is the largest pen that can be built with 64 meters of fence. The teacher asks her to explain. (Ball, 1988, p. 3)

The description of the lesson continues for almost four pages, with detailed account of the discussion, the teacher's moves, and the children's work. The section ends with a commentary on the mathematics lesson, but nowhere do I reveal that I am using my own practice as a source for understanding the nature of teaching, that I am "the teacher."

In other research I was doing, my practice was a source for behind-the-scenes work that supported my formal inquiry. For example, in the development of instruments for our longitudinal study of teacher learning at the National Center for Research on Teacher Education, we devised a strategy in which we attempted to probe prospective and practicing teachers' understandings of mathematics and their ideas about teaching and learning, and about students by presenting them with carefully described classroom scenarios. The inspiration for many of these were from experiences I had had in my own teaching. Using situations that I knew arose in trying to teach mathematics—such as a student coming up with an unexpected mathematical idea, or trying to explain something that one has only learned as a rule oneself.

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or interpreting students' written work—it was possible to design good items to tap teachers' ideas, beliefs, and understandings, and how these interacted in the context of a specific pedagogical situation. The inquiry I had been doing in my own practice was a valuable source of raw material to be shaped into theoretically framed research questions.

In these first two border experiences, practice was guiding research rather than the other way around. Gradually, my continuing work as a teacher became a more explicit and formally designed part of my approach as a scholar. Interested in teacher learning, I was convinced that the ongoing study of teaching, both from the inside and from the sidelines, was essential. I needed to continue to probe the kinds of personal and intellectual resources that seemed to bear on teaching mathematics. Old questions, newly sharpened: What do teachers need to know of and about mathematics in order to teach for understanding? What kinds of understanding, orientation, and belief shape teachers' reasoning, decisions, and moves?

Making progress on such questions requires, in my mind, multiple strategies. One is highly empirical: Watch teachers at work, and analyze what they do; interview them about their reasons, and seek to learn what they know and believe about mathematics and how that interacts with other ideas to shape their moves and decisions. Another is conceptual–analytic: Start with mathematical goals and analyze logically the kinds of understandings that it would take to manage and navigate them in a classroom. A third is a combination of the other two, yet it is radically different, for it looks at practice from the inside: Design a mathematical terrain or course, try to work with a group of students in pursuit of its goals, and examine carefully what it takes to manage that undertaking. What mathematical issues arise? What do students say and do, and what does this require of the teacher? Analyses such as these can offer other illumination of what teachers need to know to teach mathematics.

My own experience as a researcher was convincing me that my history and insight as a teacher were useful resources. I set out to harness and discipline their potential. I sought to develop uses of the first and third approaches—some study of other teachers and some first-person research in which I am the teacher and the researcher. When I study other teachers' practice, I stand back and watch people both like and different from me navigate a curriculum in which I have had no hand. In other work, I examine from the inside what it takes for me to help my students accomplish certain kinds of mathematical goals. I have a firsthand role both in what is being attempted and how it evolves in practice.

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RESEARCH ON AND INTO PRACTICE FROM THE PERSPECTIVE OF THE RESEARCHER-TEACHER

We turn now to take a closer look at research on teaching and learning where the principal investigator of the research is also the teacher and where at least one central goal is to contribute to scholarly discourse communities and to the development of theory.[3] Important to note, first of all, is that, viewed this way, the work can be seen as a special case of the genre of qualitative case studies (Borko, C. Brown, Eisenhart, & Underhill, 1992; C. A. Brown & Cooney, 1982; Eisenhart et al., 1993; Erlwanger 1973; A. Thompson, 1984; T. Wood, Cobb, & Yackel, 1991). Like other case study research, this kind of work interweaves the empirical with the conceptual. It strives to illuminate a broader point, probe a theoretical issue, develop an argument or framework. It faces challenges in convincing others that something worthwhile can be learned from the close probing of a single instance. This raises the crucial question of what any "single instance" is an instance *of* (S. M. Wilson & Gudmunsdottir, 1987).

Take Erlwanger's (1973) analysis of Benny, a well-known study of student learning. The challenges Erlwanger faced in convincing his readers that a close look at Benny can contribute to a much larger set of theoretical and practical issues are similar to those faced by all case study researchers. What is it about the study of this one child that warrants it as part of a larger discourse on learning and teaching? Despite the fact that this is a study of an individual sixth-grade child, this seminal case is not seen merely as a study of a single child's experience in the fractions unit of his sixth-grade class. Rather, it represents an inquiry into, and analysis of, the underside of students' experiences of mathematics teaching and illuminates the gap between what school assessments may reveal and what students may think about the content.

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[3] The reason to bound it in this way is that an increasing number of such studies are being attempted, in many cases by doctoral students for their dissertation research. It is a quietly growing field of research and, like the early years of ethnography in education, it is at risk as it grows. Explicitly considering what it might take to do such work well, and what the standards of such work would need to be, is crucial. As I have published several articles, all in refereed academic journals, and a number of book chapters, where my teaching is centrally the site for the research, I have been paying attention to precisely these issues. (I have published other pieces that also draw heavily on my teaching, but where my teaching is not the centerpiece of the analysis.)

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Few readers would dismiss Erlwanger's piece as an isolated "nonrepresentative case." Nor would many readers worry that Erlwanger relied on so few instances about Benny to make his argument. Readers understand the article to be about problems of learning and assessment, at that time a serious challenge to the enthusiasm for individualized instruction—not a full and extended analysis of Benny. The claims are only in part about Benny.

Research in which researchers use their own practice as teachers as a site for scholarly work is relatively recent. Arising as it does simultaneously with critiques of the dominance of researchers' ideas in what is considered "knowledge of teaching" (Carter, 1990, 1993), such work can be seen as a means to legitimate perspectives of practice in the construction of knowledge about teaching. First-person research enters a teacher's voice and perspective into the discourse of scholarship. However, for the most part, the research on which I focus in this chapter is a form of qualitative case study whose agenda is less centered on the politics of teacher voice and more centered on an epistemology of practice that structures and examines the work from the inside. The researchers are usually university based educators, some with extensive experience as practicing teachers, some with less. What characterizes this kind of work so far?

In this section, I examine three examples of first-person research on teaching and then stand back to comment on the common features of the inquiries: one piece of work each by Magdalene Lampert, Ruth Heaton, and Martin Simon. My emphasis here is on these particular works, not on the researchers themselves or their overall programs of scholarship. Although, in all three pieces the researchers use their own teaching as a centerpiece of their inquiry, there are many differences among them as well.

Lampert (1986): Inquiry Into Elementary Mathematics Teaching

I begin with Lampert's article, "Knowing, Doing, and Teaching Multiplication," an article she published in *Cognition and Instruction* in 1986. Significant is that this piece was Lampert's first published work using her own teaching as a site for research. Perhaps as significant is that it was also a first for the research community to whom she was writing. The publication of this article in *Cognition and Instruction* marked a watershed in research on teaching and learning, for it was the first piece written by a researcher-teacher to be published in a scholarly journal in the United States.

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In this article, Lampert analyzed the teaching and learning of multidigit multiplication in fourth grade.[4] Her question centers on how the computational way of knowing and doing multiplication, which is favored by and more familiar to most teachers and parents, can be intertwined with a more conceptual perspective, commonly the domain of mathematicians. Lampert sought to explore instructional strategies that favor neither computational nor conceptual approaches, but rather foster connections between these two ways of knowing mathematics. She used her teaching of fourth grade, explaining at the outset that:

> The classroom research reported here is not oriented toward conclusions about how to teach the multiplication of large numbers. . . . It is intended to be conjectural—that is, to outline an approach to instruction that is "worth trying" (cf. Noddings, 1985)—and is grounded in actual classroom experimentation. (p. 306)

Lampert asked what it means to know multiplication and identified four different ways of knowing it. A first is computational: counting or memorizing or performing operations on numbers. A second is intuitive, as in milkmen counting their units of milk on racks (Scribner, 1984). A third is concrete, that is, manipulating objects to find answers with such tools as base-10 blocks for grouping and trading. Principled knowledge, a final way of knowing, is procedural knowledge that includes understanding of why the procedures are warranted.

Based on observations of student work and on theoretical knowledge about cognition, Lampert set out to explore the potential for certain forms of classroom instruction that would allow for the strengthening of connections among these different ways of knowing multiplication. She described three experimental lessons that she taught to her fourth-graders. Each lesson that she designed used a different kind of multiplication problem: The first used coin problems, such as "Using only two kinds of coins, make $1.00 with 19 coins." The second used stories and pictures to link the concreteness of the coin problems with the third

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[4]Worth noting is that 1986 predated the NCTM *Standards* (1989, 1991b, 1995). Lampert's (1986) analysis in this article of her efforts to teach multiplication contributed to the development of images of the possible in school mathematics teaching. Such images were critical to the mathematics education community as the NCTM began its major undertaking of defining and developing articulated views of curriculum, assessment, and teaching.

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set of problems that were symbolic in form but highly narrated with conceptual terms. With structured experiences in decomposition and recomposition strategies and orders of operations, the three experimental lessons represented Lampert's operating conjecture about how to link different ways of knowing multiplication for her students. Her teaching of these three kinds of problems was part of her experiment in pursuing the conjecture. Designing both the problems and the pedagogy, Lampert constructed a context in which to investigate how students might be helped to "know" multiplication in the different ways she had posited. In her observations of students, she found evidence that they were inventing procedures using mathematical principles and that they had come to see mathematics as more than a set of procedures for finding answers.

In the last section of the article, Lampert moved away from the specific context of multidigit multiplication to consider larger questions about the teaching and learning of mathematics in school. She used the outcomes of her experimental lessons to argue that fourth-graders can do mathematics and think mathematically, that they are capable of learning to represent their thinking, to listen to one another, and to invent useful and sensible, problem-solving strategies. She described the kind of teaching that she thought would allow children to develop mathematical skill and confidence:

> I would suggest that they need to be asked questions whose answers can be "figured out" not by relying on memorized rules for moving numbers around but by thinking about what numbers and symbols mean. They need to be treated like sense-makers rather than rememberers and forgetters. They need to see connections between what they are supposed to be learning in school and things they care about understanding outside of school, and these connections need to be related to the substance of what they are supposed to be learning. They need to learn to do computation competently and efficiently without losing sight of the meaning of what they are doing and its relation to solving real problems. The lessons I have taught and described here suggest that it is possible to do these things in a conventional school classroom. (p. 340)

Lampert's work also generates questions about the epistemology of mathematics and the ways in which this kind of teaching might alter or challenge students' and teachers' conceptions of mathematics as a discipline. She described her role as a teacher thus:

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> My role is to bring students' ideas about how to solve or analyze problems into the public forum of the classroom, to referee arguments about whether those ideas were reasonable, and to sanction students' intuitive use of mathematical principles as legitimate. I also taught new information in the form of symbolic structures and emphasized the connection between symbols and operations on quantities, but I made it a classroom requirement that students use their own ways of deciding whether something was mathematically reasonable in doing the work. (p. 339)

How are these processes of acquiring mathematical knowledge related to the nature of mathematical knowledge itself? How will these ways of teaching and learning mathematics in the classroom affect teachers' and students' abilities to understand higher mathematics? How might they limit their future appreciation of other meanings and uses of multiplication? Ultimately, Lampert asked how disciplinary dispositions are, and can be, acquired, and used her teaching as evidence of what is possible. Whether and how this would play out in other classrooms is not a question she sought to answer, but she concluded by saying that it would be useful to understand what the outcomes for students might be over the long run and what it might take to do this sort of teaching and learning in other classrooms.

What does working on Lampert's questions from the inside offer? Lampert examined whether more computational ways of knowing and doing multiplication might be integrated fruitfully in teaching fourth grade. Rather than choosing to emphasize concrete and conceptual modes over symbolic ones, she sought to develop an approach that intertwines and connects different elements of knowing and doing multiplication and to see how it works. Being the teacher as well as the researcher afforded Lampert a space in which to work that is not easily available otherwise.

The approach to teaching multiplication in which she was interested is rare in practice. Although Lampert may not be alone in imagining such instruction, instances of it in action do not abound. Lampert could not simply locate a classroom with this sort of mathematics teaching. As such, Lampert had to create an instance of such teaching in order to examine how it works. This experiment also allowed her to probe what students are capable of doing in alternative instructional settings.

As creator and critic, designer and analyst, Lampert had to keep her eye on what would count as legitimate claims from her work. One kind of claim can of course be local, about what she did with these students on this topic. What did she do? How did it play out for the

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class and for particular children? What did the students learn? Although these sorts of analyses matter, they are not what matters most, for they situate knowledge in particulars. Knowing about Ko's (one of her students) thinking is not immediately of use to others.

So what can others learn from Lampert's work about settings, students, and content different from hers? She proposed two implications of her work, one derived from the work her students did in the context of her approach and the second raised from the very structure of the design itself—her teaching. First, Lampert claimed that the work her students did "raises theoretical questions about the relationship of intuitive, concrete, and computational knowledge . . . and principled conceptual knowledge" (p. 337). Did the students know to use principles because they had had direct experience with the ideas in a concrete realm? Were they understanding what they were doing or were they simply applying a procedure from one context to another? Could the teacher be seen as reconnecting procedures to their conceptual underpinnings? These are all important questions about how to help students develop both conceptual and procedural understandings of mathematics. Lampert's examples offer insight into what the composition of these understandings can look like, and her analyses of the connections offer readers ways to look at other students.

Lampert took a second tack as well. She claimed that, in addition to the potential insights into the development of mathematical understanding of concepts and procedures, her work also raises questions about the nature of teaching and of the teacher's role in helping students to learn. She suggested that what she was doing as the teacher offers an example to be scrutinized about the ways in which teachers might bridge students' intuitive and procedural understandings with formal abstract principles. Lampert argued that, viewed this way, teaching mathematics "content" is not easily separated from developing a culture of mathematical sense making. Her examples illustrate this bond and offer readers an image of a different conception of the teacher's role in students' learning to know and do mathematics.

In Lampert's work, then, we see that in order to pursue the question she had about learning to know and do multiplication in ways that linked different ways of knowing mathematics, Lampert had to create the context for her research. In creating the context, she also produced an instance worth examining of what is entailed in such creation—hence, insights into the nature of instruction and of the teacher's role. As researcher of these questions, she used herself as teacher. And as teacher, she created new possibilities not only for practice, but for research.

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We turn next to Heaton's work, which contrasts with Lampert's both in focus and design. Whereas Lampert studied student learning in the context of teaching, Heaton studied teacher learning in the context of teaching. Moreover, unlike Lampert, Heaton did not explicitly set out to design a context for her study. Instead, as a teacher, she found herself in a challenging situation ripe with possibilities for inquiry. An experienced and skilled teacher, Heaton found herself struggling to change her teaching from a traditional approach to one grounded in reform ideas about good teaching. What she found difficult, and why, as well as what helped her to learn, emerged as important questions worth examining in a disciplined way. These questions were of interest more broadly, for Heaton was not alone in the struggle to remake herself as a teacher of mathematics.

Heaton (1994): Inquiry into Changing One's Practice

In her dissertation research, *Creating and Studying a Practice of Teaching Elementary Mathematics for Understanding*, Heaton (1940) framed her inquiry by asking, "What would it take to teach elementary mathematics in ways envisioned by the current reforms in mathematics education? What struggles would be experienced by teachers as they transform their teaching?" (p. ii). To explore these questions, Heaton studied her own mathematics teaching in a fourth-grade classroom. She described her own education beginning with elementary school, her experiences in school mathematics, her teacher education program, and her years of successful teaching in various settings. Without fanfare, she let the reader know that she was awarded "Teacher of the Year" in Vermont. In her doctoral work, Heaton was exposed to reform ideas about mathematics teaching and her world began to change. As part of a research project on which she worked, Heaton (1992) did fieldwork, following two teachers in California in their efforts to teach mathematics in the context of the massive wave of reform. She began to wonder if she, an experienced teacher, could do the kind of teaching reformers were promoting, and she arranged to teach mathematics for a year in a local fourth grade. Although it was developed before the NCTM *Standards*, the curriculum in use in that school reflected many aspects of the contemporary reform visions of mathematics teaching and learning. However, the task of changing her teaching turned out to be even more challenging than she had anticipated and, after the fact, she decided to make her efforts to change her teaching the focus of her research.

What does working on Heaton's questions "from the inside" offer? Heaton analyzed the challenges of learning to teach mathematics for understanding by documenting her own learning over the course of that year. The going was tough at times. Despite the fact that the

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curriculum was scripted, Heaton got stuck as she struggled to understand the design of a lesson. She lost her mathematical bearings in the middle of class discussions. Everything seemed to take longer than the teacher's guide indicated, and she felt herself falling behind. Her frustration and embarrassment well up repeatedly.

What can others learn from Heaton's struggles? In documenting and analyzing this year of teaching, Heaton sought to make claims regarding the challenges that might face any teacher attempting to take on the task of teaching this way:

> What is it that I—an experienced and successful elementary school teacher—have had to learn to make fundamental changes in my mathematics teaching? More broadly, I was asking: What do teachers need to know, care about and be disposed to do to teach mathematics for understanding?" (p. 90)

To manage the fact that she was studying her own learning, which meant that she—the very object and tool of her own inquiry—was changing even as she was conducting her research, Heaton invented a methodological strategy that afforded her separation from herself by using different voices to represent different points on her trajectory: Ruth 1, the self that was doing the teaching at the time; Ruth 2, the self that was reflecting on that teaching at the time; and Ruth 3, the self that made sense 3 years later of the teaching she did during that year.

Heaton came to a number of realizations about the challenge of what she set out to do. For example, she saw that she lacked understanding about the purposes and significance of specific content and about how mathematical ideas interconnect. She suspected that becoming more fluent in conceptual understandings of mathematical ideas will help her to be more able to listen to students' understandings and to guide fruitful conversations about them. Heaton learns that she could no longer use the textbook as a strict timetable for where this kind of teaching might take her and her class. She saw that this kind of teaching would require an ability to see multiple ways of representing a mathematical issue.

Some of Heaton's analysis focuses more on the pedagogical aspects of the work. She learned the importance of what she called "improvisation" in teaching, that is, "to be responsive to students' understanding and to the mathematics" (p. 222). She struggled with managing disagreements in the classroom, both the content and the standards of discourse. Heaton came to think that this kind of teaching would require "sharing the lead" with her students, a practice to which she was unaccustomed.

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Ultimately, Heaton concluded that "continuous invention of a practice is inherent to the work of teaching mathematics for understanding" (p. 341). The metaphor of invention captures this kind of mathematics pedagogy for Heaton this kind of teaching is necessarily situation-specific, it is fundamentally responsive to the particular students in a given context, and because coming to know mathematics is intimately linked with the ways that knowledge is constructed. Heaton then proposed some ways in which prospective and experienced teachers might prepare for the endemic uncertainties of this kind of teaching. One is "educative curricula," materials that could enrich teachers' understandings of mathematical concepts and help them to anticipate student thinking based on these deep understandings of the mathematical terrain, its relevance, and its interconnectedness. Learning to teach this way will require a capacity for seeing, creating, and choosing among a wide repertoire of options at a given moment of practice. It will demand an ability to anticipate, hear, and interpret students' understandings. It will depend on a deep knowledge of mathematics, and a sense of its fundamental questions and ideas, how they interrelate and their purposes in the curriculum. Finally, it will acknowledge the tentative and uncertain nature that this kind of teaching entails.

In Heaton's work, we have an example of studying from the inside what it takes to change one's practice from good traditional teaching to teaching in the spirit of the reforms. The changes entailed are not minor. The reforms lead teachers to reconsider fundamental aspects of who they are, the role they play in their students' learning, the way they establish and maintain the classroom culture, the content they teach. These changes are at the core of teachers' identities and practice. Heaton's experience not only helps us analyze what it takes to manage the challenges of trying to change, but also offers us something Lampert's does not: what it is *like* to face these changes. What does it feel like? What arises? This understanding, not readily accessible from the outside, is important in seeking to understand the challenges of teacher learning and change.

We turn next to a third case of studying teaching from the inside: Simon, a teacher-educator, conducted his research in the context of his own teaching of mathematics methods. Like Lampert, Simon designed his context as a site for his inquiry. But like Heaton, Simon's focus was on teachers' learning.

Simon (1995): Inquiry into Mathematics Teacher Education

For this last case, I examine M. Simon's "Reconstructing Mathematics Pedagogy From a Constructivist Perspective," published in the *Journal for Research in Mathematics Education*

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in 1995. Simon's point of departure is that although constructivist views have provided rich models of how students learn, they do not extend to how teachers should teach. He pointed to the lack of theoretical frameworks for a pedagogy of mathematics consistent with constructivist theory. Several reasons account for this, according to Simon. First, some assume "constructivist teaching" as a direct entailment of learning theory. This common view is often simplistic, envisioning a removed and inactive teacher whose role is principally one of noninterference in students' learning. Second, within research on learning, many projects focus on individual learners; fewer look at classrooms. A third source of this gap emerges from a disjuncture between research on teaching and research on learning. Because researchers who study teachers' thinking, beliefs, and practices rarely end up studying teachers who have "well-developed constructivist perspectives and [are] implementing reform ideas" (p. 118), more such research is done in traditional settings. Consequently, research on teaching has focused on relatively traditional practice, whereas research on learning has focused on constructivism. These reasons combine to create a gap between theories of learning and theories of instruction.

M. Simon identified some research that has focused on mathematics teaching grounded in a constructivist perspective, particularly on the deliberative and design aspects of practice—selecting tasks or problems, choosing representations, and facilitating the development of community (e.g., Ball, 1993a; Brousseau, 1981; Cobb, T. Wood, & Yackel, 1993; Lampert, 1990). Simon positioned his work to extend and elaborate this line of inquiry. Designing what he called a "teaching experiment," he set out to analyze situations in which a constructivist perspective on learning comes up against "realities of real students in real classrooms" (p. 121) in order to bridge what he saw as a critical disjuncture between the development of theories of learning and of teaching. What is the nature of the design work when constructivist theory underlies the pedagogy?

To pursue this question, Simon studied his own teaching of prospective elementary teachers within an experimental teacher preparation program consisting of a mathematics course, a course on mathematics teaching and learning, and two practica. The goals of the program he designed were to increase beginning teachers' knowledge of mathematics and to develop their understanding of mathematics teaching and learning consistent with current theory and reform documents such as the NCTM *Standards*. Through analysis of his own actions as a teacher in this context, Simon develops a model of teaching and teacher decision-

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making that is rooted in constructivism. Being the teacher gives him inside access to a case of a teacher working within twin commitments to content and to students' thinking.

In his analysis, Simon sought to make his own pedagogical decision making in posing problems explicit. He attended carefully to the hypotheses that he made about what the learners might learn and what he might do to foster this learning. These hypotheses are based on his knowledge of the mathematics content and his knowledge about how students learn mathematics. He found that his hypotheses were constantly changing, based on his work with his students, and this led him to develop new problems that would address his revised hypotheses about what students might learn. Simultaneously, his own understanding of mathematics content and his knowledge about how students learn mathematics were altered. For example, he wrote:

> As we proceeded to explore the multiplicative relationship involved in evaluating the area of a rectangle, I came to believe that the context in which we were working (area) was not well understood by many of the students. They seemed to think about area as generated by multiplying length times width. Although my primary focus was on multiplicative relationships, not on area, it seemed clear that an understanding of area was necessary in order for students to think about constituting the quantity (area) and evaluating that quantity. What action could I take as a teacher? (p. 127)

Through such deliberation and reflection on his students' understandings and misunderstandings, Simon revised his hypotheses about what they might learn and how to go about providing contexts that would foster such learning.

What does working on Simon's questions from the inside offer? Using his own teaching, Simon was able to probe practice that is grounded in constructivist theories of learning. He saw patterns emerging in his teaching role that constitute what he called the mathematical teaching cycle. This model includes what Simon called the "hypothetical learning trajectory," which is determined by the teacher's original learning goal, the learning activities, and the thinking and learning that the teacher predicts will occur. He called it "hypothetical" because it cannot be known in advance and students' learning often does not proceed exactly as predicted. In order to plan, the teacher must form viable hypotheses about how the learning trajectory might develop and design on the basis of those hypotheses. Surrounding this hypothetical learning trajectory is the mathematical teaching cycle, which draws on other areas of teacher knowledge: the teacher's theories of learning and teaching mathematics, the teacher's

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mathematical content knowledge, and the teacher's knowledge about materials, problems, and activities. Reflexively, what happens in the classroom is informed by these areas of teacher knowledge and, in turn, informs the teacher's knowledge. In Simon's model, the teacher's hypothetical learning trajectory is continually modified to take into account the teacher's expanding knowledge about his students.

Simon also noticed other aspects about his role as a teacher in this kind of mathematics teaching. One is the experimental nature of teaching, which is exemplified by the discrepancy he found in the amount of time that he had planned to dedicate to certain topics and the amount of time that these topics actually occupied. Precisely because the teacher bases his planning on hypotheses about what students know and how they will learn, the actual process may take longer or shorter amounts of time. Second, again because the teacher bases his planning on hypotheses about student understandings and because he revises his activities, goals, and hypotheses in response to what he perceives to be actual student understandings in various contexts, he cannot perfectly anticipate the hurdles that students may encounter as they work on the ideas. Third, in appraising his teaching episodes, Simon concluded that he was not able to provoke the disequilibrium that he believed would be useful in his students' learning. He came to believe that he could only attempt to promote disequilibrium, that this attempt is predicated on sometimes inadequate pictures of his students' understandings, and that learning does not proceed in a linear fashion.

Working from analyses of these particular cases, Simon developed the mathematical teaching cycle to describe a more general model of pedagogy based on constructivist views of learning. At the same time, he was cautious about how the data from this study will apply to other contexts. For example, teaching students in a teacher education program is distinct from teaching third-graders mathematics in some ways. Still, the mathematics teaching cycle suggests ways teachers might think about mathematics pedagogy, with particular emphasis on the ability to generate hypotheses about student understandings, to form hypothetical learning trajectories, and to consider the conceptual knowledge of the mathematics being taught. Further, the model strives to address the inherent tension in teaching this way: the tension between teacher planfulness on the one hand, and responsiveness to students on the other.

From the inside, Simon examined this tension of planfulness and response. Using this tension, he proposed a model of teaching centered in the teacher's role in guiding student learning in relation to considered mathematical goals. This role is framed by both attention to students and analysis of the mathematical terrain, composed in an iterative cycle of design and

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revision. With a close view of the nature of this effort in practice, including its uncertainties and challenges, its imperfections and struggles, he was able to specify a theoretically grounded, normative model of design and construction in teaching.

What Is Distinctive About First-Person Research?

In some ways, these researcher-teacher, first-person projects might appear to be highly similar to other case study research. However, two features characterize important distinctions. First, design—not only of the methodology but also of the phenomenon and its context as well—plays a critical role. Instead of merely studying what they find, they begin with an issue and design a context in which to pursue it. The issue with which they begin is at once theoretical and practical, rooted in everyday challenges of practice but also situated in a larger scholarly discourse, and they create a way to examine and develop that issue further. What they ultimately focus on may emerge out of the situation and its unfolding, but they have an important hand in constructing fundamental features of the arena of study.

Lampert (1986) began by identifying a long-standing divide about the aims of school mathematics. On one side are the many school people who focus on computational skill; on the other are mathematicians for whom abstract mathematical principles and structures are central. She set out to examine how these different ideas about knowing mathematics might be designed to interplay in real classroom practice. Through her own efforts to teach multidigit multiplication to fourth-graders, Lampert explored what is possible in a regular classroom in which making principled knowledge of mathematics connected to procedures is a central aim. What does that look like? What is entailed?

Heaton (1994) started with the practical problem of experienced teachers who face the sea change of ideas about elementary mathematics teaching, and she raised central theoretical questions about making these kinds of fundamental changes in one's practice. Using her personal experience of change to study experienced teacher learning, she probed not only what happens, or what it takes to do this, but also what it is like. She developed a strategy for straddling the inside and the outside, moving across time and perspective to look with precision at the work involved in facing off with the demands and opportunities of change.

M. Simon (1995) began with a different concern, one more rooted in theory but with direct connections to practice. Arguing that constructivist theory (which has been so central to recent developments in mathematics education) is not a theory of pedagogy, he sought to develop a model of the design work entailed in using constructivist principles as the root of a

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pedagogy of mathematics. He used his own teaching to posit a provisional theoretical model that can capture elements of this design process in other mathematics teaching contexts.

Each of these researchers can be seen as conducting research in which the phenomenon they want to study must be *designed* in order to study it. Rather than studying what is, they work in a mode closer to what Ann Brown (1992), citing Allan Collins, referred to as "design experiments."[5] More like certain work in the "design sciences," such as aeronautics or artificial intelligence, this approach to research on teaching and learning involves both designing an educational innovation and simultaneously studying it. The design work does not proceed linearly; instead, the design is iteratively adjusted in the course of the research. The adjustments are themselves objects of study, and contribute to theory building.

Unlike Brown, however, Lampert, Heaton, and Simon are themselves firsthand tools of the research on teaching. Lampert (1985) described this as using the self as a tool in teaching and in research on teaching, and later she (Lampert, 1995) cited Garrison's (1995) observation that "the teacher is the most fundamental technology in educational practice." The designs of these three first-person researchers require their skilled hand and eye in construction; in different ways, their questions require them to be inside the interplay of design and construction.

In Lampert's case, her design is a kind of teaching and learning, and she studied its features in practice. She produced an image of a kind of teaching and learning and probed its elements, seeking also to describe it in ways that make the pursuit of its principles viable in real classrooms. As such, creating it in a regular, fourth-grade classroom is an essential part of the approach. Like Brown, Lampert wanted to build description and theory in the "blooming, buzzing confusion" of real classrooms (A. L. Brown, 1992, p. 141). Simon took this one step further: His project was to create a theory of design. So his teaching efforts, including the creation in process, were the objects of inquiry. Being the designer of the teaching gave him intimate access to the processes and considerations of design. For both Lampert and Simon, to have another teacher do the teaching would be to introduce issues of teacher learning that would interfere with their aims in these particular projects. Lampert wanted to shape the

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[5] It might be helpful here, too, to examine the similarities and differences between *design experiments* and *teaching experiments*, because the latter term is used so much more in the mathematics education community and literature.

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teaching in particular ways and to adjust her designs to keep her eye on a kind of learning. Simon wanted to study the complex intricacies of design. In both cases, being both designer and builder was essential to their goals. Heaton, in intriguing contrast to the other two, also used only herself but made teacher learning a major focus of the analysis by examining closely what she confronted and had to learn in trying to create the kind of teaching she envisioned.

First-person research offers the researcher a role in creating the phenomenon to be investigated coupled with the capacity to examine it from the inside, to learn that which is less visible. As architect, builder, and critic, the researcher-teacher moves fluidly and without interference across roles and functions of the work. These features make possible many inquiries that would be difficult to pursue from the outside. Still, first-person research is threaded with challenges. We turn next to an examination of three special issues, one related to questions, one related to stance, and a third related to claims.

SPECIAL VALUES AND PITFALLS OF THE FIRST-PERSON PERSPECTIVE

Considering these three cases of first-person research offers a preliminary glimpse of what such inquiries make possible. Researchers may design experimentally contexts, curricula, modes of teaching, experiences, or situations that they want to be able to probe. Rather than having to find an instance of the phenomenon in which they are interested, they can create it and then study it. Moreover, in some cases, the challenge is the creation, and having a firsthand role in the construction offers the opportunity to study what it takes to enact a certain kind of teaching, classroom, or curriculum. Another possibility of first-person research is to access, uncover, and probe elements of the situation or experience invisible to the outsider. What is it like to do this sort of teaching? What tensions arise? What are the feelings entailed? What are the incentives? What is the underlying reasoning?

Research Questions: Connecting Problem and Perspective

Studying teaching and learning from the inside is not equally fruitful, or even generative, for all questions. It is useful to ask, for a given question, whether and how the first-person perspective can play a role.

For example, consider Heaton's central focus on the effort to change her mathematics teaching. What was it like to try to make the kinds of changes she was trying to make? What

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did she struggle with? How did she feel about it along the way, and what experiences stood out as critical? Certainly, it is possible to imagine a researcher following another teacher around, seeking to understand the experience of a teacher engaged in significant changes in her practice. Such a researcher would interview the teacher about what she was doing and why, how it was different from what she usually did. The researcher might try to probe what the teacher knew and believed, and what she was learning, and might seek to describe and analyze her practice. She might talk with the teacher and try to understand the challenges of the work. This would be useful. But the researcher would also be limited. Aspects of the teacher's experience, of the struggle, would not be readily evident or easy to probe. What Heaton was able to probe about the work of changing one's teaching was different from this. Heaton sought to explore, and later represent, the journey of a serious effort to change one's teaching, using her own firsthand experience as a window onto the process. It was the experienced teacher's embarrassments, chagrins, and sources of exhilaration that she wanted to capture and analyze. From the vantage point of her own experience, she recorded what she did and felt, and she created analyzable data from that experience. The data she was able to capture and later analyze were different from those that would have been collected by another researcher. That she was able to do it was not simply that she was "there," however; I return to this later.

By way of contrast, imagine wanting to study how different children experience the curriculum and pedagogy of a mathematics class and what they are learning. Investigating this likely would require watching, listening, and talking to various children. It would mean probing their reactions and making it safe for them to be as candid as possible about other students, about the class, about the teacher. It would mean examining both generously and skeptically what they seem to be learning.

What might be the contribution of the first-person perspective in this case? The teacher has an ongoing relationship with students that may permit her to know them more closely than would someone less involved with the class. The teacher has access to detail of the class that others would not: She may be able to sense tender issues, may know about particular pivotal episodes, and may understand the children's talk and manner in ways that others would not. She knows the history of shared examples, problems, and discussions that she can use to probe the children's ideas and experiences. At the same time, her relationship with the children is itself a central part of their experience of the class. What might they not want to say to her? What might it be risky to disclose? Moreover, the teacher's commitment to help children can impede the capacity to see and hear problems and difficulties. She may not be able to notice

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subtle ways in which her manner affects particular children and, hence, may not be able to probe their responses. She may want the children to understand and to learn so much that a necessary skepticism is difficult to maintain. Quite naturally, it may not be easy to see how particular activities or discourse modes might be experienced in ways quite different from what she had intended, and thus she would not be able to ask students about things they themselves do not raise.

Turn for a moment away from research on mathematics teaching, to explore a rich and well-developed example of first-person research in another area, elementary school writing: namely, the work of Timothy Lensmire (1991, 1994). Lensmire's study of the writing workshop in his fourth-grade classroom faced challenges of the first-person perspective. His management of the role of researcher-teacher illuminates the interplay of agendas present in this work and what it might mean to exploit the first-person perspective for ends aimed pointedly at both theory and practice. The writing workshop, as a pedagogical structure, is envisioned by its designers as a means to change traditional writing instruction in school, which rarely provides opportunities for students to develop voice and to play with language and text. According to Lensmire (1994), "with the support of the teacher and numerous opportunities to collaborate and share texts with peers, children [in writing workshop classrooms] are supposed to gradually become more and more able to realize their intentions in text" (p. 3). Working from a design already in part created, Lensmire sought to construct a substantial workshop in his classroom, and to study it. He intended to describe the workshop and to investigate his experiences as the teacher trying to create it. But, as he acknowledged wryly, the story he had to tell afterwards was different from the one he had expected to be telling. Children wrote unkind things about one another, and the freedom of expression afforded an open door for class and gender biases from the wide society. Absent an explicitly political agenda of social challenge, the writing workshop surfaced a host of problems that he had not anticipated. He was faced with being both designer and builder, not simply the observer and analyst of the construction—a fundamental change in his envisioned project, which he turned to insightful advantage.

Though teachers' questions "often emerge from discrepancies between what is intended and what occurs" (Cochran-Smith & Lytle, 1990, p. 5), many teachers would not have taken the simultaneously theoretical and practical tack on the problems that Lensmire accomplished. Instead, they would have worked primarily to alter the shape of the classroom culture and the children's participation with one another. This classroom might also have been studied from

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an outside researcher's perspective, that of a participant-observer, who might have probed the interaction of sociological, personal, and pedagogical dimensions of Lensmire's classroom. But Lensmire, as the researcher-teacher, turned neither to an adjustment of his classroom nor to a probing study of the social class and gender dynamics. Instead, he adapted his study to what was happening in his class. He took his pedagogical puzzle and worked on it while he also probed the complex theoretical tangles it revealed within romantic ideals for the improvement of schools. He documented and analyzed his struggles to guide and direct the children's writing and interactions. How to manage the commitment to let children find their voices. to write about the topics they chose, in the ways they wanted, and also create a classroom dedicated to social and political commitments of equity and respect? As the teacher, Lensmire was ideally situated to probe this pedagogical tension. At the same time, he needed to understand different children's experiences in his class in order to grasp the complexity of the dilemma into which he had collided headlong. Recognizing the limits of his own position to probe in the ways he wanted, he engaged colleagues in interviewing children in the class. His colleagues helped to focus the questions students were asked, and they were able to delve in ways that he might not have been able to. In this manner, Lensmire was able to design a strategy that allowed him access to students' perspectives in ways that complemented his own perceptions and experiences, but without complicating the data collection with his complex role as both researcher and teacher.

In considering the appropriateness of the first-person perspective for a particular research agenda, three questions are crucial. First, does the phenomenon in which the researcher is interested exist? Does the researcher have a conjecture or image of a kind of teaching, an approach to curriculum, or a type of classroom that is not out there to be studied? And, if it is this need to create the phenomenon that underlies the impulse to engage in first-person research, does the researcher think he or she is particularly well equipped to be designer, developer, and enactor of the practice or would an experienced practitioner be a more reliable partner in this construction? Second, is what the researcher wants to know uniquely accessible from the inside or would an outsider be able to access this issue as well, or perhaps better? Third, is the question at hand one in which other scholars have an interest, or should have an interest, and if so, will probing the inside of a particular design offer perspectives crucial to a larger discourse?

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Scholarly Stance: Composing Distance and Insight

Studying teaching from the first-person perspective offers a special kind of personal inside view that is difficult to gain through even close participant observation. Because teaching and learning are deeply personal—that is, they are in fundamental ways relational and about persons—approaches to scholarship that use the personal as a resource offer the possibility of insights that are more difficult to gain from an outsider's perspective. Some aspects of experience are inarticulable; the chasm between what we know and what we can say is variable, but rarely closed. Limited in what can be asked or explained across any interpersonal divide, a challenge for the inside perspective is how the inarticulable can be represented, probed, and ultimately examined. Ironically, such scholarship depends also on a kind of distance between the researcher and the context and problems of study. How does the first-person researcher create the conversation with herself that makes it possible to excavate, name, and analyze aspects of experience unseen to the outsider?

Disciplined inquiry relies inherently on both faith and doubt: The researcher needs to listen and watch sympathetically, assuming that people in the setting make sense, but must also notice strange or discontinuous events or phenomena. If the researcher remains entirely inside the experience, the critical edge needed for analysis is difficult to establish; what remains may be more narrative than research.

Because research methodology is so often fraught with imperatives to separate the self from the inquiry, we need to develop disciplined methods that deliberately use the self as a tool to construct insights, perspectives, and knowledge that expand our capacity to know (Krieger, 1991). At the same time we need to guard against the tendency toward the personal on the basis of some kind of basic appeal or, worse, naive ideas about what constitutes knowledge. That it is asserted from the first-person perspective cannot make it automatically true.

What is entailed in managing the first-person perspective in the construction of this stance? One thing it implies is that researchers using this approach must be able to treat their experiments, settings, and work as matters for scrutiny. They must be able to view the teaching, the students, and the learning in the context of, but also apart from, their efforts and desires. For example, when examining videotape from his classroom, the researcher-teacher must cultivate a stance of inquiry and curiosity and must overcome a natural urge to defend against questions others raise. This is complicated, for it must be combined with an insider perspective. At the same time, to silence the interior voice, to deny the personal is to undo the very project of first-person research, shutting out part of what is experienced on the inside. In

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part, this kind of research requires both an unusual concentration on, and use of, self, combined with an almost unnatural suspension of the personal.

How can the researcher work to gain alternative perspectives and interpretations of his own and others' actions and thoughts in the session, while also seeking to use the intimate and the personal as resources? Heaton (1994) managed this problem by inventing a methodological device of distancing herself by using Ruth 1, Ruth 2, and Ruth 3, to separate her data and vantage point across the work. Ruth 1 is what she named the teacher teaching and struggling online to reconstruct her teaching. Ruth 2 is the teacher who was making sense of that teaching and learning and who offers perspectives gained through the reflective writing, recorded conversations, and journal exchanges of the teacher during that same school year, but with a temporal distance from particular events. These entries capture the interpretive work of the teacher involved in the challenges of inventing and relearning how she teaches mathematics. Ruth 3 is the perspective of the teacher, 3 years later, who knows the experiences intimately but who has increased conceptual distance on them. Heaton explained her struggles as a researcher, trying to sort out her "multiple selves":

> What makes the work of this study somewhat more complicated is that not only do the multiple selves at any given point in time matter, a particular self changes over time. Since the point is . . . to understand my learning, the changes in self are important to analyze and represent. (p. 64)

Using these temporally distinct selves helped Heaton to focus on the changes in herself, crucial because hers was a study of her own learning as a teacher. The device of multiple Ruths allowed her access to the different perspectives and experiences that she had recorded across time and also afforded her a stance in analyzing the data. This problem of using the self while also standing back from it is an endemic challenge of this kind of work. Getting clear about ways to do it is highly related to the claims one wants to be able to make.

Claims: Navigating the General and Particular

Close study of a single teacher, in a particular setting, with specific content and students, no matter how carefully done or how captivating, always raises questions about the domain of the results. What are the claims of the work about? This problem is still greater in first-person research because the fusion of researcher and teacher can make location of the claims still more complex. At times, moving beyond the particulars can be difficult because of the tight interconnection of voice, experience, and analysis. At other times, the researcher's interest in

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theory can excessively inflate the level of claims. That the author is both subject and narrator, both actor and critic raises special questions about the nature of claims born of first-person research. Answers to these questions are crucial for the disciplined development of the insider perspective in inquiry.

About the three cases in this chapter, we ask: Are Lampert's claims about Lampert and what she did? Is Heaton merely retelling the troubles she encountered? Is Simon showing what he did in his teacher education classes? Or are their claims about teaching, or learning, more generally? How do the claims of these three authors relate to the questions, stance, and design of their research? After reading Lampert, Heaton, or Simon, what are we to think about? What new insights have we gleaned? What do we understand differently, and are there special issues in separating from the interplay of the person of the researcher and the claims of the research?

Let us consider Lampert first. Surely we are not primarily to understand how she, as an individual teacher, taught multiplication. Neither was she merely trying to show us the problems she personally encountered with this group of students in East Lansing, Michigan, over 10 years ago. If not that, then what? Near the end of her article, Lampert wrote:

> The experimental lessons described in this article stand as evidence that fourth-graders can do mathematics and think mathematically. - - - The lessons I have taught and described here suggest that it is possible to do these things in a conventional school classroom. (p. 340)

One claim of Lampert's work is that the sort of work that her students were doing in learning about multiplication is work that one can expect other fourth-graders to do. How is this general claim related to the analyses in the article? At first glance, Lampert's students do not seem atypical. She described her 28 students as ranging widely in computational skill, hence, like many other fourth-grade classes. She placed a heavy emphasis on the teaching that shaped their opportunities to learn mathematics, implying that it is the opportunity to use information, organize it strategically, generate and test conjectures, and experiment with solutions and solution methods that matters. The particularity is here, in Lampert's approach. As readers, we know little about how bound up with her and her personal style and understanding the pedagogical design may be. She strove to de-center the description from herself, asking instead, "What sort of help do children need from *adults* in order to do these things and to be confident in their ability to do them" (p. 341)? Lampert described her approach to teaching, focusing in particular on the structure of asking students to explain how they "figured out" their answers (asked even when the answer is not conventionally correct).

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She explained that she had two reasons for doing this: first, to give herself a glimpse of how students are thinking and what they are using to reason mathematically, and, second, to cultivate the intellectual habit of moving the locus of authority from the teacher and the answer key to the students as knowers and to standards of mathematical evidence.

Lampert used her classroom as a setting for creating particularly designed opportunities for learning mathematics. As such, her claims are about what is possible for students to do and to think about, not what is or must be. That she was the teacher of the class means that she was able to work from inside the design. The architecture of the class—its pedagogy and curriculum—is hers in concert with her students. In seeking to explore and later to show readers what is possible, she used herself as designer and builder. This affords her the opportunity to make claims about what is possible. She was, in A. L. Brown's (1992) terms, clearly working as "a design scientist. . . . [attempting] to engineer [an] innovative educational environment" (p. 141) and, at the same time, studying what happens in such an environment—what students do, what struggles she faced as a teacher, how the mathematics develops. Lampert acknowledged that if the objective was to examine closely both instructional strategies and learning, then other programs of research might need to be designed that were more rigorous. Her claims are not about what to do, but about the nature of curricular aims in mathematics education and what it might be possible to aim for pedagogically. In her design to "[reconnect] principled conceptual knowledge with procedural knowledge" (p. 338) on the argument that these connections have been severed in most school instruction, Lampert claimed that this can be done in a regular school.

Simon's teaching experiment in preservice mathematics teacher education yields a different kind of result or claim. He used his analysis of three teaching episodes from his own mathematics methods teaching to develop a provisional general theory of pedagogy based on constructivist principles of learning. He saw this as crucial because:

> Although constructivism provides a useful framework for thinking about mathematics learning in classrooms and therefore can contribute in important ways to the effort to reform classroom mathematics teaching, it does not tell us how to teach mathematics, that is, it does not stipulate a particular model. (p. 114)

The mathematics teaching cycle that M. Simon developed is "a schematic model of the cyclical interrelationships of aspects of teacher knowledge, thinking, decision making, and activity that seems to be demonstrated by the data" (p. 135).

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How did Simon leverage this from the insider work he had done on teaching? At the beginning of the section of his article in which he developed this theoretical perspective, he explains:

> In this section, I use the first person singular to refer to my actions and thinking as the teacher. I use the third person, often referring to "the teacher" to designate ideas I am lifting from the particular context in which I was the teacher. (p. 132)

Simon's model is a descriptive one, showing the teaching cycle rooted in the construction of a hypothetical learning trajectory, which includes the teacher's learning goal, plan for learning activities, and a hypothesis about the learning process. He examines the components of the teaching cycle, showing domains of knowledge and processes of knowing in practice that interact in the course of teaching to modify the trajectory of instruction. This section is an abstracted model of the process of planning, doing, listening, adjusting that Simon argued is at the heart of teaching—not just his teaching, but teaching more generally. In the next section of his article, Simon returned closer to the data from his teaching to articulate some elements of teaching that "embodies the reform principles." Here, he described some aspects of what he was doing in the episodes offered earlier in his article, drawing more directly on his firsthand experience. He described the experimental nature of this kind of teaching, hence, elaborating the "hypothetical" and "experimental" nature of the work. Speaking from the inside again, he layered practice against his provisional model.

Interesting to note is that Simon strove to move beyond the particulars of his own context in more than ways related to who he is individually. His aim was broader than Lampert's. His model of mathematics teaching is provisionally applicable to any teaching, not solely the teaching of preservice teachers in a mathematics methods course. In his conclusion, he reminded his readers that: "The data from this study must be seen in its particular context. The teaching practice was embedded in a teacher education program; the mathematics students were prospective elementary [teachers]" (p. 142).

Like Lampert, he also notes the important relationship between his first-person research and other lines of inquiry: Mathematics teaching with other populations involves a set of different constraints. Research in other contexts will inform us about the degree of context dependence of the ideas generated" (p. 142).

M. Simon's article is followed by a response written by two other researchers, Leslie Steffe and Beatriz D'Ambrosio (1995), who engaged the model as an abstraction about

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mathematics teaching. Like Simon, they referred to examples from his teaching to argue their points, but the argument is not about Simon's teaching itself but about the model and its role in research and its relationship to constructivist theory. As such, their response reflects their reading of his claims as theoretical, abstracted from the particulars of his own situation, yet developed and supplied by it.

What about Heaton's study of learning to teach mathematics for understanding? What are the claims of this study about? Arguing that her experiences in trying to change her mathematics teaching are not unique to her, Heaton explained that she, nonetheless, intended her work to be "both an autobiographical account of learning to teach and a piece of scholarship" (p. 29):

> What I have written is not just a story of my experience. It is also a close and careful study of my learning experiences over two points in time based on an analysis of a variety of source of documentation of my teaching. (p. 29)

Heaton sought to surface issues about learning to teach mathematics for understanding that she wanted her readers to understand as endemic to the challenges of trying to change one's teaching in these directions. However, of the three researchers examined in this chapter, Heaton used her self the most centrally. Perhaps because her work is as autobiographical as it is, she endeavored to establish carefully who she is in relation to the central questions of the study. She sought to do this both so that her readers can make sense of her experiences, but, more important, so that she could be seen as similar to many other capable, experienced teachers. She argued that:

> This study yields theory and questions about teaching generated in a rigorous way by an insider. As in medical research, when charting new territory, the value of the work does not come only from the questions answered but from new questions that get asked because of it. (p. 91)

Heaton's original question was, "What does it take for an experienced and successful elementary teacher to make changes in teaching mathematics" (p. 339). A central claim she made is that "learning to teach mathematics for understanding entails, simultaneously, learning to continuously invent a practice of teaching mathematics for understanding while you do it" (p. 339). With an analysis of the reforms and the sorts of guidance they do and do not provide for teaching, Heaton argued that the reform visions are underdetermined and, hence, require teachers to invent versions of teaching that fits with these aims. This claim is meant

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to apply to all who begin trying to teach this way. What she was claiming, drawing from both her careful analyses of her own experiences and her examination of the reform sources, is that there is no single practice of teaching for understanding. Hence, she claimed, interpreting and constructing it are parts of the process of learning to do it. Heaton continued with an analysis of her expectations in setting out to remodel her teaching and argued that learning to change one's teaching is not helpfully construed as complete abandonment of past practices. Instead, it requires "a skillful merger of old and new practices" (p. 358). A third area of claims for her study entailed subject matter understanding needed to teach in this way. She claimed that teachers have to be able to construct new understandings of mathematics as they explore the ideas with their students. Again, she drew from her experiences with the curriculum and with students' responses and work to make a broader claim about the nature of the subject matter understandings necessary in this kind of teaching.

Lampert set out to design a kind of teaching so as to be able to make claims about what is possible. Simon also very consciously designed a way of working with students, carefully documenting the decisions he made as he worked, and then he used his teaching as a platform to construct a provisional model of teacher decision making and teaching in this kind of teaching for understanding. Heaton did something distinct from these two. Heaton used herself and her experience to examine what happens to an experienced teacher who tries to change her teaching. She did not design the processes by which she would learn, other than setting out to do it. She put herself in a position to try to learn to teach, making herself quite vulnerable, for it was her experience that would form the material for analyzing the process of making such change. She, and what happened to and with her, was the central material of the study. Her claims are about herself as a case of an experienced, good teacher; her intellectual project was to convince her readers that her experience was logically rooted in things endemic to learning this kind of teaching and how to do it. That is, she aimed to make claims that would help us to consider closely the demands of learning to change one's teaching to this kind of teaching in general, not only her own experience.

Across these three cases, all three researchers were self-conscious and careful about the relationship among questions, stance, and design. Lampert, wondering about a particular way to manage the multiple ways of knowing central to mathematics, designed an approach to teaching on the basis of a conjecture about teaching and learning. Focused on learning, she traced her students' work and thinking across a series of lessons and examines how their mathematical understanding evolves. She had her eye on her students, and she used her

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researcher-teacher perspective to scrutinize what they do. Seeing what they do convinced her, and she, in turns, sought to convince her readers that what they did demonstrates what is possible to do more generally in the teaching of mathematics in school. She offered a way of thinking both about the nature of mathematical knowing and of the teacher's role that underlie her efforts, and, by implication, others' efforts. Simon, like Lampert, had to design a situation for his work. In so doing, he was able, like Heaton, to examine what goes on for the teacher in trying to work in that context. He examined the process of pedagogy and curriculum in action, using his own efforts as a source of insight. He probed the interplay of attention to the curriculum and to the students, elaborating what this attention is like and what it means to navigate the two in constructing a class. Unlike the others, Simon's yield is a model, a schematic for conceptualizing the relationships of teacher knowledge, student thinking, and teacher learning in the course of teaching. Heaton, unlike the other two researchers, did not design her situation. Using her own naturally arising experience also makes her challenge to move beyond her case more difficult. Although, as she acknowledged, she represents many other good, experienced teachers faced with changing how they have apparently successfully taught mathematics, her story is more autobiographical, and it takes more attention to locate the claims beyond her story. She did so by reminding the reader who she is and what her experience offers in considering the learning of other practicing teachers. And she did so by pushing herself to consider what the features of her struggles were and what sorts of support might help: curriculum materials, opportunities to learn with and from them, opportunities to learn mathematics.

FIRST-PERSON RESEARCH: FACING THE RESPONSIBILITY FOR DEVELOPING A GENRE

In writing about recent trends in anthropology to acknowledge and use the self in writing, Ruth Behar (1996) posed a crucial question for our interest in first-person research on practice. Acknowledging the inevitable interpermeation of the self and what is being studied, she asked:

> How do you write subjectivity into ethnography in such a way that you can continue to call what you are doing ethnography? Should we be worried that a smoke alarm will blare in our ears when the ethnography grows too hot and "too personal"? (p. 7)

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On one hand, Behar argued firmly for the need to find a place for the self in the scholar's voice and position. At the same time, she cautioned against the unexamined move to include the "personal." She explained that writing the conventional, "author-evacuated texts"[6] produces scholarship that is at worst boring and unenlightening. Using oneself explicitly in one's work ("author-saturated texts") has the potential to be humiliating, embarrassing, and useless unless one can connect the particulars of one's perspective and experience to the subject under study, to the "enormous sea of . . . issues" related to theory and experience. Otherwise, it runs the risk of realizing its critics' claims that such work is little more than a "nouveau solipsism" (Patai, 1994).

Behar (1996) wrote eloquently an impassioned story of her own evolution as an anthropologist gradually rejecting the traditional and almost unnatural isolation of self from a form of work that so centrally uses the self. Her story is itself an exemplar of inquiry that uses and moves beyond the first-person perspective, for her story can be read as a case of inquiry into the very terrain of her own scholarly work. As an anthropologist involved in changing her practice, she—like Lampert, Heaton, and Simon—was at once creating a new practice of anthropology and investigating the issues entailed in both doing and creating this new practice:

> When I began, nine years ago, to make emotions part of my ethnography, I had no idea where this work would take me or whether it would be accepted within anthropology and the academy. I began with a sense of urgency, a desire to embed the diary of my life within the accounts of the lives of others that I was being required to produce as an anthropologist. As a student I was taught to maintain the same strict boundary Malinowski had kept between his ethnography and his autobiography. But I'd reached a point where these forms of knowing were no longer so easily separated. (p. 19)

She wrote about her experiences as she changed her work: struggles with the tenure process, reactions of other scholars, and questions from her Aunt Rebecca about what anthropology "is." But Behar (1996) did not write only about her own change; she wrote also

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[6] Behar cited Geertz's *Works and Lives* (1988) for this characterization of conventional social science texts.

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about changes in the fields around her: the rise of "first-person narratives written by those who previously had been more likely to be the ethnographized rather than the ethnographer," which challenged anthropology's traditional views of "truth"; new debates about what it means to be an "insider" to a culture; and the rise of "native anthropology." As in other fields where shifts in epistemology and politics are altering practice, research on teaching is opening previously closed approaches to the construction of knowledge.[7] Behar issued a caution to which all who are involved in such projects would be wise to attend:

> As is the case with any intellectual trend, some experiments work out better than others. It is far from easy to locate oneself in one's own text. Writing vulnerably takes as much skill, nuance, and willingness to follow through on the ramifications of a complicated idea as writing invulnerably and distantly. I would say it takes still greater skill. (p. 13)

If first-person research on teaching and learning is to take a legitimate and developed place in the lexicon of scholarly work on teaching and learning, the challenges examined in this chapter will require ongoing attention. For what sorts of questions is first-person research appropriate, or even ideal? For what sorts of questions is it inappropriate? How can distance and insight be composed in the creation of this genre of research such that the inside view is coupled with analysis, that belief and conviction born of intimate involvement are threaded with skepticism and critical perspective? And how can shared notions evolve about what count as reasonable claims, and what it means to warrant them with evidence?

In addition to the thoughtful development of this approach to the study of teaching and learning is the need to consider the learning of new researchers. How might doctoral students learn to design and write first-person dissertations? What are the kinds of experiences and opportunities, distinct from other aspects of research preparation in which they already participate, that graduate students may need in order to develop the capacity to do such work? When might it be unwise to choose such an approach?

Three possible avenues seem fruitful to pursue as this genre of scholarship develops. One is to consider more explicitly the relation of different forms of "teacher research" and research

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[7] Susan Krieger (1991) offered a view of her own and others' shifts within sociology away from traditional approaches to knowing to include the knower much more prominently within the processes and products of the work.

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on teaching (which I mentioned briefly at the beginning of this chapter), to articulate more broadly the relations of question, purpose, stance, audience, and knowledge claims across these different forms of inquiry in, on, and from the perspective of practice.

A second avenue is to consider more explicitly what might constitute "methods" of first-person research. In what ways do the structures and concepts of other, more established approaches to inquiry provide the ingredient skills, methods, and ideas for this, a variant on other forms of qualitative research? What special methods might be invented or needed to face some of the special problems of focus, analysis, interpretation, and writing?

A third promising avenue is to look to the development of method and scholarship in other fields as sources of insight into the relationship of the self to the objects of inquiry: anthropology and sociology, history and literary criticism, psychology and philosophy. How have scholarly approaches and texts evolved as issues of voice, perspective, and representation have emerged? The study of other practices could broaden ideas about the role of the practitioner in developing knowledge about practice: other professional practices, some of the performing arts, writing. How do practitioners have a voice in the study of these practices? Are there ideas about knowing and knowledge in these other realms that might inform or inspire the development of insider approaches to the study of teaching?

Knowing that there are important things to know about the work of teaching that may best be investigated from the inside brings these questions to the fore. An interest in neither being seduced into a simple-minded enthusiasm for first-person approaches to inquiry, nor an unthoughtful dismissal of them as solipsistic, makes the challenge of developing this kind of work worthy of attention.

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