Teaching as Invisible Work

by

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Chapter 1

A Theory of Teaching as Invisible Work

The premise of this study is that much of the work of teaching is invisible. Here I do not mean invisible in the usual sense-- that what goes on in the teacher's head as she thinks and makes decisions is invisible (Lortie, 1975). This argument is different. This study contends that many aspects of the work of teaching are actually visible to the eye but escape notice nonetheless. Some of the most crucial acts in the work of teaching are hard to discern, even to seasoned observers. That the work is difficult to see makes it difficult to study, to teach, and, hence, to learn. This is a problem for the professional education of teachers, because fundamental work in teaching is hard for novice teachers to "see." In this dissertation, I analyze what makes teaching invisible in this sense, and I engage in an experiment with preservice teacher education students to make teaching more visible and to better understand this conundrum.

This first chapter is organized in three sections. The first section defines what it means when I claim that teaching is invisible work. I show, by means of examples from classroom teaching, how acts of teaching work, despite their imminence, are often invisible to the observer. The second part of the chapter analyzes the cognitive, social, and occupational conditions that contribute to make teaching invisible. In the third part of

this chapter, I lay out the central questions for the dissertation and how they will be studied.

Teaching work is "invisible"

I begin by recounting two scenes from teacher education classes.

The first scene comes from a mathematics methods class for preservice students.[1] The instructor is conducting a lesson on place value with her teacher education students. She begins by posing a math problem: to estimate how many pockets are being worn by all the preservice students in the class that day. The problem involves estimating some number that each student would be wearing on average, then adding or multiplying that number by the number of students in attendance. So, for example, students often estimate that each student is wearing four pockets—two to four pants pockets, one to two shirt pockets—and some are probably wearing clothing that has no pockets. If twenty-five students are in attendance, a student might reason that there would be around one hundred pockets in all. In today's class session, the instructor directs her students to attend deliberately to the questions she uses to shape the learning in this lesson, and then launches into the lesson itself:

Instructor:	So here's the beginning of the task: I'd like you to think for a second about how many pockets you think our class is wearing today. Pockets, how many pockets do all of us have all together today? Try to come up with some estimate. [Pause.] Does anyone have an estimate? It won't be right on, probably,

[1] In teacher education, the roles of teacher and learner shift frequently. For example, the students in the teacher education program are variously acting as teachers and as students, and could be referred to as "preservice teachers," "intending teachers," "students," "preservice students," and so forth. For the sake of clarity, I have adopted the following conventions for naming participants throughout the dissertation: I refer to the preservice teacher education students as "preservice students," the elementary school students as "children," and to myself and other teacher educators as "instructors."

	but it will be sort of, around…
Ariana:	I would say 100.
Instructor:	You would say 100?
Ariana:	I was thinking there is an average of four pockets per person.
Instructor:	The way you were thinking about it is four pockets per person, twenty-five people in our class?
Ariana:	And there's some people, like Carly might have an extra pocket, but Martina might not have any.
Instructor:	So you think the four would take into account the more than four, less than four, so you…Eileen, you were thinking the same thing and that's how you got to 100 also. Could you hear what she had to say?
Eileen:	I said I did the same thing. I eyeballed it and I saw that everybody, well not everyone, is wearing blue jeans so we're all…
Instructor:	Margie, you were going to say something a minute ago.
Margie:	Actually, I was thinking 75 because I have a pair of jeans with only three pockets. And then she has a pocket on her shirt.
Student:	She has five-pocket jeans?
Instructor:	Wait, let's hear Margie's logic. She thinks her guess would be 75. Tell us how you got there.
Margie:	I started out with 100, and then I looked around and saw people with …..pockets, and then you have people with an odd number of pockets, so I thought of 3, and I don't know…
Instructor:	Does anyone want to revise what their original estimate was?
	[Discussion continues…] * * * * * *
Instructor:	Other estimates?
Student:	We're all excited about our pockets now.
Student:	What about watch pockets in our jeans?

	[Laughter]
Instructor:	So one of the things in mathematics you know definitions are always really important. So what we have to decide as a class is what we define as a pocket, so like, would that little square thing that I never knew was called a watch pocket, would we count that as a pocket, because we all have to agree on a definition. Would we count, like I have pockets on my backpack. Are we counting that? We really have to come to some consensus definitionally, right?
Student:	Are we counting [inaudible] pockets?
Instructor:	Well, that's what we're asking. As a class
Student:	Does that count as two pockets?
Instructor:	So, it seems funny, but actually in mathematics it's an important thing for second graders to understand that this is very important, and the count will be different based on our definition.

The instructor stops the lesson at this point, midstream, and asks her students to write down the questions they have noticed, in the order posed, and to consider each question's function in the lesson, from the perspective of the teacher.

Instructor:	First what I'd like us to do is stop. We're going to stop the lesson—
Students:	[Some sighs]
Instructor:	--oh, we're going to do the activity, don't worry— So here's what I want you to do right now. What I want you to do is, so right now you were in the seat of being the learner, and it's always funny to turn from one to the other, but try to look at this with the teacher's lens and ask, what were the questions I used to set this up?

At this prompt, the students turn to their notebooks to write down the questions they have just heard. They come up with nothing.

There is something odd about this moment. Recall that the instructor had given her students an advance direction to pay attention to the questions asked in the course of instruction. The students knew to attend to the teacher's questions. They realized that this was the explicit focus of class on this day. Despite this, the students come up empty. They were unable to reproduce any of the questions posed by the instructor during the lesson. Although they had, only minutes before, participated in a lively discussion answering the same questions, when asked to reconstruct them, they drew a blank.

The second scene is from a professional development workshop for practicing teachers. A group of experienced teachers views a videotape of third grade children working on the following mathematics problem:

> I have pennies, nickels and dimes in my pocket. What amounts of money could I have if I pick out three coins?

In the videotape, the teacher reviews with the children the values of each coin, and she does a few sample combinations with the children. She asks questions to ascertain whether the children understand the problem sufficiently. She starts them working independently, and circulates, talking with children individually about their work and how they are recording their solutions. The teacher then reconvenes the children as a whole group and leads them through a review of different solutions that children have generated.

After viewing the videotape of this lesson, the experienced teachers have very little to say about the work of the teacher that filled the frames of this video. In fact, several teachers comment that the teacher in the video was virtually absent, that "she just let the children work without intervening much." The highly structured work in which the teacher was engaged was unseen by these observers. Even with a second viewing of the videotape (which they clearly enjoy), the teachers notice little about the teaching. They comment animatedly about the mathematics problem, and about particular children in the video. Some like the teacher's style, some are concerned by it. But no one identifies or questions specific elements of what she is doing. Why?

In both of these scenes taken from teacher education, crucial features of teaching work went unnoticed by either preservice students or practicing teachers. In the first scene, preservice teachers could not track on the questions that they were being asked to model a key strategy in teaching mathematics, even though they had been asked ahead of time to pay attention to the content and function of the questions that would shape the lesson. In the second scene, experienced teachers didn't "see" the work the teacher in the video was doing to launch a new problem in mathematics class, even though it dominated the video they watched.

Learning a professional practice depends, in part, on being able to notice and attend to what practitioners do. In nursing, for example, nurses must be able to observe closely the administration of therapeutic interventions in order to learn to do this themselves. Similarly, learning to manage rapidly changing situations requires observing other practitioners do this in the field (Benner, 1984).

Learning to teach is no different. Teachers must be able to observe key teaching activities in order to learn to do them. That is to say, teachers need to see such activities in play, recognize their significance, and make explicit their function and deployment. In order to learn teaching practices, teachers need to *articulate* such practices – in two senses. On the one hand, teachers must articulate — that is, name — what is being done. Such naming entails recognizing practices, and giving each a separate and legitimate existence coded by its label. On the other hand, teachers need to see how each practice is composed, and understand how its constituent parts interrelate—another meaning of *articulate*.[2] As we saw in the two scenes above, aspects of teaching work often go unseen. This presents a paradox: Even when the teaching acts are experienced first-hand, or portrayed clearly on a video screen, significant acts in teaching practice evade notice nonetheless.

Scholars of teaching have characterized teaching work as invisible—but invisible in the physical sense. That is to say, there is no physical trace of such teaching acts as planning, deliberating, listening to children's ideas, considering various instructional options. Lortie, for example, wrote that "students do not receive invitations to watch the teacher's performance from the wings; they are not privy to the teacher's private intentions and personal reflections on classroom events. Students rarely participate in selecting goals, making preparations or postmortem analyses. Thus they are not pressed to place the teacher's actions in a pedagogically oriented framework" (1975, p. 62). Despite years in classrooms, this "apprenticeship of observation" affords little in the way of usable professional knowledge for teachers.

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[2] These distinctions between these meanings of "articulate" are elaborated in Strauss, A. (1988). "The articulation of project work: An organizational process." *The Sociological Quarterly* **29**: 163-178.

It makes sense that years in the learner's seat may not afford much understanding of what goes on in the teacher's head. But the scenes presented earlier press us to consider another dimension: Why is it that, even from the perspective of an intending teacher, the *visible* work of teaching slips from view? Thus, we have several layers of complication in trying to recognize various practices in teaching. One is that so much of the practice is indeed physically invisible. But the scenes recounted earlier illustrate how much of the practice is physically visible, yet still difficult to "see." A third, further complication is the absence of formalized identified domains and competencies for the profession. In nursing, for example, Benner (2001) has identified what she calls the "Domains of Nursing Practice." They are:

> The Helping Role
> The Teaching-Coaching Function
> The Diagnostic and Patient-Monitoring Function
> Effective Management of Rapidly Changing Situations
> Administering and Monitoring Therapeutic Interventions and Regimens
> Monitoring and Ensuring the Quality of Health Care Practices
> Organizational and Work-Role Competencies (p. 46)

Teacher education is not structured around analogous parsings of domains of the work. Even practiced observers of teaching struggle to apprehend and give words to the salient features of teaching work. The posing of questions, for example, is among the most commonly used strategies in classroom instruction. Yet there is little shared professional knowledge regarding the content of questions, their sequencing, the matching of appropriate questions to specific learners, the differentiation between types of questions, or their pacing. Educational research has contributed extensive analyses of

questioning in teaching[3]—yet little professional consensus exists regarding their deployment in the classroom, and there is a paucity of shared language among teachers to discuss such elements of teaching. This lack of a shared professional knowledge base, along with the absence of naming both the domains of practices contained therein, reinforces the "invisible" nature of teaching work. Even practices that an observer *could* see go unrecognized.

This has implications for learning to teach. If teaching does in fact elude apprehension and articulation, then learning to do the work is all the more difficult.

The claim that key aspects of teaching work are invisible, or unnoticed, by observers rests on some definitions that I set out here. One term that is used frequently and differentially throughout this thesis is *practice*. This dissertation is deeply concerned with practice, in a number of its definitional and connotative uses. A source of confusion about the word practice is that it is both a noun and a verb, and to add complexity it is both a transitive and an intransitive verb. In the table below, I have compiled the relevant definitions of *practice* from the *American Heritage Dictionary of the English Language*[4] that are germane to teaching and to this paper. On the left side of the table below, I give the *American Heritage Dictionary* definition, and to the right of each definition I provide an example of the word practice used in the context of teaching.

Definition of *practice* from the *American Heritage Dictionary*	***Practice* used in the context of this study**
Transitive Verb	
1. To do or perform habitually or customarily; make	Teachers practice discretion in their handling of

[3] See, for example, Cazden, C. B. (2001). *Classroom discourse: The language of teaching and learning*. Portsmouth, NH, Heinemann; and Edwards, D. and N. Mercer (1987). *Common knowledge: The development of understanding in the classroom*. London, and New York, Methuen.

[4] *American Heritage Dictionary of the English Language,* Electronic Edition. http://www.bartleby.com.proxy.lib.umich.edu/61/85/P0498500.html

a habit of: *practices courtesy in social situations*	sensitive student information.
2. To do or perform (something) repeatedly in order to acquire or polish a skill: *practice a dance step.*	Before teaching lattice multiplication to children, the teacher practiced it herself a number of times.
3. To give lessons or repeated instructions to; drill: *practiced the students in handwriting.*	[Not used in this study]
4. To work at, especially as a profession: *practice law.*	[Not used in this study]
5. To carry out in action; observe: *practices a religion piously.*	[Not used in this study]
Intransitive Verb	
1. To do or perform something habitually or repeatedly.	[Not used in this study]
2. To do something repeatedly in order to acquire or polish a skill.	Before teaching lattice multiplication to children, the teacher practiced on her own.
3. To work at a profession.	[Not used in this study]
Noun	
1. A habitual or customary action or way of doing something: *makes a practice of being punctual.*	One teacher worked to improve her practice by audiotaping her lessons and listening to them with colleagues.
2a. Repeated performance of an activity in order to learn or perfect a skill: *Practice will make you a good musician.* **b.** A session of preparation or performance undertaken to acquire or polish a skill: *goes to piano practice weekly; scheduled a soccer practice for Saturday.*	[Not used in this study]
3. The act or process of doing something; performance or action: *a theory that is difficult to put into practice.*	The teacher was able to introduce a new questioning method into her practice.
4. Exercise of an occupation or profession: *the practice of law.*	The practice of teaching involves content knowledge, relational skill, and the ability to interpret and respond to multiple demands and inputs.
5. The business of a professional person: *an obstetrician with her own practice.*	[Not used in this study]
6. A habitual or customary action or act. Often used in the plural: *That company engages in questionable business practices. Facial tattooing is a standard practice among certain peoples.*	Children were engaged in a number of mathematical practices in solving a particular problem. It is common practice in mathematics teaching to review homework at the beginning of a class session.

All these definitions of practice can apply to teaching, but only some are used in this study and it is these for which I have provided examples of use. Mainly I use practice as a noun throughout the study, and its meaning weaves together and between definitions #1, 3, 4, and 6. Practice is something teachers work on; it is a set of habitual acts or actions; it connotes a professional mode of being. Pickering's work on scientific practice

emphasizes its performative, real-time, and agentic nature (1995) and these are relevant to our definition here. It is practice in this sense that I address in this study, leaning on definitions #1, 3, 4 and 6 above.

In a similar vein, the word *work* is used frequently and differentially throughout this study. In earlier work, Ball, Lewis and Thames (in press) use *work* in intentionally variant meanings to describe what teachers do: they have work to do (noun); they are concerned with what works (verb); teaching is a form of professional work (noun); they work or labor towards a goal (transitive verb). These meanings of work are found throughout this study, and where the intended definition is not clear from the context it will be noted.

Work and practice are defined here because these words are important in building my argument. My claim is that aspects of teaching are invisible, and I will go on to explore how work on practice can intervene on this state of invisibility. This study explicates what makes teaching invisible, and then takes us through a pedagogical structure in preservice teacher education designed for work on practice towards understanding invisibility and towards making headway on this problem. I will argue that bringing preservice students "close to practice" helps to intervene on invisibility.

At this juncture, we turn to consider how teaching work has come to be "invisible."

Factors that make teaching invisible

In this section, I argue that important aspects of teaching work have been rendered invisible by a combination of cognitive, social, and occupation-specific factors. In compiling a list of all the factors that contribute to making teaching invisible, I found they could be grouped into these three categories, which encompass the individual (here

the designation "cognitive" connotes individual cognition), the broadly social (sociological phenomena that account for invisibility of work in general), and the profession-specific (also social, but particular to the sociology of teaching). This is not an exhaustive list, but rather a list that future research will expand and refine. But it provides background to the design of the study, and a further elaboration of my claim that aspects of teaching are invisible.

Individual cognition makes things disappear

In a now well-known study, Simons and Chabris (1999) staged a basketball game recorded on videotape and viewers were asked to count how many passes one team completes. A gorilla walks through the middle of the basketball game and stops to do a little jig. Fully half of the viewers make no notice of the gorilla at all. In fact, when shown the videotape again, these viewers often suspect that the videotape of the game with the gorilla passing through cannot possibly be the one that they watched first. Simons and Chabris cite this as an example of "inattentional blindness." They write:

> All of the information in the visual environment is potentially available for attentive processing. Yet, without attention, not much of this information is retained across views. Studies of inattentional blindness have made an even stronger claim: that, without attention, visual features of our environment are not perceived at all (or at least not consciously perceived)—observers may fail not just at change detection, but at perceptions as well. (p. 1060)

Simons and Chabris attribute this to cognitive processing, and their work calls to mind the work of John Mason on "noticing" (2002). Mason puts this in the context of professional work:

> To notice is to make a distinction, to create foreground and background, to distinguish some 'thing' from its surroundings. This may not be conscious. For example, one mark of an expert is that their sensitivity to notice certain things is integrated into their professional functioning so that all they are aware of is a possibility to act, but not necessarily of the distinctions which trigger that act. Thus to *notice* can be taken to mean the same as *to perceive*, even *to sense* in the

> most general 'sense' of that word. What is critical is that a distinction is made by virtue of the fact that some change is registered in our perceptual apparatus, whether this is primarily physical, emotional, or cognitive. (p. 33)

What psychologists have called "inattentional blindness" helps to explain why observers miss so much that is available to see in classroom teaching. The dynamic character of classroom life certainly draws one's attention to wildly changing foci, at a rapid pace. There is much to see, and therefore much that gets overlooked. But individual cognition does not fully explain the blindness to important aspects of teaching. To understand more about why the eye is repeatedly drawn to certain features of teaching and not to others, we need to consider the social and occupational structures that shape what observers tend to see, and what they tend to miss. In the Simons and Chabris experiment, observers were directed to watch the basketball players in white shirts and count the passes made among them. What is the equivalent "directive," or viewing frame, with which observers of classrooms come to look at teaching? How did these frames come to be? Individual cognition is one resource for understanding this, and there are social and occupational structures that, along with the cognitive, have conspired to make aspects of teaching hard to see, and thus hard to learn.

Social structures hide teaching

A number of social structures work together to render aspects of teaching invisible. In this section, I show how a number of social structures collude to make the work of teaching invisible.

First, a word on "structure." Anthony Giddens has written that structures are "both the medium and the outcome of the practices which constitute social systems" (quoted in Sewell, 1992, p. 4). Sewell goes on to explicate: "Structures shape people's practices, but it is also people's practices that constitute (and reproduce) structures" (p.4).

Thus, structures constrain human activity, but humans have agency and act in ways that can produce or alter structures. This duality is indicated by Giddens' naming of this process as "structuration," reflecting the view that structures are not immutable but rather in process of formation and re-formation.

I rely upon Giddens' notion of social structure in considering the social forces that make teaching invisible. Teaching transpires in a social world, and this social world is defined by structures that shape, and are shaped by, teaching. In this section of the chapter, I point to a number of social structures that impinge on teaching work and that make it hard to discern.

Consider, for example, the frames of reference described by Goffman (1986/1974). Here he describes the extent to which such frames of reference shape what is perceived:

> It seems that we can hardly glance at anything without applying a primary framework, thereby forming conjectures as to what occurred before and expectations of what is likely to happen now. A readiness *merely* to glance at something and then to shift attention to other things apparently is not produced solely by a lack of concern; glancing itself seems to be made possible by the quick confirmation that viewers can obtain, thus ensuring that anticipated perspectives apply…Mere perceiving, then, is a much more active penetration of the world than at first might be thought (p. 38).

Frames of reference

Familiarity hews a frame of reference that obscures a whole host of teaching practices. Do we notice, as Jackson (1968/1990) did, that the teacher asks the questions and the children are expected to answer them? That children sit at desks and face certain directions? That bells punctuate what might be a seamless school day? Rarely are such features of teaching work noticed, since they conform to the frames we bring to view

teaching. These frames, paradoxically, obscure otherwise notable features of teaching work. Contrast Goffman's "framework" here with the purely cognitive processes described in the previous section. Cognition plays a role in Goffman's analysis, but it is cognition inside a social world that produces such phenomena as "frameworks." Goffman here extends the kind of perception that we see in Simons and Chabris' (1991) work in the previous section. Familiarity also inhibits the kind of study and analysis that would produce thoughtful teaching by its rendering of teaching practice as unremarkable. When teaching is seen to be a set of simple and commonplace actions, the prospective teacher does not look for complexity or the kind of ends-means analysis that underlies actions so readily visible to the observer. Activity in that realm of teaching work remains unseen. This is not unlike the kind of "backstage" work that Goffman refers to in *Frame Analysis* (1974). There, Goffman describes the work that has to go on in the kitchen to produce a meal in a restaurant. The behind-the-scenes work is often hard to appreciate when one sees only the finished product. This holds for teaching as well: the polished performance of a veteran teacher belies the great complexity and rehearsal that underlies the work. The problem in teaching is that there is often no physical "backstage" to view. The work itself comprises both cognitive acts that are physically invisible, and relational work that is physically visible but difficult to pinpoint. These are easily obscured by frames of reference that exclude such acts from the analysis of teaching work.

Work in general is underdetermined

We tend to think of work in general as obvious, clearly available to inspection and analysis. But not all work is visible. In this section, we turn to professions other than teaching in which aspects of work are invisible. Nardi and Engeström, for example, parse

the domains of invisible work for the purposes of understanding how new technologies and restructuring of tasks affect workplaces in general:

> Much work is visible. It yields to being mapped, flowcharted, quantified, measured. When planning for restructuring or new technology, visible work is the focus of attention. It is the only work that is *seen*, so efforts to restructure center on how visible work can be manipulated, redrawn, reorganized, automated or supported with new technology. But a growing body of empirical evidence demonstrates that there is more to work than is captured in flow charts and conventional metrics.
> This special issue documents four kinds of invisible work: (1) work done in invisible places, such as the highly skilled behind-the-scenes work of reference librarians, (2) work defined as routine or manual that actually requires considerable problem-solving and knowledge, such as the work of telephone operators, (3) work done by invisible people such as domestics, and (4) informal work processes that are not part of anybody's job description but which are crucial for the collective function of the workplace, such as regular but open-ended meetings without a specific agenda, informal conversations, gossip, humor, storytelling. (1999, p. 1)

This typography of invisible work has its parallels in teaching. Some teaching work takes place behind the scenes. Some teaching work seems routine but requires a good deal of problem-solving and knowledge, such as grading papers (a proxy for assessing what children know and can do—a much more complex practice than making red marks on a worksheet). Teachers do the work of domestics—caring for children, straightening up. We will return to this point subsequently. And many of the practices of teaching fall into the fourth category above, the informal work processes unspecified in a job description but crucial for the collective function of the workplace: smoothing feelings in the wake of conflict; monitoring physical and emotional states such as exhaustion, frustration, engagement; making and adjusting decisions about sequencing in the presentation of new concepts in a lesson or unit, the timing for testing, and the pacing of a lesson's components.

Star and Strauss contend that all "articulation work" is invisible: "*The important thing about articulation work is that it is invisible to rationalized models of work"* (1999, p. 10). By articulation work, they mean

> the work that gets things back 'on track' in the face of the unexpected, and modifies action to accommodate unanticipated contingencies...The support of articulation work…means developing a subtle and thorough analysis of the politics and culture of the work to be supported, one which distinguishes the routine from the exceptional, and which does not violate contextual norms. (p. 10)

This concept of "articulation work" characterizes much of the work in teaching. It fits nicely with analyses of teaching that suggest that teaching is "uncertain" (McDonald, 1992), fraught with dilemmas (Lampert, 1985), and context-dependent. So much of teaching involves the unexpected and the unanticipated that this notion of "articulation work" is central rather than incidental to the work of teaching. It is precisely why the teacher needs to know unswervingly what constitutes the work that is to be supported, what is crucial and what is peripheral, since the uncertainties and the unexpected and the highly context-dependent are ever-present in teaching.

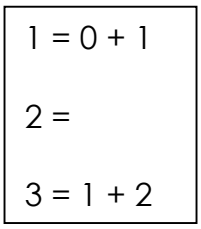
Consider a fourth grade classroom in which children have been working individually on the following math problem[5] for twenty minutes.

> Express each number, 1 through 25, as a sum of consecutive numbers.

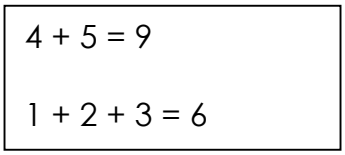
Any observer can see the teacher writing the problem on the chalkboard for students to copy and solve in their notebooks. The observer can also see the teacher circulating among children's desks and peering into their notebooks, sometimes asking a question or directing a child to focus on the task at hand. But the observer cannot see what conclusions the teacher draws from her movement around the classroom, or what

[5] From Marilyn Burns, *Math for Smarty Pants.*

she decides to do next, and on what basis. The teacher might notice that children have a wide range of solution paths for this problem. Some children have written all the numbers, one through twenty-five, on their papers in a single column, and are working through each problem in order.



Other children have started to write number sentences with consecutive numbers using whatever numbers come to mind.



A fair number of children ask what consecutive numbers are, and then record several false starts. They seem to be confused about what is meant to be consecutive, the sums or the addends. The teacher stops to ask the whole class what the word *consecutive* means. Then, she asks for a few children to give examples of sums of consecutive numbers. Those teaching moves are visible—but often unnoticed. They prepare the ground in which problem solving can proceed. The teacher here is pausing so that all children can have enough understanding of the terms of the problem that they can commence to work on it. Observers may not distinguish these moves from the other questions she poses: "Do you have a pencil?" or directives: "Emilia, to work now." One little boy asks whether zero can be counted as an addend, and if so, are the solutions 0 + 1 + 2 and 1 + 2 different from one another? A few children have found multiple solutions for one sum:

9 = 2 + 3 + 4; 4 + 5

In her mind, the teacher intends for children to consider several questions: First, is the simple addition of digits correct? Two, are multiple solutions possible for any of the numbers? If so, under what conditions? Three, is there a pattern to notice among the solutions and what does the pattern tell us about number composition? Four, are there numbers for which there are no solutions? Can we predict what these numbers will be beyond 25? The teacher's intentions in asking these questions are, of course, invisible to an observer. The logic that underlies them, and the mathematical sensibilities that drive her questions, are invisible as well. These are examples of the kind of work that is physically invisible and about which an observer can make only inferences based on outward behaviors. And they are crucial to the substance of teaching work.

Certainly the cognitive and relational demands that are unseen by the human eye comprise some of the hidden practices that expert teachers need to acquire. But as we saw in this moment of teaching, there are features that are actually discernable by the eye but that go unseen nevertheless.

The teacher notices that a few children have an idea of consecutive, and know how to write sums, but they are off-track. They are writing number sentences like this:

1 + 2 + 3 = 6
2 + 3 + 4 = 9
5 + 6 + 7 = 18

Those are correct number sentences, but they are not proper solutions to the problem at hand, which asks for consecutive sums to each number, 1-25, as a sum of consecutive numbers. The problem's intent is for children to do the following:

$1 = 0 + 1$

$2 =$

$3 = 1 + 2$

$4 =$

$5 = 2 + 3$

To get things back "on track," the teacher has to know what the "track" is and when one has gotten off from it. Here she would need to know that children have correctly used the idea of consecutive sums and would need to find a way to parlay that correct understanding into the children's correct process on this problem. She would need to know if it matters that the numbers 1-25 are worked on in order, or if children could profitably work on a random number, say 15, to see what consecutive number sums could express it. The teacher would need to know that the important outcome of work on this problem, besides practice with number facts, is the interesting set of patterns revealed in the sums: that the powers of 2 have no consecutive sums that produce them, the patterns one sees in consecutive strings for adjacent numbers or numbers at intervals, and the patterns of numbers of terms for each sum. She would need to ask a raft of questions, first to get children to produce the sums and array them in a way to see the patterns, and then to make some kind of sense of the patterns once displayed. A teacher might specifically

ask about sums for the numbers 9 and for 10, as strategic adjacent choices from which to build and observe such patterns. These are all visible acts in teaching, but noticing themand understanding their logic often eludes observers.

The children working on the consecutive sums problem reveal several things: that they are shaky knowing their single-digit math facts, that they aren't sure what consecutive means and where it applies in this problem, that they are not sure what constitutes a pattern, that they're not sure if zero should count as an addend, that they don't know what sense to make of the pattern once they see it, that several students aren't sure they should work on each number in counting order, and for each number whether they should guess different numbers or work in some systematic way. Knowing which thread is worth pursuing, how far to be off-track, and how to get things back on track (and knowing which track to be on) is not uncomplicated. It constitutes the heart of teaching work.

Strauss (1998) suggests a model of project work in which work projects can be mapped against the continua of routine-nonroutine and simple-complex.

	Simple	Complex
Routine		
Nonroutine		

This matrix helps us understand that simple work in teaching is more likely to be "visible" in the sense that I use the term in this study. If a teaching act demands little interpretive effort by an observer, it is more likely to be "seen." So for example, consider the teaching work of the consecutive sums problem in the simple-routine matrix. We can

notice a teacher's routine for writing the problem for the day's lesson on the chalkboard for children to copy and begin working on, and we understand its meaning without much interpretive effort. Similarly, the simple non-routine task of composing a question in response to a child's mistake on this problem to get the child "back on track" may be straightforward in interpretation. But routine-complex teaching acts can be less readily meaningful. How the teacher makes sense of children's initial efforts on the consecutive sums problem, the mental notes that follow, and how she appraises what her students need as a result, is less available to the eye. This is, nevertheless, a central routine in teaching work. An observer can make sense of other simple teaching acts, even if they are nonroutine. Thus, the ready simple meaning of an act is key to its visibility. Complexity shrouds a teaching act in darkness, and this is especially true for complex-nonroutine teaching. Imagine the complex-nonroutine teaching that is involved in including a child who habitually reverses numbers and letters in working on mathematics problems. Without many overt indicators, the teacher modifies tasks and behavior to be responsive to learning issues that are themselves not physically evident. These modifications and behaviors take different forms regularly. An observer would be hard-pressed to make sense and "see" all that the teacher is doing in this kind of instruction. (And such nonroutine complex work is "routine" for teachers!)

Joyce Fletcher (1999) documents the features of work in a design engineering department of a large multinational corporation that are typically "invisible" to managers and workers both. The "invisible work" that Fletcher documents would belong in the fourth category in Nardi and Engeström's schema above, "the informal work processes that are not part of anybody's job description but which are crucial for the collective

function of the workplace." Among the design engineering teams that she studied, Fletcher found that "no one liked to spend time adopting, adapting, or reiterating another person's solution. It was inventing something unique, different, and singularly yours that was considered fun and worthwhile. Anything else was seen as not real engineering" (p. 90). Fletcher's analysis surfaced those domains of work that were not considered "real engineering." She found entire categories of work crucial for "real engineering" were neither valued nor recognized in the firm's image of work. Fletcher refers to these categories of work as "disappeared."[6] One example is what she terms "preserving."

> In practice this meant doing "whatever it takes" to ensure the health and well-being of the project even if that meant putting aside one's personal agenda or sacrificing some symbols of status or hierarchy. (p. 91)

Another such practice she calls "mutual empowering," "voluntarily helping others achieve" (p. 95). A third disappeared practice that Fletcher found in the engineering division she names "self-achieving," which she defines as seeking growth and achievement through connection to others (p. 98). The fourth disappeared practice Fletcher names "creating team," the efforts to enhance group life or collective achievement" (p. 102).

In the context of the engineering division that Fletcher studied, she found that these work practices were "disappeared" by an institutional and social narrative antithetical to these practices. She found that these practices were "disappeared" by a

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[6] "The transitive use of the verb 'to disappear' is used to convey agency and make clear a distinction between being invisible and getting disappeared. Although awkward, I could find no better way to convey the sense that the behavior in question is not simply invisible or behind the scenes. Instead, it is *acted upon* by a system of practices, norms, and common understandings that suppress its impact and contribution." (Fletcher, 1999, p. 141)

number of categories of action: misinterpreting the intention, limits of language, and social construction of gendered roles (p. 104).

Jacques (1993) has analyzed the aspects of nursing practice that are not commonly articulated in any of the descriptions of nursing work but are nevertheless vital to the success of the work. Jacques focuses on the caring work so central to nursing, but virtually unrecognized as *work.* He notes that "the language associated with caring is often sentimentalized and conceptualized as selfless giving, motivated by love or altruism, *the very antithesis of work*" (p. 8, emphasis added).

Bowker and Star (1999) analyzed an effort by nursing scientists at the University of Iowa to classify nursing interventions. The *Nursing Intervention Classification* is an attempt to catalogue the work nurses do day to day.

> Caring work such as calming and educating patients, usually done by nurses, often cuts across specific medical diagnostic categories. The NIC investigators use their list of interventions in order to make visible and legitimate the work that nurses do. The idea is that it will be used to compare work across hospitals, specialties and geographical areas, and to build objective research measures for the outcomes…Before NIC, much nursing work was invisible to the medical record. As one nurse poignantly said, "we were just thrown in with the cost of the room." Another said, "I am not a bed!" The traditional, quintessential nurse would be ever-present, caregiving, and helpful—but not a part of the formal patient-doctor information structure. Of course, this invisibility is bound up with traditional gender roles, as with librarians, social workers and primary school teachers. (p. 20)

The *Nursing Intervention Classification* shows the kind of shared professional language that exists in nursing. No such shared language exists for teaching, and the profession is far from being able to classify teaching interventions into a taxonomy in the way that the NIC has, where nursing interventions are classified into six domains and 26 classes. The lack of shared professional language for significant aspects of teaching work, or even the recognition of such aspects, contributes to the invisible nature of this work.

Suchman (1995) has pointed out that this has advantages and disadvantages. On the one hand, making practices visible allows for novices to learn them and for practitioners in general to talk about them and to value them. On the other hand, to the extent that practices are labeled and recognized, they can be required and quantified, potentially impinging on the discretionary judgment of practitioners.

> Public sphere attributes, such as rationality, cognitive complexity, and abstract thinking, are often absent from commonsense definitions of work in the private sphere. By the same token, private sphere attributes, such as emotionality, caring, and community, are often invisible in commonsense definitions of work and competence in the public sphere. (Fletcher, p. 166)

Women's work gets "disappeared"

Patriarchy as a social structure is a significant player in the creation and maintenance of invisibility in teaching work. We know from multiple contexts that work typically associated with women has historically been erased or "disappeared" (Acker, 1992; Fletcher, 1999; Star, 1991). Like nursing and social work, teaching has been dominated by women. And, like nursing and social work, significant portions of the work in elementary teaching involve caregiving. As Noddings notes, these aspects of teaching work garner relatively little attention.

> To suppose, for example, that attention to affective needs necessarily implies less time for arithmetic is simply a mistake. Such tasks can be accomplished simultaneously, but the one is undertaken in light of the other…Our guiding principles for teaching arithmetic, or any other subject, are derived from our primary concern for the persons whom we teach, and methods of teaching are chosen in consonance with these derived principles….This way of thinking and speaking has almost disappeared from formal educational discourse. It occurs on the fringes of the educational community, in almost embarrassed whispers. (Noddings 1986, p. 499)

This association with what has traditionally been in the domain of "women's work" has not elevated or emphasized the status of such work.

The gendered nature of this split means that "real" work is conflated with the masculine, and work associated with the idealized feminine is both silenced and devalued. To return to the study of nursing, Jacques suggested that there is tension between work that is valued in a particular culture of expertise and the kind of caring practices that are central and untheorized in nursing. This analysis seems relevant to teaching as well. "Within our time and culture, professionalism is the path to occupational recognition, but professional recognition implies a very specific relationship to knowledge" (Jacques, p. 5). Jacques notes that the tasks of nursing that are visible are often those that are quantifiable, and that caring work can not be captured in this way. In the work of teaching, quantifiable measures are also primary: test results, written work, displays of concrete artifacts from classroom work. Caring work escapes such measures. Although teachers' job descriptions and the associated criteria for excellent performance obscure the relational aspects of the work, it is those relational aspects that constitute the medium in which learning is transacted. Ironically, it is often the relational dimensions of teaching that live on the minds of students years later.

Occupational hazards

The "blooming buzz" of the classroom

Classrooms are busy places. In the classroom lesson described earlier, the teacher's attention flits from a single child's work on the problem at hand, to the monitoring of the whole group's purposefulness, to considering the validity of the solutions offered and how the class discussion might best proceed, to the provision of a sharpened pencil, to the worry about a child who wasn't feeling well earlier. And this is not anomalous in classroom life. In teaching, the eye is drawn to so many different and competing issues that it is challenging to track on one for any significant amount of time

or in any depth. The result is a fleeting treatment of complex domains of practice, which is, by necessity, the standard mode of operation in most classrooms. Knowing the subject matter for each of all the elementary subjects in ways that are substantive, that can be represented for multiple kinds of learners, and in ways that connect with children's prior knowledge and what they are poised to learn in future grades, is daunting for any teacher. That is compounded by the press to know each child in depth, to appreciate strengths and compensate for areas of weakness, to design instruction that matches each child's unique circumstances while answering the needs of a group. Simply focusing the attention and harnessing the behavior of a large group of young children towards purposeful and productive learning is by itself a huge enterprise for most mortals. Still another domain is the interaction with the world outside the classroom—the parents, the community, the other teachers in the building, and the social and communal forces at play. Teachers know that their jobs require that they function competently in all these domains and more, but must settle for juggling all of them and in seemingly superficial ways. Because the teacher has all her charges arrayed in front of her simultaneously, all day, every day, her attention darts between the domains—which precludes any prolonged or systematic study of any one of them. What Brown (1992) has called the "blooming buzz" of classroom life mutes the ability to perceive and apprehend in an articulate fashion.

Lampert (2001) presents what she calls an "elaborated model of teaching practice" that conveys the complexity of instruction. The model itself is so complex that it is difficult to summarize it here, but some excerpt may give the reader a taste. Lampert lists the "problems every schoolteacher needs to address: setting up the room and making a schedule, planning lessons, working with students while students work independently

or in small groups, instructing the whole class at once, linking lessons over time, covering the curriculum, helping students get motivated to study, assessing whether progress is being made, managing diversity, and bringing the year to a close" (p. 423). But she elaborates by including other facets of teaching practice that are not taken up by usual models: "In the classroom, both social relationships and relationships with content have a history and project into future encounters" (p. 425). "Actions taken by the teacher in relation to individuals and groups are thus continuous, not only with what happens immediately prior, but with the entire history of relationships with all of the students in a class and all of the curriculum, across however many lessons the class has shared" (p. 428).

> To do the work of teaching, the teacher in the classroom also needs to do something akin to zooming and zooming out, acting simultaneously in both "the big picture," across time and across relationships, and in moment-by-moment interactions with individual students. To solve the problems of teaching "this content" and teaching it *now*, as well as building up ideas over time, to teach "this student" as well as every other student, the teacher must be constantly readjusting the lens through which she sees both students and content. The readjustment is not just about multiple levels of *seeing,* however. The teacher's *actions* must zoom in and out, from individuals to groups and back again, from the whole class to a pair of students who disagree and back again, from constructing a drawing on the chalkboard to constructing a whole unit of instruction and back again. These actions must be, at the same time, both narrowly convergent and widely panoramic, and everything in between. And, they must often converge on more than one focal point (p. 430).

And, as Lampert adds, she has identified only a few of the many relationships and complications in teaching practice. With so many facets to focus on, it is little wonder that teachers simply don't "see" all that is in front of them.

Uncertainty in teaching

> Real teaching…happens inside a wild triangle of relations---among teacher, students, subject—and the points of this triangle shift continuously. What shall I teach amid all that I might teach? How can I grasp it myself so that my grasping

> may enable theirs? What are they thinking and feeling—toward me, toward each other, toward the thing I am trying to teach? How near should I come, how far off should I stay? How much clutch, how much gas?
> Inside the triangle, clear evidence is very rare. Snarls and smiles mix disconcertingly. Right answers fad to wrong, and vice versa: a matter of interpretation, of how one construes a gesture or an attitude, of whether one thinks the moment demands more criticism or more encouragement, of how much energy one has to believe in teaching's effectiveness. (McDonald, 1992, p. 1)

Lortie's study of teaching (1975) details a number of factors that contribute to teaching's invisible status. Lortie devotes an entire chapter to the uncertainties inherent in teaching work. In sum, says Lortie, "the teacher's craft… is marked by the absence of concrete models for emulation, unclear lines of influence, multiple and controversial criteria, ambiguity about assessment timing, and instability in the product" (Lortie, p. 136).

Lortie notes that the work processes and the products of teaching are difficult to measure. Teaching is assessed by multiple and often competing criteria, so for example, the teacher working on the math problem of expressing each of the numbers 1-25 as a sum of two or more consecutive numbers may mine the content in great depth and pursue important mathematical concepts but may lose the interest and control of a large group of her students. As Lortie writes, "Breadth of purpose means that teaching performances will be judged in terms of moral, aesthetic, and scientific values all at once: But what *is* good or beautiful or true? General socialization can be free of controversy only in societies which are marked by an extremely high degree of value consensus" (p. 136).

It is also unclear *when* a teacher is to appraise the success of her efforts. At the end of the class period, few children have solved the consecutive sums problem completely, and even fewer have articulated the pattern present in the solutions and the explanation for such a pattern. Should the teacher conclude that the lesson was a flop?

Perhaps a few more class periods would yield more correct, complete answers to this problem. It could be years before a teacher could know whether her efforts made some difference—and then it would be difficult to attribute a child's strengths or knowledge with any degree of certitude to a single teacher's efforts. Children change over time, and pinpointing the decisive factor that accounts for such change is daunting. Even the tests that teachers design to monitor student learning give teachers only partial information regarding the progress of their students. In the face of so much uncertainty, it is unclear where teachers should train their focus. If what matters in instruction is ill-defined, then the significant features of teaching practice are ill-defined as well. This too contributes to the invisibility of teaching practice.

The relationship between disciplinary knowledge and school subjects

The diet of academic subjects as they are taught in school often holds little obvious relationship with the disciplinary knowledge bases from which the school subjects are derived. Consider the mathematics problem discussed previously. On its surface, this problem has to do with adding small numbers. It could potentially provide a good deal of practice in estimation, in extending patterns, and in addition calculations. But hidden from view, and unperceived by teachers, are the disciplinary virtues latent in such a problem. The problem could be instructive in fundamental notions of number theory, since the sums for which there are no solutions turn out, remarkably, to be exactly the powers of two. To reason through why powers of two cannot be expressed as sums of consecutive numbers would take the teacher and her students into interesting mathematical territory with principles of number theory that would extend far beyond this particular problem. But such treatment of this problem is rarely available to the teacher,

and does not appear as a learning goal in most accounts of essential mathematics learning for elementary school students. School subject matter is often distant from the disciplinary structures that produced it. Schwab (1978) wrote that

> curricular practice of the past few decades has tended to such a substitutive practice. Because structures were not generally accessible for study, it became easy and habitual to treat the fruits of disciplines as self-evidently whatever we thought they were. Scientific conclusions were treated as a true report of the indubitably significant matters of the past. Similar but more various dogmas were imposed on the novel, the drama, and the lyric poem. (p. 242)

Teachers set their sights on the measurable products of learning distant from the disciplinary structures of inquiry (or, as Schwab preferred, *enquiry*) that produced them. School learning largely consists of memorizing what Schwab calls the "fruits of disciplines" disjunctive of the structure of the disciplines themselves. This disjunction is another source of invisibility in teaching.

Teaching work is predominantly experiential

This is a theme that we will revisit in the next chapter, but it is yet another vagary of teaching that renders the practice invisible. Unlike other professions, most teaching work occurs in real-time, "live," in the interaction with students. More than other professions, teachers have little time to reflect on their actions; indeed, nearly all reflection that goes on has to take place *while teaching.* Lived experience is hard to examine as it occurs, and, as we discussed earlier, teaching occurs mostly outside the presence of other professionals so it is unobserved.

The experiential nature of teaching demands a presentation of a public self at the same time that it demands attentiveness to others. Much of this interaction leaves no trace and is therefore difficult to examine both during and afterwards. What is left to appraise? As any teacher can tell you, the written student work generated from a full hour of

intense reading or class discussion is hardly a complete record of all that has transpired. Yet is it frequently the only record of instruction that remains. In other words, that period of instruction virtually vanishes once it has concluded.

Teachers work in isolation

Teachers also teach in isolation one from the other. Surrounded by students though they may be, teachers are alone in terms of professional peers. Teachers are not practiced in watching others teach, nor is it common to be watched when one teaches. Many teachers will say that they teach quite differently when they are being watched, the implication being that their "normal" mode of teaching is when they teach with no other adult in the room. In this sense, teaching is visible but there is no one there to see it. (If a tree falls in the woods…)

This reality of teaching shrouds practice from public discussion and appraisal among colleagues. The isolation creates a paucity of shared conceptualizations and vocabulary with which to discuss the work. This constrains the development of collegiality centered on important features of teaching, since there is no shared experience of practice and little common language with which to discuss it. Teachers see few images of teaching other than their own, and even their own teaching is viewed through their own eyes as it happens, without the remove of time, distance, and perspective that observation permits, in contrast with direct experience.

Up until this point, we have considered the vagaries of teaching that account for its invisibility. Now we turn to another set of reasons that explains what renders teaching invisible, namely, the frames of reference that one brings to seeing teaching work.

Frames of reference: Familiarity

Earlier we looked at how isolation of teachers one from another contributes to the invisibility of teaching practice. Ironically, we now consider the antithesis: the fact that teachers have watched teaching their whole lives. Because adults have spent many years observing teaching as students, teachers bring to their professional training a highly developed view of teaching before their formal programs of study even begin. This "apprenticeship of observation" (Lortie, 1975) breeds a kind of familiarity that, while useful in some ways to the induction of teachers, serves as an obstacle to seeing particular aspects of teaching practice. The work is thought to be commonsense and straightforward; beginning teachers start out teaching by mimicking the images they remember from their own school days. Teaching, in Lortie's analysis, is perceived as easy and obvious work; 90% of the teachers in his sample expected teaching to be easier than it turned out to be once they began working. From their "apprenticeship of observation," teachers see the overt actions of teaching but without the analytical lenses or appreciation for their underlying educational foundations. Furthermore, this prolonged exposure to teachers as a child creates a varied history in schooling among prospective teachers that they bring to their training. As Lortie writes, "The mind of an education student is not a blank awaiting inscription" (p. 66). Education students come to their teacher education programs with a vast and varied body of experience and opinion based on their own educational histories. These histories form a set of lenses through which certain teaching activities will be seen --and others unseen.

The prospective teacher who is accustomed to mathematics instruction in the form of, say, timed tests for memorizing single-digit number facts will perhaps not "see" the

opportunity for practicing single-digit addition facts that comes up in the context of the problem we discussed earlier:

Express each number, 1 through 25, as a sum of consecutive numbers.

The practice with number facts that this problem occasions might not be obvious if one's frame of reference puts such problems outside the realm of substantive, everyday mathematics instruction. Instead of seeing this problem as containing extensive practice of single-digit addition facts, a teacher might place it in the category of an amusement that does not accomplish her goals of helping children learn their math facts. If a prospective teacher thinks of learning math facts by means of competitive timed tests on a full page of sums, she may not "see" this mathematics problem in terms of drill and practice for single digit addition facts, nor would she necessarily appreciate the mathematical value of a class discussion of possible solutions and their validity. If what she expects to see in a mathematics lesson is the teacher providing and confirming correct answers, for example, then the discussion around this problem detailed earlier will not strike her as "teaching." The lenses she brings with her from her own experience in school obscure what she can apprehend in this mathematics lesson.

Familiarity also inhibits the kind of study and analysis that would produce thoughtful teaching by its rendering of teaching practice as unremarkable. Consider our earlier discussion of "frames" as developed by Goffman. When teaching is seen to be a set of simple and commonplace actions, the prospective teacher does not look for complexity or a kind of ends-means analysis that underlies the actions so readily visible to the observer. Activity in that realm of teaching work remains unseen. This is not unlike the kind of "backstage" work that Goffman refers to in his work *Frame Analysis* (1974).

In this work, Goffman describes the work that has to go on in the kitchen to produce a meal in a restaurant. The behind-the-scenes work is often hard to appreciate when one sees only the finished product. This holds for teaching as well: the polished performance of a veteran teacher belies the great complexity and rehearsal that underlies the work. The problem in teaching is that there is no physical "backstage" to view. The work itself comprises both cognitive acts that are physically invisible, and relational work that is physically present but difficult to pinpoint. These are easily obscured by frames of reference that exclude such acts from the analysis of teaching work.

Teachers' training contributes to invisibility

The theory-practice divide has plagued teacher education for years. In recent history, teacher education has veered to the academic, seeking respectability and a knowledge base in the halls of the great universities (Clifford & Guthrie, 1986; Labaree, 2004). Since the decline of normal schools[7], the object of study in education schools has not been the practice of teaching; rather, teacher preparation in university settings typically consists of three components: content courses such as history and mathematics, methods courses that often draw on academic disciplines such as psychology and sociology for their substance, and a field placement. Teachers are left to integrate all three components into usable knowledge for teaching children. This contributes to the invisibility of teaching because teacher educators themselves leave practice out of the picture. What teachers actually *do* in classrooms is of little interest to the university instructor; instead, what is valued in many teacher education programs is knowledge in

[7] "Normal schools" were the post-graduate institutions where teacher education took place before teacher education was moved to universities.

the form of academic writing. This orientation "disappears" the work of practice, to borrow Joyce Fletcher's use of this term.

Central questions for the dissertation and how they will be studied

This dissertation begins with the claim that crucial acts in teaching are invisible. By "invisible" here, I do not refer to the features of teaching that have no physical trace. Instead, I point to acts of teaching that are physically present but that go unnoticed nevertheless. In this chapter, I presented a constellation of factors that conspire to make such acts of teaching invisible. That fundamental features of teaching are invisible makes teaching hard to learn. And these features are not invisible to observers only; even experienced teachers find it difficult to be conscious of, intentional about, and articulate regarding some of their most skillful actions. Thus, fundamental acts of teaching are invisible to expert practitioners, and this maintains the hiddenness of practice. Professional education is hobbled by invisibility at all these levels.

The central questions of my dissertation, then, are three:

What would it take to make features of teaching more visible in the education of teachers?

What do student teachers notice and do if such features of teaching are made more visible?

What can we learn from an effort to make teaching more visible about the invisibility of the practice and about implications for teacher education generally?

To pursue these questions, I designed an experiment in preservice teacher education intended to study invisibility and to learn what is involved in making invisible features of teaching more visible. I used key elements and principles of Japanese lesson study to design this intervention for preservice teacher learning. Japanese lesson study is

described in detail in Chapter 2, where I also discuss why I thought Japanese lesson study might be a source for developing a promising intervention for making features of teaching more visible. Chapter 3 provides a rationale for the research design in this study and the methods used to investigate these three central questions. In Chapter 4, I describe the intervention itself and its use in a preservice mathematics education class. In Chapter 5, I discuss what the preservice students noticed and did in the context of this intervention. Chapter 6 considers conclusions that can be drawn from this work. In this next chapter, we turn to Japanese lesson study and why this pedagogical structure seemed to offer promising elements for designing an intervention to make teaching visible in a preservice teacher education course.

Chapter 2

Instructional Designs to Make Practice Visible

It was in reading *The Teaching Gap* by James Stigler and James Hiebert (1999) that I first learned about Japanese lesson study. Stigler and Hiebert include lesson study as one of a number of professional development interventions in Japan known as *kounaikenshuu*, the continuous process of school-based professional development for teachers (p. 110). Lesson study struck me as an intervention that might address some of the persistent challenges in teacher education in the United States. In this chapter, I describe these challenges, and then turn to the qualities of lesson study that seemed responsive to such challenges. I argue that lesson study aligns with enduring challenges present in the nature of teaching work. It is grounded in practice and uses experience from particular situations to build usable knowledge.

In *The Teaching Gap*, Stigler and Hiebert describe the steps of a lesson study. Although I describe the steps of lesson study elsewhere in greater detail, I review them here briefly. A group of teachers identifies a problem from practice that they would like to like to make progress on. Over an extended period of time—several months to a year—the teachers plan a lesson to address this problem, bringing in other professionals as needed. One member of the group then teaches the lesson while the others look on.

The group reflects afterwards on the teaching of the lesson and its outcomes. Based on these reflections, the group revises the lesson. Then the members of the group all teach the revised lesson. Again, the group reflects on the lesson, and finally publishes the results of their extended inquiry.

I divide this chapter into two sections: in the first, I review some of the enduring challenges in teacher education. In the second section, I consider how lesson study might address these challenges. I do so in part to explain why I used key features of lesson study to design a pedagogical intervention in preservice teacher education that I hoped would bring students "closer to practice" to make teaching more visible, and to help me better understand invisibility in teaching.

The perennial challenges of teacher education

When I first read about lesson study in *The Teaching Gap*, its structure seemed to provide a response to some of the enduring challenges of teacher education. The history of teacher education in this country is a virtual catalog of recurring problems in professional education. The following quotations give a sense of how teacher education is viewed, now and over time: "In teaching…it would be hard to demonstrate that even today there is any body of knowledge about pedagogy that can be transmitted from old-timers to apprentices" (Jencks & Riesman, 1977, p. 203). And "…no way has been found to record and crystallize teaching for the benefit of teachers" (Lortie, 1975, p. 58). Further, "education as an academic discipline has poor credentials. Relying on other fields, especially psychology, for its principal substance, it has not yet developed a corpus of knowledge and technique of sufficient scope and power to warrant the field's being given full academic status" (Koerner, 1963, p. 17).

Such criticisms of teacher education were legion, and little has changed since Koerner's lament from 1963. The poverty of the enterprise is attributed to a constellation of factors that feed one another: the poor quality of the students who enter teaching, the teachers who teach them, the underdeveloped curriculum they are taught, and the setting in which this all takes place.

Let me elaborate. Teacher education students are thought to be drawn heavily from the bottom quartile of all college graduates; they often enter teaching because it is one of the few avenues open to them or because they believe it will be easy work (Lortie 1975; Lanier with Little, 1986; Cochran-Smith & Zeichner, 2005). Those who teach them are often themselves the least academically able of all their faculty peers. As Koerner says, "the inferior intellectual quality of the Education faculty is *the* fundamental limitation of the field, and will remain so, in my judgment, for some time to come" (1963, p. 17, emphasis in the original). The sheer numbers of teachers needed to educate a population almost by definition ensures its lack of elitism. If one teacher is required for every thirty children, the teaching force must be massive—and therefore is unlikely to be drawn from a small elite. Teachers' salaries and their diminished status mean that few of the "best and the brightest" will choose teaching as a career. The undifferentiated career path, the history of normal schools as training grounds for teachers, all contribute to the difficulties in attracting and retaining good teachers. Good teachers will have to come from these quarters—but it will require effective teacher education, which seems to elude us. Consider the fact that nurses are drawn from the same populations, and face similar structural obstacles, yet nurses are ably trained.

Education as an academic discipline is underdeveloped; it is thought to be a derivative field, drawing from a multitude of other disciplines and lacking any body or substance of its own. Coursework in education is widely reputed to be irrelevant, "'too theoretical'" and of "'scant intellectual substance'" (Lortie, 1975, p. 69). More recent studies confirm this finding (see, for example, Clift & Brady, 2005).

This familiar analysis of all that is wrong with teacher education locates the problems in four domains: the students who will become teachers, their instructors in teacher education, the content or field of study, and the environment in which all this is situated. Lanier with Little (1986) used Schwab's "commonplaces" of education (1975) to parse what is wrong with teacher education. Efforts to improve teacher education are typically aimed at one or more of the commonplaces—for example, a common reform effort seeks to improve teaching by recruiting more elite candidates for teacher education programs based on standard measures of academic achievement or related professional expertise. Other reform efforts seek to improve education by enriching teacher education with more academically substantive coursework. I propose an alternative analysis, one that does not approach teacher education piecemeal by addressing its constituent parts: the students, the instructors, the content, the environment. This parsing misses the totality of practice. In the last chapter, I argued that teacher education has struggled because the work of teaching as an integrated whole is not sufficiently understood, and that efforts in teacher education fail to engage the experience of teaching practice. A well-conceived teacher education program recognizes the nature of teaching work and is designed accordingly.

The nature of teaching work

In this section, I consider the nature of the work itself, particularly the elements that are typically underserved by teacher education. In the last chapter I argued that facets of teaching, as in a number of other professional practices, are invisible. I provided cognitive, social, and occupational reasons that make teaching work so hard to perceive. Here I refine that argument a bit by considering the nature of teaching work itself. This augments our understanding for what makes teaching difficult to learn and why teacher education efforts often miss the mark.

The nature of practice in general

Teaching is a particular practice. It is a function of culture—that is, teaching is shaped by the culture in which it is located (Stigler & Hiebert, 1999). But teaching also transcends individual cultures and exists as a practice in its own right. It is a set of actions that one would recognize across time and place. An observer would very likely recognize what we call "teaching" whether it is in China, Germany, or Papua New Guinea, in the 5th century or the 21st. This fact in itself is a powerful argument for teaching as a coherent practice across time and place. It is this notion that leads me to a point I will elaborate shortly, namely, that teaching has its own internal logic of practice.

But first, consider the nature of practice in general. To do so, we turn to Andrew Pickering (1995), who has written about scientific practice. This affords a consideration of practice as a generic construct. Pickering refers to practice as a "mangle." One definition Pickering provides is the notion that "'practice' is the generic one around which all that follows is organized—practice as the work of cultural extension and transformation in time" (p. 4). In science, Pickering writes that "'practice' relates to

specific, repeatable sequences of activities on which scientists rely in their daily work" (p. 4). But he concludes that "*practices*, in my definition, *fall into the sphere of culture*" (emphasis in original). Pickering's definitions provide contours for thinking about practice in general, and apply to the practice of teaching in specific.

Practice has its own logic

Following the work of Bourdieu (1990), de Certeau (1984), and Pickering (1999), we learn that practice has its own internal logic. It is common to use disciplinary lenses to interpret the work of teaching—sociology, for example, or anthropology, or psychology. These frames bring features of teaching to the surface that are otherwise difficult to perceive. For example, when a child refuses to complete a task in class, psychological analyses of the individual have much offer to the teacher. Perhaps the student is fearful that she will fail the task, or she is reacting to another experience in her day. An anthropological stance offers another explanation: consider the elements of classroom culture that support or inhibit such as response. An anthropological lens might lead to considerations of discourse patterns among classroom actors, or the routines or "rituals" that seem to be in place in the classroom. Bourdieu's work suggests an alternative: that teaching has its own internal logic. It is, in this sense, its own discipline. There are patterns of behavior, sequences of action, expressions of agency that give teaching its own logic. The student who refuses to complete a task in class is operating within a logic of schooling and this internal logic might provide its own powerful lenses for understanding this act.

Bourdieu points out that one aspect of practice is its integral location *in time*, and that any analysis of practice or distance from it obliterates this. He writes:

> Practice unfolds in time and it has all the correlative properties, such as irreversibility, that synchronization destroys. Its temporal structure, that is, its rhythm, its tempo, and above all its directionality, is constitutive of its meaning. As with music, any manipulation of this structure, even a simple change in tempo, either acceleration or slowing down, subjects it to a destructuration that is irreducible to a simple change in an axis of reference. In short, because it is entirely immersed in the current of time, practice is inseparable from temporality, not only because it is played out in time, but also because it plays strategically with time and especially with tempo. (Bourdieu, 1990, p. 81)

He goes on to describe the aspect of urgency that is integral to practice:

> Urgency, which is rightly seen as one of the essential properties of practice, is the product of playing in the game and the presence in the future that it implies. One only has to stand outside the game, as the observer does, in order to sweep away the urgency, the appeals, the threats, the steps to be taken, which make up the real, really lived-in, world. (p. 82)

Nothing better captures one dimension of teaching practice than this description of urgency. Facing a classroom full of expectant, impulse-driven, curious children, one can be overcome by the sense of urgency that demands action in the moment. To be a teacher means to be required to respond to immediate and sometimes conflicting demands *right now.* In contrast, much of teacher education is conducted outside such demands, and this gives it a seeming lack of authenticity. The suspension of time and press for immediate action is what lends teacher education its sense of remove from the "real work" that teachers must do. Take, for example, a contemporary compendium of teacher education, *Studying Teacher Education* (Cochran-Smith & Zeichner, 2005). Chapter after chapter in this important volume describe how teacher education endeavors to teach teachers how to think—not to *do.* The lexicon there includes terms such as reflective practice, deliberation, habits of mind, practical judgment—all referents to thought, not action. This is predicated on the notion that thought will inform action. Let us take, for example, an exciting development in teacher education: the use of multimedia

records of practice (see, for example, Lampert & Ball, 1998). Such interventions succeed in part because they suspend the flow of time and the urgency that presses one to act without deliberation. Viewing a videotape of a lesson, teachers can hold a moment still in order to analyze, consider, reflect— indulgences that evade the teacher in real time. The tape can be rewound and shown again, another impossibility in the moment of practice. But this is also where videotape has its limitations. The same suspension of time that videotape affords is what makes it seem divorced from practice, since practice is a function of temporality. Videotape, discussions of practice from afar, literature discussions—indeed, most forms of professional development in teaching—fail to include this sense of urgency. That distance from the press of time allows for the kind of deliberative reflection that is difficult to achieve in the presence of a room full of children. It is necessary for the development of a reasoned, reflective stance towards teaching work.

But without returning to the urgency of the classroom moment, such professional development efforts feel unconsummated. If the urgency that is a function of time is indeed what Bourdieu called "an essential property of practice," then teacher education experiences, at least some of them, need to include that sense of urgency. One of the features of lesson study is that the research lesson provides this sense of time and urgency. Lesson study's apex is the research lesson, the actual teaching with real children in a chosen classroom. The planning beforehand is the lead, and the reflection and revision afterwards its denouement. That all elements build towards a publicly viewed live lesson anchors lesson study in what Pickering would call the "mangle of practice." Other instructional designs in teacher education may encompass the planning phase of

teaching, or the defining of the problem of practice. They may include reflection on a videotaped excerpt of classroom teaching, and suggested revisions. But the centerpiece of lesson study that lends it the time and urgency so integral to practice is the research lesson. This is where the fruits of reflection, deliberation, and practical judgment are reintroduced into the test of real-time work. In this sense, lesson study inquiry is driven by practice and the standards to which its outcomes are judged are practice-based.

Another "essential property of [teaching] practice" is the simultaneous presence of all one's cases. If urgency is a defining quality of teaching practice, the same may be said for the presence of so many bodies in the classroom. Teaching is unique in the fact that all the practitioner's cases must be tended to at once, differentially and simultaneously. The feel of authenticity for teaching practice, then, involves contending with all one's students (cases) at the same time. Teacher education activities so necessary to developing deliberative, practical judgment slow down the dizzying flow of events in teaching by focusing on a single element at a time: a single student, a single dimension (subject matter content, use of language, socioeconomic issues), a single perspective (participation structures), and unless this singular focus is somehow brought back to interweave with the myriad complexities of teaching practice, such tasks seem irrelevant to the "real" work that teachers do.

Teaching practice is iterative

Pickering (1999), in his analysis of scientific practice, uses the metaphor of *tuning* to describe what I call its iterative nature.

> As active, intentional beings, scientists tentatively construct some new machine. They then adopt a passive role, monitoring the performance of the machine to see whatever capture of material agency it might affect. Symmetrically, this period of human passivity is the period in which material agency actively manifests itself.

> Does the machine perform as intended? Has an intended capture of agency been effected? Typically the answer is no, in which case the response is another reversal of roles: human agency is once more active in a revision of modeling vectors, followed by another bout of human passivity and material performance, and so on. (p. 21)

For teachers, lessons function as the machine in Pickering's example. Teachers construct some new way to present an idea, and then monitor its performance with children. Lesson study as a practice mirrors the iterative nature of teaching. Just as teaching begins with a problem that a teacher wants to solve—how to motivate a certain child, how to represent a new idea in mathematics, how to help a child learn some abstract concept—lesson study begins with such a question. Over time, and in collaboration with others, teachers design a lesson that is meant to make headway on such a problem. Methods are considered and discarded, experts are called upon, libraries of teaching materials consulted. Lessons are drafted, launched, observed, revised, observed again, revised again. This mimics the dialectic Pickering writes about, what he calls the "dance of agency" where scientists design actively, observe passively, and design again in response to what is observed. The steps of lesson study follow this "dance of agency" as well. The cycle of lesson study begins from a problem of practice, moves to planning, then teaching, observation, reflection, revision, teaching, reflection again.

Lesson as the unit of analysis

Carter (1993) has argued that teachers think in stories. She cites Gundmundsdottir, who claims that "the curriculum knowledge of experienced teachers is organized in narrative structures, that is, that teachers use story as a frame for organizing and integrating their content knowledge…. Through story, then, teachers transform knowledge of content into a form that plays itself out in the time and space of

classrooms" (p. 7). The present work follows the literature positing narrative as a deep cognitive structure that organizes thought (see, for example, Mishler, 1995). Here, I want to suggest more pointedly that teachers think in terms of *lessons*. Lessons are the unit of analysis for teachers: they chunk their planning, execution, and reflection in units—storied units, perhaps—that we would call lessons. A lesson can vary in length of time, but, like stories, lessons have a beginning, middle, and an end. They constitute some kind of meaningful whole in school life. Lesson study, the organization of ideas, exercises, knowledge, materials, time frames and the like in the unit of a lesson is therefore well-matched to the work of teaching and the ways that teachers think about it. We will return to this idea in Chapter 3.

Teaching is practiced in a cell-like structure

Lortie (1975) describes the cell-like structure of schooling. By this he meant that teachers are isolated one from another, and that they practice their craft in the absence of other practitioners. Individual style is celebrated; there is little consensus about how to teach or what counts as good teaching work. This impedes the growth of knowledge in teaching, since the prevalent ethic is: "To each his own."

Lesson study intervenes on the notion that teaching is a private affair. Teaching is, in lesson study, very much a public enterprise. Planning for a lesson is collaborative, and the actual teaching of the lesson is conducted in the presence of a roomful of colleagues. This is no small obstacle in a culture where the norm is for teaching to take place behind closed doors. We will return to this theme presently.

The primacy of experience in teaching work

Teaching work is characterized by the primacy of experience. All manner of readings, discussions, or written assignments in teacher preparation pale in comparison to the powerful place of experience. Teachers report that what they really learned in their teacher education programs was in field placements (see for example, Lortie, 1975). Experience is vivid, convincing, and interesting because it creates strong sensory images and feelings, and it is "real." This is, I believe, intrinsic to the work of teaching but reified and cemented by teacher preparation and induction.

A number of educational researchers have suggested that experience inhibits inference and judgment (Feiman-Nemser & Buchman, 1985; Buchmann & Schwille, 1993). Firsthand experience is imbued with emotions, and "emotions have no inherent connection to defensible thought" (Buchmann & Schwille, 1993, p. 36). This line of thinking guides teacher education to sidestep experience—i.e., field placements—altogether and instead learn only through non-experiential designs such as reading. But learning is our natural state, and we learn from everyday experiences just as we learn from reading texts, engaging in arguments, viewing visual works of art. That is, we learn all the time, just as we breathe (Smith, 1978). We observe, test hypotheses, entertain theories, notice patterns, draw conclusions, all the time. Like it or not, teachers are bound to learn something from experience. Whether one learns the instructor's intended lessons is, of course, a different story. But every experience entails some kind of learning. And teachers will eventually in their work need to be able to learn in the classroom from their experiences there. The question, therefore, is not how to suspend or break with experience in order to learn, but rather how to render experience educative. Since humans

make conjectures, test hypotheses, observe events, notice patterns, draw conclusions from their experiences, the task of teacher education is to frame or mediate or ready experience for interpretation linked to action. The mandate for teacher education is not to break with experience, but to frame experience in such a way that is educative.

Qualities of lesson study

Stigler and Hiebert propose five qualities of lesson study in their analysis. In this section I comment on each in relation to the enduring challenges of teacher education that I enumerated above. Teaching is not an extension of other academic disciplines, an application or a composite of them, although certainly the academic disciplines provide lenses through which to better understand the work of teaching and the work of the teacher online. Useable knowledge for teaching derives from practice itself with the illumination from other disciplines and ideas. Lesson study can be a venue for this knowledge development.

•"Lesson study is based on a long-term continuous improvement model" (Stigler & Hiebert, p. 121). Most professional development consists of single-session workshops sprinkled incoherently across a teacher's career. To illustrate, I list the professional development experiences from three years of my own teaching career: I attended a presentation from a psychologist on grief counseling for young children, a master kindergarten teacher's presentation on teaching Africa across the curriculum, three sessions on teaching writing, a weekend conference on innovations in mathematics teaching, a dinner and hands-on training playing Indonesian gamelan. The model is one where a jumble of disparate presentations over a period of years are meant to constitute professional learning. Nowhere in this model do we see a staged, coherent series of experiences that build one upon the other towards some targeted idea.

•"Lesson study maintains a constant focus on student learning" (Stigler & Hiebert, p. 121). Professional development rarely considers directly what children are learning. Teaching strategies or inspirational models imply children's learning, but rarely do teachers examine what children learn as a result of those strategies. Consider the list of professional development activities drawn from three years out of my own teaching career. None of them presented children's work or achievement, although admittedly there is in the back of everyone's mind an imagined sense of how children would fare. It is difficult to project what a particular group of children will learn from a certain teaching intervention. In lesson study, children's work is a focus of the lesson design, it is obviously present in the public lesson, and it is collected for teachers' analysis following the lesson.

•"Lesson study focuses on the direct improvement of teaching in context" (Stigler & Hiebert, p. 122). From scholarly studies of teacher education to popular media reports, teacher education is known to be too theoretical, divorced from the real work of teaching, and irrelevant for what teachers believe they need. "For decades, education schools have gravitated from the practical side of teaching, seduced by large ideas like 'building a caring learning community and culture' and 'advocating for social justice'… With the ambition of producing educators rather than technicians…schools have embraced a theoretical approach. But critics say that ill prepares teachers to function effectively in the classroom" (*New York Times*, Education Life, July 31, 2005, p. 24).

A similar observation to the one in this newspaper article is expressed in an article from a scholarly journal from twenty years before. In an article by Arthur Bolster (1983), he notes that "most research, especially that emanating from top-ranked schools of

education, construes teaching from a theoretical perspective that is incompatible with the perspective teachers must employ in thinking about their work" (p. 295). This same idea has been voiced repeatedly and over the decades, not only by researchers and journalists, but by teachers as well. Bolster continues in his article to describe precisely the kind of need that lesson study anticipates. He writes:

> Productive situational decisionmaking is the touchstone of the teaching craft. In the course of their work, competent teachers make an amazing number of decisions based on predictions about the probable effect of their actions on students' task accomplishment. When teachers are planning, these predictions are anticipatory and based largely on beliefs acquired from previous experience. In classroom sessions, the predictions are made more existentially through a process of giving and receiving cues. (p. 296)

Lesson study includes both the planning and the classroom sessions that Bolster mentions. Thus it has the potential to draw upon the theory that education researchers want to infuse practice but in a way that seems relevant to practice in the moment. Since the focus of lesson study is "the direct improvement of teaching in context," this theory-practice divide may be diminished.

•"Lesson study is collaborative" (p. 123). Teaching is surprisingly lonely work. Although teachers spend their days in the constant presence of 30 other people, they are isolated in terms of professional company. Their work is done mostly outside the view of other teachers.

The implications of this workplace environment have long been documented. One dimension of this regards the development of the profession: as we discussed earlier, teachers' isolation one from another inhibits the growth of shared professional norms, or even a vocabulary for talking about basic features of practice. Another dimension concerns individual teacher growth: teachers have little professional audience for their

work, and rarely view others teach beyond their student teaching experience. Still another dimension has to do with the epistemology that this loneliness breeds: physically separated one from another in their work, teachers are left to learn in classrooms on their own. Knowledge of teaching is therefore personal, private, and highly idiosyncratic. Lesson study offers an alternative to this arrangement.

•"Teachers who participate in lesson study see themselves as contributing to the development of knowledge about teaching as well as to their own professional development" (p. 125). There are long-standing tensions between practitioners and educational researchers about what is produced, and what counts as useful knowledge about and for teaching. One of the questions in educational research in general has been the extent to which it is used or relevant to teachers (Floden & Klinzig, 1990). Lampert and Clark (1990) have suggested that much of educational research is not used by teachers or teacher educators, or used in ways that degrade the professionalism of teachers, because claims of generalizable findings, or tendencies, do not speak to the highly local, context-specific conditions under which teachers work. They assert that "the way in which teachers acquire and use knowledge is contextual, interactive, and speculative" (1990, p. 21). In this light, the use of research findings that are purported to be generalizable may not be the most accessible or useful for classroom teachers. In their view, knowledge about teaching is best acquired situated in practice, and the presentation of general principles derived from more conventional educational research "will be converted into technical prescriptions that impede the flexibility teaching requires and degrade teachers' professionalism" (Floden & Klinzig, p. 16). Lampert and Clark (1986) have also claimed that research situated in practice can capture the complexity and

uncertainty of classroom work in ways more difficult to achieve with study designs that isolate and control variables.

Goldenberg and Gallimore (1991) take this point further:

> Understanding how local cultures work...depends on direct experience of them. To profit from such direct experience requires the painstaking collection and interpretation of local information, in search of points at which propositional knowledge is relevant and meaningful. This is another way of saying that locally valid experience and observation is prior to, and the foundation of, valid propositional knowledge. (p. 12)

Lesson study steps into this breach. Its project is to employ simultaneously the "dynamic interplay of research and local knowledge" to which Goldenberg and Gallimore refer.

When practice is the testing ground for knowledge about teaching, a multiplicity of sources and forms of knowledge are admissible. As we will read in more detail in the Chapter 3, Schwab's (1972) orientation regarding the need for multiple and even conflicting perspectives is necessary in the work on real problems of practice. Schwab argues that it is only outside of practice that we have the luxury to maintain theoretical purity.

The structures of lesson study provide opportunities for different kinds of knowledge about teaching to be drawn upon or developed. Research knowledge about teaching and learning is employed in the phase of lesson study when the public lesson is being planned. Lesson study groups cull findings from educational research in service of the lesson they are designing.

But lesson study also provides opportunities for teachers to generate knowledge about teaching and to share that knowledge through various pathways of dissemination. This constructs a role for teachers to be both consumers and producers of knowledge

about teaching, and casts different kinds of educational research as relevant and useful. In this sense, lesson study privileges no form or source of research on teaching. It functions as a holder for "teacher-research" and implicitly values multiple "ways of knowing" (Belenky, Clinchy, Goldberger & Tarule, 1986) about teaching.

These five qualities speak directly to some of the enduring challenges of teacher education in the United States. Common to all these qualities is the fact that the lesson study process is rooted in the experience of teaching. It provides opportunities for teachers to learn "in and from practice" (Ball & Cohen, 1999). What does this mean and why does it matter?

Framed and driven by problems of practice

The lesson study process begins with teachers formulating a problem to study drawn from their own practices. Schwab (1978) has referred to "practical problems" of teaching practice, pointing out that, unlike problems in theory, "practical problems…are never solved completely or once and for all" (p. 322). Lesson study can be thought to make use of what Schwab called "arts of eclectic" to make progress on problems in teaching. He described why problems of practice are not solved by pure theory:

> Theories borrowed from the behavioral sciences are marked by two other forbidding traits. Each of these sciences treats only a portion of the complex field from which educational problems arise, and, in the course of enquiry, the science isolates its treated portion from the portions treated in other behavioral sciences. Second, each behavioral science brings to bear on its treated portion not one but many principles of enquiry, each of which affords a different perspective and leads to a different treatment of its subject. Thus, pluralities of theory arise, no one member of a plurality complete, each member throwing its own useful light on the subject treated. (p. 323)

Teachers' planning of a lesson is likewise anchored in the specifics of teaching work, blending teachers' knowledge and experience with theory from relevant academic

and professional disciplines. Child psychology, research mathematics, philosophy and other disciplines are drawn upon in the planning of the lesson, but unlike other professional development efforts, these disciplines do not drive the lesson, but rather serve as resources for teaching and learning in the context of a single lesson designed around a real problem of practice. The lesson study group continues its investigation by trying out a lesson with children in the presence of other teachers. The teachers reflect on the outcomes of that lesson using teaching and learning as the criteria of reference. The iterative steps that follow, reflection, redesign, teaching, reflecting again, are also anchored in the practice of teaching as reference points, not some theoretical framework, policy document, or disciplinary lens, although all these may be woven into the teachers' appraisal and understanding of the lesson. Perhaps this seems obvious, that teaching and learning should be the frames of reference in lesson study or in professional development for teachers in general. Or it may seem circular, that the very object of improvement is its own standard for improvement. But modal teacher education experiences do not automatically take as starting point (or ending point) the realities of practice as a complex dynamic. More often, teacher education approaches the improvement of teaching piecemeal, where a single dimension of teaching work, or one relevant discipline, is addressed. So, for example, in preservice teacher education, students typically take courses that focus on social science disciplines meant to have applications in teaching generally. A common and very useful task for preservice teachers is to complete a "child study" in which they build a rich and detailed portrait of a single student. Through such an exercise, preservice students learn a great deal about a single child, possibly through the lens of a particular discipline or disciplines, such as psychology. What does the child

like to do in school? What are her strengths? What is her home life like and how does this play out in school? What motivates her and what does she find frustrating? etc. Such an exercise is undoubtedly useful and instructive. It leaves off, however, what all this means for instruction. What are the implications for this child's learning, and what kind of teaching moves would be appropriate? What instructional steps should be prescribed, and then how do they actually play out in the real life of this child? How would such instructional prescriptions fit with the instructional needs of other children who will be taught simultaneously? Without following through to actual teaching and observation of resulting learning for this child, and for all the children in the class, this exercise contributes to the pervasive feeling in preservice teacher education that its curriculum is far removed from the 'real work' that teachers do every day. Similarly, in inservice training, there are often single-session workshops treating either a new policy affecting teachers (Individual Education Plans for special education students) or a new technique (cooperative learning) or a new resource (a new mathematics textbook). These workshops are divorced from practice in their presentation and leave it to the teacher to apply to their work. Even long-term, discipline-rich professional development interventions such as that described by Grossman, Wineburg and Woolworth (2001) do not take practice as a point of departure. In this professional development effort, teachers gathered to read together in the fields of English and history over a period of years—satisfying the collaborative and long-term criteria offered by Stigler and Hiebert (1999). How teachers were to make use of this experience in practice, however, was left unspecified. Like other teacher education efforts, teachers' translations of such inputs into their practices are left for teachers to figure out on their own.

In contrast, the work of lesson study is shaped by problems of practice, and ultimately returns to practice as the site for its field-testing. Problems of practice are lesson study's point of departure, and practice is its endpoint as well. The "text" of the professional development experience is a problem from practice. The work on this problem, inside the specifics of practice, constitutes the professional development experience throughout. And by "inside the specifics of practice," I do not mean that the work in lesson study occurs only inside classrooms of children. The planning of the research lesson is not physically located inside a classroom of children. By "inside" here I mean that the work is intellectually "inside" the work of teaching in the sense that it is situated in the dynamics of classroom life. It is an example of what Ball and Cohen have called "learning in and from practice" (1999).

Cognitive inquiry into the work of teaching

"Learning in and from practice" can be thought of as cognitive inquiry into the work of teaching. This cognitive inquiry into the work of teaching can be in the physical presence or absence of classrooms of children. When, for example, a teacher reads Jackson's *Life in Classrooms* (1968/1990) and in her mind's eye sees herself monitoring children's work as Jackson describes, this would qualify as an experience situated in the work of teaching. If she mentally tinkers with having children suggest their own topics for social studies reports, this would also be an experience grounded in practice. As she asks children questions and notices that her questioning falls into the patterns described by Heath (1983), this is also experience situated in the work of teaching. If she were to experiment with asking questions differently during the following lesson, she would

likewise be learning in and from practice. When she compares the papers that children wrote following this discussion, she is also learning in and from practice.

Ball and Cohen (1999) give the example of studying children's work as an instantiation of learning in and from practice. What is necessary is an inquiry-oriented community of practice in which artifacts of practice (Ball & Cohen, 1999) could be jointly studied—and lesson study provides at least the structures for such a collaborative inquiry.

Reflective experience

Classroom artifacts are only useful insofar as they provoke worthwhile questions about teaching and learning. One crucial ingredient for such work, for example, is the element of dissonance that moves the teacher outside her taken-for-granted ways of interpreting experience. This element is included by Dewey in *Democracy and Education* (1916/1961) in his listing of the features of a reflective experience. Scheffler (1974) enumerates them succinctly:

> (i) perplexity, confusion, doubt, due to the fact that one is implicated in an incomplete situation whose full character is not yet determined;
> (ii) a conjectural anticipation—a tentative interpretation of the given elements, attributing to them a tendency to effect certain consequences;
> (iii) a careful survey (examination, inspection, exploration, analysis) of all attainable consideration which will define and clarify the problem at hand;
> (iv) a consequent elaboration of the tentative hypothesis to make it more precise and more consistent, because squaring with a wider range of facts;
> (v) taking one stand upon the projected hypothesis as a plan of action which is applied to the existing state of affairs: doing something overtly to bring about the anticipated result, and thereby testing the hypothesis. (p. 228)

These features of a reflective experience strike us as fitting criteria for worthwhile professional development. And they follow the structure of lesson study nicely. We can

see how each of the five parallel segments of the lesson study structure align with Dewey's criteria by presenting them side-by-side in the table below:

Dewey's features of reflective experience	**Structures of lesson study**
(i) perplexity, confusion, doubt, due to the fact that one is implicated in an incomplete situation whose full character is not yet determined	Lesson study begins with a complex problem of practice for which there are no clear-cut answers.
(ii) a conjectural anticipation—a tentative interpretation of the given elements, attributing to them a tendency to effect certain consequences	A research lesson is pieced together over a long period (a year or more), including brief experiments testing elements of the lesson in local settings
(iii) a careful survey (examination, inspection, exploration, analysis) of all attainable consideration which will define and clarify the problem at hand	Lesson study involves a long-term investigation of the defining problem towards the development of a single lesson that will address the presenting problem
(iv) a consequent elaboration of the tentative hypothesis to make it more precise and more consistent, because squaring with a wider range of facts	
(v) taking one stand upon the projected hypothesis as a plan of action which is applied to the existing state of affairs: doing something overtly to bring about the anticipated result, and thereby testing the hypothesis	After revision, the research lesson is published for other teachers to learn from.

If we take Dewey's features of reflective experience as a set of rough guideposts for worthwhile professional development then the appeal of professional development efforts such as lesson study must be obvious from the table above. Lesson study engages experience as defined by Dewey (1916/1961):

> The nature of experience can be understood only by noting that it includes an active and a passive element peculiarly combined. On the active hand, experience

> is trying—a meaning which is made explicit in the connected term experiment. On the passive, it is undergoing. When we experience something we act upon it, we do something with it; then we suffer or undergo the consequences. We do something to the thing and then it does something to us in return: such is the peculiar combination. The connection of these two phases of experience measures the fruitfulness or value of the experience. Mere activity does not constitute experience. It is dispersive, centrifugal, dissipating. Experience as trying involves change, but change is meaningless transition unless it is consciously connected with the return wave of consequences which flow from it. When an activity is continued into the undergoing of consequences, when the change made by action is reflected back into a change made in us, the mere flux is loaded with significance. We learn something. (p. 139)

A worthwhile teacher education intervention provides structures that lead to this kind of experience.

It is important to emphasize here that lesson study is not the sole intervention that provides such opportunities for teachers. Other interventions—microteaching, for one (see, for example, Winitzky & Arends, 1991)—engage experience and deliberation in ways that satisfy the criteria I have argued for here. This study is not meant to promote a single particular intervention in teacher education. Instead, it analyzes one intervention in detail, a single case from a wide field of teacher education choices. It is the features of this particular intervention that interest us, not the intervention itself. The criteria for the engagement of experience on the one hand, and usability in practice on the other, mean to be the focus of this study, not a singular recipe for achieving them.

In this chapter, I have argued that one intervention in this case, lesson study, provides ripe conditions for teacher education that is intellectually substantive, grounded in particulars of practical problems of teaching, and engaged with experience. Its successful execution, however, does not necessarily follow. In the next chapter, I describe the research design and methods for this study that included the use of a modified form of Japanese lesson study.

Chapter 3

Research Design and Method

Teaching, like other complex practices, is in part characterized by its enduring problems, and this study begins from a problem of teaching practice. The problem of practice that captured my imagination in this study is the invisibility of even the most basic features of teaching work, as I described in Chapter 1. These features, I argue, are physically present but escape notice nonetheless. Learning to teach is made more difficult because its most basic features evade inspection. In this chapter on method, I describe how I understand this problem of practice, and what I did to design an intervention and the tools I used to study the intervention. This account will include the theoretical frameworks that helped me to define the problem, the intervention that I designed, and the research methods that I used to investigate the intervention. I explain what I did in this study, and why these choices were suited to the question I am investigating. I conclude with a discussion of the nature of claims that are made in such a study.

Problems of practice

This study joins a research tradition whose point of departure is the enduring problems of teaching practice.

> The fundamental structure of activity in the practice of teaching involves a teacher doing something with students around something to be learned. The fundamental

> problem of teaching practice is being able to do the things that will enable students to learn the things under study….
> One reason teaching is a complex practice is that many of the problems a teacher must address to get students to learn occur simultaneously, not one after another. Because of this simultaneity, several different problems must be addressed by a single action. And a teacher's actions are not taken independently; they are interactions with students, individually and as a group. A teacher acts in different social arrangements in the same time frame. A teacher also acts in different time frames and at different levels of ideas with individual, groups, and the class to make each lesson coherent, to link one lesson to another, and to cover a curriculum over the course of a year. Problems exist across social, temporal, and intellectual domains, and often the actions that need to be taken to solve problems are different in different domains. (Lampert, 2001, p. 2)

Although such problems of practice are not easily solved, being able to see them more clearly, articulate their characteristics, disentangle their elements, and investigate their constituent parts, allows progress to be made. To make inroads on such problems of practice, I begin with a conceptual lens for viewing and describing teaching, the "instructional triangle," which permits an articulation of teaching practice, and a framework for understanding problems of practice. Invisibility, as I have defined it in this study, is one such enduring problem of practice. To return to my central questions, I wanted to learn: What would it take to make features of teaching more visible? What do student teachers notice and do if such features of teaching are made more visible? Finally, what can we learn from an effort to make teaching more visible about the invisibility of the practice and about implications for teacher education generally?

I organize this chapter describing my research design and method along the lines of these three central questions.

Making teaching visible

From Chapter 1, it is clear that I had some idea about the forces that conspire to make teaching invisible. What I wanted to learn about was what it would take to render

crucial acts of teaching more visible. I chose to study this in my own teaching, studying my preservice methods students and the records of my own practice of teaching them. It seemed obvious to use real classrooms as a research site for the purposes of this study; the research questions required the dynamism and unpredictability of classroom life absent in laboratory settings or interviews, since part of my argument is that the busy-ness of classroom life is one of the factors that obscures focus on teaching. I wanted to learn what it would take *in practice* to make teaching more visible, and for that I would need to work in a typical practice setting. To do so, I drew upon Brown's notion of "design experiments" (1992) and the tradition of teacher research.

Design experiments

A number of educational research models informed the design of the intervention, primary among them Brown's "design experiments." Brown says that this approach to classroom research is " modeled on the procedures of design sciences such as aeronautics and artificial intelligence…I attempt to engineer innovative educational environments and simultaneously conduct experimental studies of those innovations" (1992, p. 141).

There were a number of reasons of that this model was suited to the problem I am investigating. One, because part of my argument is that teacher education often suffers from an atomized approach to instruction where its elements are studied in isolation, it was important to have a model located in a regular classroom setting. In contrast to other research designs, I did not want to study individual child responses to a task, or interview preservice students about their thinking. It was essential, given the theoretical frameworks above of instruction as a cultural activity, that the research would be

conducted *in situ.* If practice has its own logic, this research project needed to be located inside of practice. As Brown writes,

> Just as it is impossible to change one aspect of the system without creating perturbations in others, so too it is difficult to study any one aspect independently from the whole operating system. Thus we are responsible for simultaneous changes in the system, concerning the role of students and teachers, the type of curriculum, the place of technology, and so forth. These are all seen as inputs into the working whole. (p. 143)

In addition, I wanted to pursue a kind of research program that would generate knowledge *for* practice. Brown describes design experiments as sharing this goal. I was interested in generating knowledge for teacher educators for use in settings like mine. Besides an academic understanding of lesson study and the invisibility of teaching, my aim was to contribute to knowledge that educators would use in practice. Lampert writes:

> The teacher's emphasis on concrete particulars in the description of a classroom problem distinguishes the perspective of practice from the perspective of the theory builder…Another fundamental though less familiar difference involves the personal quality of teaching problems as seen through the eyes of a practitioner. Who the teacher is has a great deal to do with both the way she defines problems and what can and will be done about them. The academician solves problems that are recognized in some universal way as being important, whereas a teacher's problems arise because the state of affairs in the classroom is not what she wants it to be. Thus, practical problems, in contrast to theoretical ones involve someone's wish for change and the will to make it. Even though the teacher may be influenced by many powerful sources outside herself, the responsibility to act lies within. Like the researcher and the theoretician, she identifies problems and imagines solutions to them, but her job involves the additional personal burden of doing something about these problems in the classroom and living with the consequences of her actions over time. (Lampert, 1985, p. 180)

In this context, lesson study was a ready-made design package that I was able to modify for my purposes. It is based in real practice in classrooms, it aims to produce knowledge for practice, and it draws on my knowledge of practice from the perspective of practitioner, as Lampert writes here. In my case, I am a schoolteacher with ten years of experience teaching public school, but the mathematics methods class drew little on the

"thinking-in-action" (Benner, Hooper-Kyriakidis, & Stannard, 1999, p. 9) that I brought from the world of practice. Instead, the course felt heavy on *studying* teaching, using the academic analytic frames that were layered upon experiential knowledge. As it was, teaching experience could be invoked but not witnessed. Using lesson study in a design experiment offered a window onto the practical knowledge that I brought to the course.

Teacher research

Design experiments such as this often involve teacher research, a form of participant-observation familiar from other fields. There is a history of teacher research, especially if we consider that in a very rudimentary way, the work that such psychologists as Freud and Piaget did with their own children was an early form of participant-observer work in education. Stenhouse (1985) made a more explicit argument for teacher research, suggesting a possible working definition as "systematic self-critical enquiry" (p. 8) practiced by teachers in their own classrooms. He elaborates:

> The basic argument for placing teachers at the heart of the educational research process may be simply stated. Teachers are in charge of classrooms. From the point of view of the experimentalist, classrooms are the ideal laboratories for the testing of educational theory. From the point of view of the researcher whose interest lies in naturalistic observation, the teacher is a potential participant observer in classrooms and schools. From whatever standpoint we view research, we must find it difficult to deny that the teacher is surrounded by rich research opportunities.
> Moreover, there is in the research field of education little theory which could be relied upon by the teacher without testing it. Many of the findings of research are based on small-scale or laboratory experiments which often do not replicate or cannot be successfully applied in classrooms. Many are actuarial and probabilistic, and, if they are to be used by the individual teacher, they demand situational verification. The application of insights drawn from naturalistic case studies to a teacher's situation rests upon the quality of the teacher's study of his home case. Using research means doing research. The teacher has grounds for motivation to research. We researchers have reason to excite that motivation: without a research response from teachers our research cannot be utilized. (1985, p. 15)

Teacher research draws from Geertz' work in interpretive anthropology (1983) which combines both emic (insider) and etic (outsider) ways of knowing. The notion that a "native," in the anthropologist's terms, would possess an understanding of her/his culture that would differ from the "specialist's" interpretation of that culture paves the way for teachers to articulate their views of their work next to researchers' observations of that work. Both the emic and the etic, in Geertz' view, have a useful and perhaps complementary contribution to understanding the culture being studied, in this case, the culture of schooling. As Geertz wrote,

> in each case, ought one to deploy them so as to produce an interpretation of the way a people lives which is neither imprisoned within their mental horizons, an ethnography of witchcraft as written by a witch, nor systematically deaf to the distinctive tonalities of their existence, an ethnography of witchcraft as written by a geometer. (p. 57)

In its best version, teacher research could resemble Duckworth's ideal:

> I am not proposing that schoolteachers single-handedly become published researchers in the development of human learning. Rather, I am proposing that teaching, understood as engaging learners in phenomena and working to understand the sense they are making, might be the sine qua non of such research. This kind of researcher would be a teacher in the sense of caring about some part of the world and how it works enough to want to make it accessible to others; he or she would be fascinated by the questions of how to engage people in it and how people make it accessible to others; he or she would be fascinated by the questions of how to engage people in it and how people make sense of it; would have time and resources to pursue these questions to the depth of his or her interest, to write what he or she learned, and to contribute to the theoretical and pedagogical discussions on the nature and development of human learning. (1986, p. 495)

Brown (1992) described how her work as a researcher-teacher allowed her to develop "a theoretical model of learning and instruction rooted in a firm empirical base" (p. 143). Brown's work demonstrated the ways in which a researcher-teacher could create

or design teaching and learning situations that she may not find in the field or laboratory. This kind of research is problematic, Brown says, because one cannot control variables, but it is useful because it captures the realities of classroom life, and it projects what is possible in the classroom with all its complexity and variability and unpredictability.

> This reflects the major problem of trying to conduct design experiments consisting of many interwoven aspects. Components are rarely isolatable, the whole really is more than the sum of its parts. The learning effects are not even simple interactions, but highly interdependent outcomes of a complex social and cognitive intervention. And this presents a methodological headache for traditional psychology, allergic as it is to multiply confounded experiments. (p. 166)

I chose to study my own practice in this project because of the possibilities described here by Brown, Duckworth and Stenhouse, and following the model of my mentors Deborah Ball (2000) and Magdalene Lampert (1990). Its advantages were well-suited to this study: practice is kept "whole" in this kind of work; practitioner knowledge could be made public and visible; and insights from practice were sources for the discovery of grounded theory (Glaser and Strauss, 1967) so essential to the research method in this work.

Learning what preservice students notice and do

Japanese lesson study provided a model of professional development work that I could modify for my purposes. As I outlined in Chapter 2, lesson study is physically located in the classroom, is aimed at studying practice, and examines the intricate moves that teachers make. This was a promising model for articulating and narrating the acts and logic of practice in the context of a preservice mathematics methods class. Chapter 4 describes in more detail the intervention that I designed based on Japanese lesson study. But to learn what preservice students would make of such an experience, I would need to gather data from the lesson study and other relevant segments of the preservice methods

class, and investigate what preservice students notice and do in my efforts to make teaching more visible. The primary data sources were my students' work in multiple forms. I would use qualitative methods to analyze them. These approaches are detailed below.

Records of practice

Since I am interested in the totality of practice, I wanted to collect "records of practice:" written and digital records of classroom sessions (see, for example, Cohen, 2005). Thus, I collected my written plans for the mathematics methods course; my field notes following each class and the field notes of occasional observers; the written notes and assignments of my students; children's written work from the research lesson; and videotapes (and occasional audiotapes) of all class meetings. Relevant portions of class meetings were transcribed. The lesson study would be investigated using these artifacts of practice.

These records of practice, taken as a whole, would provide a window onto what transpired in the class meetings and what my students were learning in the process. Other data sources might have been before- and after- surveys of preservice student opinion, performance on a mathematics teaching task designed specifically for this study, or interviews of students following the lesson study. All these would have been useful, and in fact would have enriched the current data set that I collected. But I wanted the particular records of practice that I collected for a number of reasons. One, I wanted to have a sense of student learning over time, and these records are taken from across the semester in a number of settings. Two, classrooms are busy places, even university classrooms. The thread of instruction is hard to follow, it differs for every participant, and

experience leaves no trace. For these reasons, it was important to have multiple records from as many angles as possible in every class. The data set includes videotape, my lesson plans, my field notes, observers' field notes, and students' journal notes from every class session. We are not searching for a single, convergent version of what transpired in each class, so the traditional reason for triangulation of data does not apply here, although the notion of triangulation here lends layering and richness to what can be seen in the data. Three, it was important to use artifacts of instruction rather than data generated specifically for research purposes. I did not want to design an instrument for collecting data that was not an existing artifact of regular classroom instruction. My interest is in studying "regular" instruction, and this was to be its own experiment in "learning in and from practice" (Ball & Cohen, 1999). How could teachers learn from their day-in and day-out work with students, without special instruments created for this purpose?

I should make special mention here of the use of videotape as a research tool in this context. Videotape was a particularly rich data source for a number of reasons: it provides relatively unprocessed data (as distinct from field notes, for example, that first pass through one observer's interpretive frames), it is contextually rich and can capture social complexity in a way that other sources may not. "Video captures different aspects of complex situations and processes. A video segment can show attributes of social interactions, such as collaboration among peers, division of labor, negotiation, and reconciliation of different interests" (Farber, 1990, p. 320). Videotape may also convey relational qualities that are harder to see in written artifacts. Videotape was used in this project at a number of levels: as case materials for preservice student learning (see, for

example, Copeland & Decker, 1996); as a record of preservice classes and the research lesson to which the preservice students could refer; and as a data source for my subsequent study of this course.

Qualitative data analysis

The analysis of the data in this study was primarily qualitative. Following Glaser and Strauss (1967), the purpose of data collection and analysis was to develop theory that would contribute to our understanding of the problem of the invisible nature of teaching.

> Generating a theory from data means that most hypotheses and concepts not only come from the data, but are systematically worked out in relation to the data during the course of the research. *Generating a theory involves a process of research.* By contrast, the source of certain ideas, or even "models," can come from sources other than the data. (p. 6)

The grounded theory perspective of Glaser and Strauss informed the treatment of these data, using the constant comparative method (1967, p. 105). I began by viewing the videotapes repeatedly, and reading through transcriptions of the tapes and the preservice students' written assignments. I was most interested in what the preservice students were learning, so I eventually read and re-read the transcripts of their discussions and the work of four focal students most carefully. I first made a rough list of themes that stood out in their writings and discussions, and then I moved to formal coding. I used QSR N6 software for qualitative data analysis to aid in this process. Students' written work or transcribed talk was coded at the sentence level or greater, noting for each passage a theme that stood out. N6 allows for coding without any hierarchy or order; codes can then be grouped and reordered as needed. It became apparent that there were five broad categories of student thinking: mathematical care, general pedagogical concerns, views of mathematical pedagogy, instructional design, the self. These are discussed in detail in

Chapter 5. Passages of student written work or transcribed talk could be coded such that it appeared in multiple categories, as was often the case.

Multiple interpretive frameworks

A number of theoretical perspectives helped to define the problem under study, and make sense of the data generated from the intervention in this study. In fact, Schwab argued that a number of competing theoretical perspectives were necessary to understand the complexity of real practice. In his essay, "The Practical: Arts of Eclectic" (1975), Schwab describes how individual theories from social science are inadequate in addressing problems of practice. He contends that bringing multiple theories to bear on such problems illumines them so that progress can be made. Schwab notes that problems of practice "are never solved completely or once and for all," (p. 322) and he attributes this in part to the disparities between theory and practice. While practical problems in teaching are situation-specific, particular to time, place, person and circumstance, theory leaves behind particulars towards abstraction and generality. Schwab proposes that theory can be readied for practical use through "the arts of eclectic" such that the distortions and limited perspectives that theory imposes can be discovered and counterbalanced. Thus, in this work, I draw from multiple theories to illumine classroom phenomena, even though the multiplicity of theories may present conflicting or inconsistent views. As must be evident from Chapter 1, I intentionally draw together multiple perspectives on problems of practice based on Schwab's contention that no one theory will sufficiently illumine what is by nature a complex object of study. For example, in interpreting and explaining the invisibility of teaching, I make use of discourse theory, the psychological notion of "situated cognition," behaviorist theories of learning, feminist analyses of work, and sociological theorists such as Bourdieu and Goffman. These theories are not always

compatible or complementary, but each provides a useful if competing lens that produces a wide range of interpretations. The aim is neither to attain theoretical purity nor to illustrate theory with concrete examples from classroom work, but to better understand and explicate practical problems in teaching and in teacher education.

Cultural interpretive theory

Cultural interpretive theory (Geertz, 1973) proved useful in my analysis. Applied to classroom settings, this research tradition aims to articulate the logic internal to practice. In this tradition

> data are treated as text, and the enterprise is to understand its meaning. Analyzing the data is an attempt to untangle the tangled web of human activity in settings (like classrooms) where activity is carried on for purposes other than doing research...there are multiple ways to interpret any action, and that the levels of meaning that can be found are confounded and sometimes in conflict....The purpose of interpretive research is not to determine whether general propositions about learning or teaching are true or false but to further our understanding of the character of these particular kinds of human activity. (Lampert, 1990, p. 36)

Geertz notes that interpretive cultural theory is not predictive and does not generalize across cases (1973, p. 26). Rather, "the aim is to draw large conclusions from small, but very densely textured facts; to support broad assertions about the role of culture in the construction of collective life by engaging them exactly with complex specifics" (p. 28). Classroom life is treated as a "culture" in the sense that Geertz means here, and research is an effort to make sense of human activity in the context of schooling.

Cultural interpretive theory assumes that practice *makes sense* in its own terms, that is, that it has its own internal logic. Teaching, in this view, is like a culture, whose webs of meaning are to be understood within its own "grammar."[8]

[8] The *Oxford English Dictionary, Second Edition (1989)* includes the following definitions for "grammar":.

> In the analysis of practice, or even in planning lessons, one can look at what happened or imagine what might happen from one or another coherent perspective, screening out the multiple and conflicting concerns that barrage the practitioner. In practice, however, teachers often are choosing between two or more courses of action, each of which is sufficiently warranted, but any one of which might be in logical conflict with another....To frame a logical argument that justifies a teaching practice, the complexity of practice must be sacrificed. (Lampert, 1990, p. 38)

I use this "grammar," or internal logic of teaching, as a lens for viewing classroom data, in a recursive process where classroom data are also used to construct that grammar. Teaching has its own meanings and patterns that can be understood from within that system, and that make sense within that system. On a related point, see the discussion of Bourdieu's "logic of practice" in Chapter 4. There I used Bourdieu's notion that practice in general has its own logic; here, teaching in specific has an internal logic or "grammar."

Instructional triangle

The "logic of practice" is borrowed from sociology, but I also made use of interpretive frameworks specific to education to make sense of instruction. In this study, I make frequent reference to the "instructional triangle." I offer some detail here about this model because it served as a fundamental organizer for my work on this project at many levels. The instructional triangle specifies three fundamental elements of schooling: the teacher, the students, and the content, and these all exist in environments. The model is

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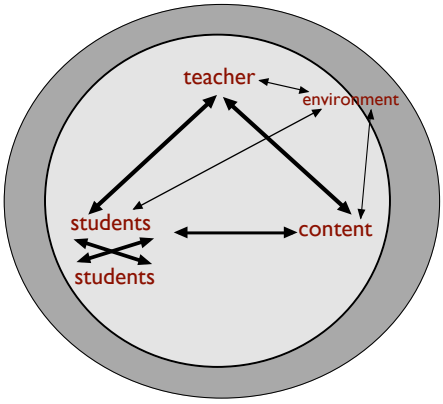
"**1. a.** That department of the study of a language which deals with its inflexional forms or other means of indicating the relations of words in the sentence, and with the rules for employing these in accordance with established usage; usually including also the department which deals with the phonetic system of the language and the principles of its representation in writing. Often preceded by an adj. designating the language referred to, as in *Latin*, *English*, *French* grammar.
As above defined, grammar is a body of statements of facta 'science'; but a large portion of it may be viewed as consisting of rules for practice, and so as forming an 'art'…
6. *transf.* **a.** The fundamental principles or rules of an art or science."

meant to be a generic one, one that can be used to make sense of any teaching, by holding its most basic elements. It *holds* its most basic elements by providing containers for what goes inside them, but also *holds* them by holding them still and disentangling them one from another.



An illustration of the instructional triangle, taken from Ball and Cohen, 1999

To give a sense of the range of scholars that have used a model with such elements, I review a number of authors who have made use of some form of this model. Sizer describes the triangle here:

> Nearly all formal learning in schools involves the interactions of three actors: the student, the teacher, and the subject of their mutual attention. The character of this triangle is subject to change, varying from pupil to pupil, teacher to teacher, subject to subject, day to day, even minute to minute. Change any one of the triangle's members, and the others have to shift, to accommodate, or even to break apart. The mathematics teacher acts in a particular way when he is answering in class a question whose answer he is certain of. The next moment there may be a question whose answer he is uncertain of. He will deal with that situation differently, with a different impact on the students and on the subject, especially if he gives a wrong or misleading answer.... as long as schools are for learning, no relationship within them is more important than this triangle. That these triangles vary for different people, subjects, and times makes the task of providing

> constructive schooling an extraordinarily complex and subtle business. (Sizer, 1984, p. 151)

Schwab (1975) referred to the four commonplaces of education, which parallel the elements of the instructional triangle: teacher, children, subject matter, and milieu.

McDonald gives a sense of the dynamism of the triangle:

> Real teaching... happens inside a wild triangle of relations - among teacher, students, subject - and the points of this triangle shift continuously. What shall I teach amid all that I might teach? How can I grasp it myself so that my grasping may enable theirs? What are they thinking and feeling - toward me, toward each other, toward the thing I am trying to teach? How near should I come, how far off should I stay? How much clutch, how much gas?
> Inside the triangle, clear evidence is very rare. Snarls and smiles mix disconcertingly. Right answers fade to wrong, and vice versa: a matter of interpretation, or how one construes a gesture or an attitude, of whether one thinks the moment demands more criticism or more encouragement, of how much energy one has to believe in teaching's effectiveness. (McDonald, 1992, p. 1)

The model was key in formulating the problem in my study, the invisibility of significant elements in teaching, because the vertices of the triangle are so readily seen in instruction (the teacher, the children, the content) while the relational transactions that give life to instruction are so hard to see. So, for example, an observer can see the teacher posing questions, can see the children answering them, and can see the mathematics written on the chalkboard, but can not necessarily see how the teacher tracks on cues of affective and cognitive states in the children to moderate the tone and substance of her questions, or how one child's response conditions the next question that the teacher composes. Some of what is invisible is the teacher's judgment and reasoning in action, but some is physically visible but overlooked nonetheless. Visual cues indicate affect, and the child's words are available for inspection. The mathematical problem is often represented on the chalkboard. The instructional triangle helps comb through the tangle

of classroom events so that each of these elements can be considered in isolation. This also draws attention to what is missing: the transactions that connect the teacher, children, and content.

The instructional triangle is used in multiple contexts both in this research project and in my teaching of the mathematics methods class. I often suggested the elements of the instructional triangle as an organizer for preservice students' viewing of videotaped lessons over the course of the semester. Similarly, in their written assignments preservice students were instructed to divide recorded observations of teaching work into the categories of teacher, children, mathematics. To turn to research design, the elements of the triangle, or the four commonplaces, served as rough guidelines when I first began coding data. This is but one example among many in which those three elements organized my thinking and my work. But in a much more overarching way, the entire approach to my research question is anchored in Ball and Cohen's (1999) use of the instructional triangle as a fundamental conceptualization of teaching. It conceives of teaching as a dynamic and coherent human activity, one that has recognizable actors over time. It shines equal light on the teacher, the child, and the subject matter, giving more weight to subject matter than other models of instruction.

Nature of claims

Using the tools and approaches described in this chapter, this study was designed to make headway on the problem of invisibility in teaching practice. But it is important to note what kind of claims can be made from such an investigation.

From the coded data, I am able to make some claims about what I believe my students were learning in the lesson study. Here I discuss the nature of those claims.

From the students' written work and the records of their discussions, I was able to discern patterns and definite themes; the five categories listed above sum these up nicely. I can describe in detail what the students were learning in that context. What I cannot do is attribute them solely to the intervention I designed. The preservice students were immersed in a number of environments and experiences, and they were "learning to teach" in the way that Feiman-Nemser (1983) uses the term—over time and from multiple sources. The study was not designed to map isolated inputs onto discrete outcomes, and because I am interested in the totality of practice, the data do not tell us about particular change over time or as a result of a single variable. Instead, I am interested in the kind of "highly contingent" claims that Labaree describes below:

> Disciplines seen as producing hard knowledge are those that are most successful in establishing the rhetorical claim that their research findings are verifiable, definitive, and cumulative. The natural sciences are the leading examples in this arena….Disciplines that produce soft knowledge, by contrast, find themselves working an intellectual terrain that is considerably less clearly defined….Supporting causal claims is particular [sic] difficult in these fields, so the producers of soft knowledge necessarily focus the bulk of their attention on the problems of description and interpretation: how to portray and make sense of the texts or events under study in the absence of clear decision rules and validating methodologies…. From this perspective, education emerges as the softest of the soft field of inquiry. Problems of teaching and learning, curriculum and governance, educational organization and educational reform—all of these resist efforts by researchers to establish causal claims about them that are verifiable, definitive, and cumulative in anything like the way that researchers in hard-knowledge disciplines can accomplish these things. For one thing, of course, education is the social product of actors—teachers, students, administrators, parents, and policymakers—whose actions both shape this institution and are shaped by it….As a result, educational researchers are able at best to make tentative and highly contingent claims that are difficult to sustain in the face of alternative claims by other researchers. (Labaree, 1998, p. 5)

I can claim that lesson study provided an opportunity for preservice students to *exercise* in the domains of mathematical care, general pedagogical concerns, views of mathematical pedagogy, instructional design, the self. Students' discussion of these

issues was substantive and sensitive. They looked to one another, to evidence in practice, and to literature to do powerful work in these categories. But none of the categories was new to them and in fact I had evidence that they had done serious thinking in the same categories prior to the intervention I designed. Thus, I do not claim that lesson study produced something that was otherwise absent; rather, I claim that lesson study presented an opportunity to practice[9] habits, dispositions, ways of thinking and doing that may or may not have been continuous with their prior experiences.

What is missing is a record of my students' practice following the lesson study. I am able to make claims about the kinds of thinking they do about instruction as represented in their written and oral work for in the mathematics methods class—but I have no evidence of the relationship of this work to their practice.[10] What is their teaching like? I am interested in effects in practice, not self-reports about it, and the research design did not include this. Further research would follow students into their field placements or their first teaching assignments to collect records of their practice there for analysis.

This study is primarily conceptual-analytical. That is to say, its contribution is a conceptual one regarding the practice of teaching. The idea that visible acts of teaching are invisible to observers is the core idea of the dissertation. The ensuing "design experiment" does not produce results in the traditional scientific design sense. The intervention did not take place with randomized subjects nor do I have data or make claims about pre- and post-treatment. Although the modified lesson study was empirical

[9] In this usage, practice is meant defined in the *American Heritage Dictionary*, "To do or perform habitually or customarily; make a habit of."
[10] In this usage, practice is meant as defined in the *American Heritage Dictionary*, "A habitual or customary action or act."

in the purest sense, this was not, in its whole, an empirical study. Rather, the modified lesson study was conducted so that more could be understood about invisibility and the concept could be further refined.

It is important to note that my obligation as an instructor doing teacher research is not only to the body of knowledge that my dissertation was intended to build, but to the very students who were being studied. Thus, the modified lesson study also needed to meet the learning needs of my students. For the main, their learning aligns with my purposes, but one can imagine situations in which the learning needs of the "experiment" and experimenter would be served at the cost of student learning needs.

In education, there are a number of types of knowledge to pursue. One is the kind of "hard knowledge" that is produced by a random assignment controlled clinical trial, and I believe this kind of knowledge is crucial for teachers as "guidelines, not prescriptions" (Benner, Hooper-Kyriakidis, & Stannard, p. 11) for judgments about instructional design. That is not the kind of knowledge this study produced. This study produced knowledge for what Benner et al. (1999) call "clinical judgment" in nursing.

> Scientific reasoning or formal critical reasoning seeks certitude. Scientific problem solving is set up to yield absolute "yes" and "no" judgments. Although critical care requires exacting judgments, clinical judgments cannot be as certain or predicted and controlled to the degree that scientific experiments can. Learning to develop the best account of a clinical situation to make the best clinical judgment under circumstances of uncertainty is an interpretive process. The best account of the clinical situation under the circumstances of uncertainty will yield the best judgment. Certitude, although sought, is seldom achieved in actual practice. (p. 5)

One of my aims in the study, discussed earlier, was to generate usable knowledge, both for other teacher educators, but equally for my students in the moment. This was a design experiment conducted not only for research purposes, but to make headway on a

problem of practice for my students in that class, then. Since this is a general problem of practice, and not one specific to that group of students, what I learned will apply, I hope, to other students in other contexts, and for this reason it warrants study.

In Chapter 4, we turn to the specific pedagogical structure that I designed for this study.

Chapter 4

Lesson Study in a Preservice Mathematics Methods Course

In Chapter 1, I described a problem in teacher education: that much of teaching work remains surprisingly "invisible" to observers, and therefore hard to learn. Essential parts of teaching work are hard to "see," and thus hard to learn to "do." In this chapter, I present a pedagogical structure in a preservice methods course that I claim makes aspects of the work of teaching more visible. This pedagogical structure is a modified form of lesson study, and I will claim that it casts the teaching of lessons as the central text of the mathematics course, so that practice becomes "study-able." I offer this structure, a modified form of lesson study, as one example of what Ball and Cohen might consider a structure that permits teachers to "learn in and from practice" (1999). On the surface, lesson study is a device for teachers to plan, teach, and analyze a single lesson, collaboratively. But beyond these surface forms, the lesson study constituted an opportunity where *the work of teaching* was the subject matter of the course—the ***enacted*** *work of teaching*. And, the *collaborative* nature of the work is not incidental. In fact, the kind of collaboration that goes on in lesson study is crucial to its outcomes. I argue that this cycle of lesson study made certain aspects of teaching visible, and therefore available for novice practitioners to learn.

In this chapter I walk through the enactment of the cycle of lesson study that I conducted in a preservice mathematics methods course. The chapter is organized into two parts. First I tell the story of the lesson study in chronological order, organized by the steps of lesson study described as Catherine Lewis (2002) has defined them as we saw in Chapter 2. In this part, I try to tell, plainly, what *happened*, with as little embellishment as possible.[11] My perspective here is that of teacher educator and course instructor, so the view offered here is framed by pedagogical concerns for preservice students in a university course.

The second section of the chapter is an analysis of what transpired in this lesson study, looking back on the lesson study with a bit more distance. Here I make note of what stood out in the lesson study with a particular eye to my research question, namely, how lesson study creates conditions for specific kinds of teacher learning that are otherwise hidden from view. I also discuss the problems that lesson study presents, particularly in a preservice setting.

Lesson study in a preservice mathematics methods course

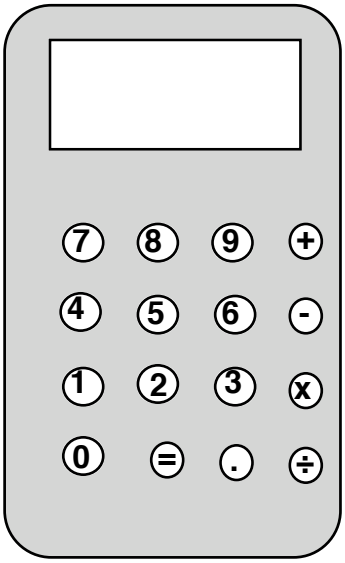
So we begin with a recounting of the lesson study itself. Below is a worksheet that shows the central mathematical task for the research lesson I would teach in a fourth grade class.

[11] I make no pretense here about recounting events "objectively." Among the many examples of this, Margery Wolf shows how a single story can be understood differently depending on the standpoint of the teller in her book *A Thrice-Told Tale* (1992).

MRS. HAYDEL'S BROKEN CALCULATOR

Name_____

Date_____



Mrs. Haydel's calculator is broken. The problem is that the 6 key doesn't work. If you type 6, it doesn't show anything in the display.
Is her calculator useless now, or can she figure out a way to use it to do any problems she wants?

Can she still display any number she wants into her calculator?
We are going to explore this and decide.

My prediction and reason:

My conclusion and reason:

Can she get her calculator to show these numbers? Try each one, and write down the steps you think she can take.

406	4.06
.65	1.065
3.640	6.000
5.62	6.66

The task here was meant to be the centerpiece of a single lesson composed of other subtasks and activities which together comprised a research lesson. The problem is one which draws on children's knowledge of place value generally, and decimal place value in specific. So, for example, to show the number 4.06 on the calculator if the six key is broken, a child could enter 4.02 on the calculator, and add .04. This would display 4.06. The virtue of this problem, as can be seen in this example, is that the child needs to

use place value knowledge to solve it. A common error, overlooking the place value understanding, would be to enter 4.02 to the calculator, and add 4 rather than .04. The calculator would display 8.02 in this case, which might prompt a child to revise his entries into the calculator.

In this chapter, we will see the planning and execution of this research lesson. I tell about each step in the process of this lesson study, what led to the entire research lesson plan, and how was it devised. We will look at the mathematical work this occasioned, for both the children and the preservice students, and the teacher education work as well.

A standard lesson study takes place over a year or longer. This lesson study was conducted in a preservice methods course comprised of 13 class sessions during one semester, with its own central curricular demands outside of this lesson study project. The lesson study was therefore greatly truncated; we devoted parts of four class sessions and one entire class session to the lesson study over a six-week time span. In the planning phase, we spent about 90 minutes in two class sessions that were three hours long, we spent one entire class session of three hours planning, observing, and discussing the research lesson at the school site, and then we spent less than 30 minutes out of two subsequent class sessions on lesson study discussion. On the following page is a timeline showing this: