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SITUATING THE STUDY OF TEACHER NOTICING

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Theoretical constructs are the cornerstones on which the advancement of any field rests. Constructs are not valued simply in terms of whether they are right or wrong; instead, they are valued by their usefulness to the field. Occasionally a construct emerges that transforms the field by enabling researchers to reconceptualize their endeavors and to shift, sometimes in subtle ways, the focus of their attention. Such constructs may not be entirely novel. They may be consistent with previous ideas and yet bring to light new research questions and new methodological approaches. Pedagogical content knowledge is one such example. Pedagogical content knowledge appeared quite suddenly with the publication by Lee Shulman (1987) of “Knowledge and Teaching: Foundations of the New Reform.” However, the core insight behind pedagogical content knowledge goes back at least 100 years (Dewey, 1902, 1904/1964). The idea that teachers might possess knowledge about teaching that is specific to subject matter cannot have been entirely foreign to researchers reading Shulman’s article. Nonetheless, Shulman’s introduction of this construct significantly changed the field, and, although the introduction of pedagogical content knowledge faced obstacles, the change was dramatic enough to drive decades of research on teaching and to influence the preparation of a generation of teachers.

This book is dedicated to another construct in teaching that we call teacher noticing. Perhaps it is an accident, or perhaps the time is just right, but, across institutions, researchers in teacher education have begun to describe their work as being about teacher noticing. Those researching teacher noticing ask what are, in some respects, primal questions of teaching: Where do teachers look, what do they see, and what sense do they make of what they see? Although these questions are relevant to teaching in any domain, this book is focused on noticing as a component of teaching expertise in mathematics.
The idea that noticing is a component of expertise is well documented. Experts in a variety of domains are able to recognize meaningful patterns in their areas of expertise (National Research Council [NRC], 2000). For example, expert chess players are better able than novice players to identify established chess moves, and radiology experts reading an x-ray call upon a combination of perceptual processing followed by extended qualitative reasoning (Lesgold et al., 1988). But the situation in teaching is arguably more complex. The chess expert is faced with a static display of arrangements of a small number of pieces, which are always the same; a radiologist looks at what is essentially a picture. A teacher, in contrast, faces a much more varied and amorphous set of phenomena that are constantly in motion, and hence the processes of teacher noticing must, in some respects, be more complex.

We believe that the importance of noticing, as a theoretical construct for understanding teaching, extends well beyond any brief definition that we might give of this construct. Consider, again, pedagogical content knowledge. The introduction of this construct moved the field forward not solely because of the notion of pedagogical content knowledge itself—that teachers possess subject-specific pedagogical knowledge. Just as importantly, pedagogical content knowledge brought with it a particular stance toward teaching and toward what teaching involves, and it drew our attention to distinctions that heretofore did not exist.

The same is true, we believe, of teacher noticing. A focus on teacher noticing is associated with a particular stance toward teaching, and it is a stance that draws our attention to phenomena that have received relatively little attention. At the heart of this stance is an image of the teacher-in-action as a teacher in a maelstrom, confronted with a “blooming, buzzing confusion of sensory data” (B. Sherin & Star, this volume, chapter 5). Embracing this stance toward teaching opens the door to new research paradigms and methodologies, and, though it is too early to determine how influential teacher noticing will be, we think that the groundswell of interest raises the possibility that teacher noticing may emerge as another transformative idea in teacher education.

This image of teacher noticing is, of course, not completely novel. In fact, Walter Doyle, writing in 1977, asserted that the “most salient features of the classroom” for teachers are its “(a) multidimensionality; (b) simultaneity; and (c) unpredictability” (p. 52). Given the prevalence of new technologies today, including inexpensive and ubiquitous digital video that can capture teachers in action, conducting a program of research that is dedicated to understanding how teachers negotiate these “most salient” features of teaching now seems particularly feasible.

What Is Teacher Noticing?

We recognize that the term noticing is used in everyday language to refer to general observations that one makes. Here we use the phrase teacher noticing to encompass
the processes through which teachers manage the “blooming, buzzing confusion of sensory data” with which they are faced, that is, the ongoing information with which they are presented during instruction. Note that, in describing teacher noticing in this way, we intend to imply that teacher noticing is not at all a passive process. Teachers do not merely sit back and try to make sense of what is going on in a classroom or other instructional setting. Instead, teachers are actors in the instructional scene that they are observing.

Across the chapters in this book, the authors adopt somewhat diverse conceptualizations of noticing. In general, however, the authors discuss teacher noticing as involving two main processes (or a subset of those processes):

- **Attending to particular events in an instructional setting.** To manage the complexity of the classroom, teachers must pay attention to some things and not to others. In other words, they must choose where to focus their attention and for how long and where their attention is not needed and, again, for how long. Some chapter authors focus on the range of things to which teachers do (and do not) attend whereas others focus on whether teachers attend to particular things of interest (e.g., students’ mathematical thinking).

- **Making sense of events in an instructional setting.** For those features to which teachers do attend, they are not simply passive observers. Instead teachers necessarily interpret what they see, relating observed events to abstract categories and characterizing what they see in terms of familiar instructional episodes. The chapter authors offer different conceptualizations of what this reasoning encompasses and, in particular, whether it includes consideration of teachers’ instructional responses.

These two aspects of noticing are interrelated and cyclical. Teachers select and ignore on the basis of their sense making; the way they respond shapes subsequent instructional events, resulting in a new and varied set of experiences from which teachers attend and make sense.

To be clear, we do not see teacher noticing as something that can be grafted onto existing accounts of teaching, at least not in any simple manner. For example, it is not helpful to think of teacher noticing as simply another category of teacher knowledge. To some extent, this should be obvious just from the name. The word *noticing* names a process rather than a static category of knowledge. And this word choice points to what we believe is a real, consequential difference: The focus is on how, at a fine-grained level, the teacher interacts with the classroom world rather than solely on a teacher’s reasoning.

**Linking Teacher Noticing to Current Efforts in Mathematics Education**

Thus far, we have emphasized the importance of studying teacher noticing because it is at the heart of managing the “most salient features of teaching” (Doyle, 1977,
At the same time, however, we believe that recent interest in teacher noticing derives, in some measure, from the current zeitgeist in mathematics education and what the field currently takes to be important. Here we highlight three areas of mathematics education research that support the idea that teacher noticing is likely to be an important and productive focus:

- **Adaptive and responsive teaching.** In contrast to a traditional style of instruction in which the structure of a mathematics lesson is determined by the teacher prior to instruction, reform recommendations promote mathematics teaching that is adaptive and responsive, so that teachers make decisions on the basis of the ongoing nature of a lesson (National Council of Teachers of Mathematics, 2000; NRC, 2001). In particular, teachers are expected to attend closely to the ideas that students raise in class and to how these ideas relate to the mathematical objectives of the ongoing lesson. This style of teaching, by its very nature, heavily informed by teachers’ noticing in the moment of instruction—what teachers see as the essential components of the unfolding lesson and the sense teachers make of those features. Thus, in this volume, authors explore one of the critical skills needed for the type of teaching envisioned in the reform movement.

- **Learning from teaching.** A promising approach to supporting the growth of prospective and practicing mathematics teachers is to help them learn from their own teaching (see, e.g., Franke, Carpenter, Fennema, Ansell, & Behrend, 1998; Hiebert, Morris, Berk, & Jansen, 2007). We believe that teacher noticing plays a central role in making teaching generative because the principles that a teacher extracts from an experience of teaching depend intimately on how the teacher perceives those events and what meaning the teacher attaches to them. For example, many of the chapters in this volume are focused on teachers’ noticing of students’ mathematical thinking, and research has shown that, when teachers learn how to learn from the thinking of students in their classrooms, teachers can continue learning throughout their careers (Franke, Carpenter, Levi, & Fennema, 2001). Thus, students’ mathematical thinking can provide a coherent and constant source of professional development for teachers, but only if they learn to productively notice students’ thinking in their classrooms.

- **Decomposing practice.** A movement gaining voice among mathematics educators calls for decomposing teaching into core activities that can be productively discussed and practiced (Ball & Cohen, 1999; Ball, Sleep, Boerst, & Bass, 2009; Grossman & McDonald, 2008; Lampert, 2001; Lampert, Beasley, Ghousein, Kazemi, & Franke, 2010). The idea is that, by decomposing the complexity of mathematics teaching into specific activities, we can more feasibly and directly address key practices and develop a common language for discussing these practices. This volume contributes to these efforts by decomposing mathematics teaching in a way that makes it accessible while simulta-
neously preserving its interactive nature. In particular, we provide multiple
eamples of how a focus on mathematics teacher noticing—on teachers'
seeing and sense making—can provide language for describing teaching,
 enhance our understanding of the complexity of teaching, and promote the
development of teaching expertise.

An Overview of the Book
The chapters in this book represent a variety of perspectives and programs of
research on mathematics teacher noticing. We have organized these perspectives
into two broad sections preceded by this introductory section and followed by a
concluding section.

Foundations of Teacher Noticing
Section II is an exploration of the historical, theoretical, and methodological per-
spectives on teacher noticing. As a collection, the five chapters in the section
situate current research on mathematics teacher noticing within prior studies of
teaching as well as within studies of noticing outside of teaching. The chapters
also highlight key characteristics of teacher noticing and features of past and present
studies of teacher noticing. In chapter 2, Erickson offers a historical account
of research on teacher noticing. He describes a program of research on teacher
noticing that began in the early 1980s and draws connections between studies of
teacher thinking and teacher noticing. On the basis of extensive observations of
teachers, Erickson proposes that teacher noticing is an active process that draws
heavily on a teacher’s prior experiences and is opportunistic in that teachers notice
in order to take action. In chapter 3, Mason discusses roots of attention to noticing
and uses his own experience as the context through which to explore the
development of attention to noticing. Mason writes about the discipline of noticing
and emphasizes the need to train oneself to “notice in-the-moment,” that is, to
be able to act with fresh intent rather than simply out of habit.

Miller, the author of chapter 4, considers how research in domains other than
teaching can inform research on teacher noticing. In particular, he characterizes
situation awareness, the sort of “skilled viewing” that is required of experts in com-
plex domains such as sports and aviation, and emphasizes that expert noticing is
distinguished not only by that to which experts attend but also by that to which
they choose not to attend.

The authors of chapter 5, B. Sherin and Star, review a number of ways that
researchers typically study teacher noticing. They assert that different approaches
to this task do not represent solely methodological differences but instead reflect
different conceptions of teacher noticing on the part of researchers. B. Sherin and
Star recommend that researchers attend closely to these different conceptions as
research on teacher noticing moves forward.
In the final chapter of the section, chapter 6, M. Sherin, Russ, and Colestock explore methodological issues in the study of teacher noticing. They highlight the difficulty in accessing teachers’ in-the-moment noticing and describe how new technology in the form of teacher-wearable cameras may help to mediate this challenge.

**Studies of Mathematics Teacher Noticing**

Section III presents studies of mathematics teacher noticing in the context of teaching and learning. Across the seven chapters in the section, the noticing of both prospective and practicing teachers is explored. In addition, teacher noticing is investigated as it takes place during instruction and in professional development. A theme running through most chapters in the section concerns the development of teacher noticing—how noticing expertise changes over the course of a particular intervention with teachers or over the career paths of teachers.

In chapter 7, Jacobs, Lamb, Philipp, and Schappelle investigate a specialized type of mathematics teacher noticing, professional noticing of children’s mathematical thinking. The authors use a cross-sectional design to study the development of this expertise among prospective teachers and practicing teachers who have been engaged in sustained professional development for different amounts of time.

The chapter 8 authors, Star, Lynch, and Perova, explore the noticing of prospective secondary mathematics teachers before and after a semester-long methods course designed to improve observational skills. Using video, the authors examine participants’ abilities to notice features related to classroom environment, management, tasks, communication, and mathematical content.

The next three chapters (9, 10, and 11) share a focus on mathematics teacher noticing in the context of professional development work with practicing teachers.

In chapter 9, van Es presents a framework for studying the development of elementary school teachers’ noticing of children’s mathematical thinking. Drawing upon her framework, the author presents a developmental trajectory from basic to specialized noticing.

The author of chapter 10, Santagata, describes an approach for supporting the noticing of middle school mathematics teachers by promoting in-depth analyses of classroom lessons. Specifically, Santagata describes the testing and revision of an observational framework for teachers’ reflection on lesson learning goals, the extent to which learning goals are achieved, and alternative instructional strategies.

In chapter 11, Goldsmith and Seago explore the development of teacher noticing when middle and high school teachers participate in professional development centered on written and video-based records of practice. The authors discuss shifts in three areas of teachers’ noticing: teachers’ use of evidence, attention to students’ thinking, and attention to mathematical content.
The authors of chapter 12, Kazemi, Elliott, Mumme, Carroll, Lesseig, and Kelley-Petersen, take a different approach to the study of noticing in professional development. Rather than explore a setting of teacher professional development, they examine professional development for leaders of teachers. Specifically, they reflect on their own noticing while they worked with leaders, helping the leaders learn to more effectively facilitate teachers’ engagement with mathematical tasks in teacher professional development. Thus chapter 12 is a report on the noticing of “leaders of leaders.”

In contrast to the previous focus on noticing in the context of professional development, the focus in chapter 13 by Schifter is on the noticing of an elementary school teacher as it is revealed during instruction—what the teacher hears in her students’ questions and how the teacher recognizes the significance of their comments and the opportunities these comments afford the class. This study takes place in the context of instruction designed to support early algebraic reasoning for elementary school students.

Conclusion

To conclude the volume, Alan H. Schoenfeld argues for the consequential nature of teachers’ noticing. He also discusses the need for further study of the connections between teachers’ noticing and teachers’ knowledge, goals, and orientations.

Variations in the Study of Teacher Noticing Across the Chapters

Earlier in this introduction, we explained that the authors in this volume draw on somewhat diverse conceptualizations of noticing. Although some authors (e.g., M. Sherin et al., chapter 6; Star et al., chapter 8) define noticing solely as that to which teachers attend, most authors consider noticing to involve two main processes (attending to particular events in an instructional setting and making sense of those events). However, authors differ on their conceptions of making sense. Specifically, some conceptualize making sense only as interpreting (e.g., van Es, chapter 9; Goldsmith & Seago, chapter 11) whereas others conceptualize making sense as both interpreting and deciding how to respond (e.g., Jacobs et al., chapter 7; Kazemi et al., chapter 12). Similarly, Erickson (chapter 2) notes that teachers generally notice instrumentally, that is, in order to take action in their teaching.

Another variation in how authors conceptualize noticing concerns whether they narrow their focus to a particular aspect of noticing, for example, noticing of students’ mathematical thinking (e.g., Jacobs et al., chapter 7; van Es, chapter 9) or of particular mathematical content (e.g., Schifter, chapter 13). This contrasts with the approach of other authors, who explore, more broadly, the range of events that teachers notice (e.g., M. Sherin et al., chapter 6; Star et al., chapter 8).
These variations in how noticing is conceptualized also have methodological implications. Indeed, there is quite a bit of variability in the methods employed in the research reported in this volume. For example, some authors choose to study individual teachers’ noticing whereas others look at groups of teachers. Variations also occur among the media used to assess teachers’ noticing, including written student work, video clips of instruction, and teachers’ live classrooms. Among those who use video, researchers differ on how the video was selected (from the teachers’ classrooms or from unknown classrooms), the length of video (entire class lessons or short clips), and whether or not the clips were edited. Researchers also vary in how they capture teachers’ noticing, some by examining teachers’ discussions and others by analyzing teachers’ written responses to prompts. One innovative approach involved attaching cameras to teachers’ foreheads in order to capture that to which teachers attend while they teach (M. Sherin et al., chapter 6).

Clearly, each of these different methodological approaches may be more or less consistent with a particular conception of noticing (see B. Sherin & Star, chapter 5, for further discussion of this issue). For example, Jacobs and colleagues (chapter 7) maintain that, because teachers are constantly making decisions, they need to attend to and interpret students’ ideas in the service of deciding how to respond to those ideas. Thus, in studying “professional noticing of children’s mathematical thinking,” their data necessarily includes both teachers’ descriptions of children’s ideas and the reasoning teachers use when deciding how to respond to children. Star and colleagues (chapter 8), on the other hand, suggest that, before prospective teachers can make sense of classroom features, they must first learn to attend to pertinent features. Their data collection reflects this conceptualization of noticing, and therefore focuses exclusively on what teachers attend to.

Although we believe that the state of research on teacher noticing is too young to benefit from a single definition or methodological approach, we suggest that researchers will move the field forward by clarifying the conceptualizations they are using and by explicitly connecting these conceptualizations to the methodological commitments made in their studies. In doing so, we will further our understanding not only of mathematics teacher noticing but also of the affordances and constraints that are linked to various conceptualizations of noticing.

**Key Considerations in the Study of Teacher Noticing**

Because this is an edited volume, each chapter stands on its own as a piece of research, but our hope is that the book is more than the sum of its parts. Our goal here has been to give the reader the sense that a new subfield is forming within research on teaching. We would like this book to be read as beginning to map the boundaries of this new field. For that reason, we close this introduction by stating what we believe to be the core questions of this new field, and we encourage readers to consider these questions while reading each chapter:
1. *Is teacher noticing trainable?* A key set of questions has to do with the trainability of teacher noticing. For example, can we teach prospective teachers to notice, or can they learn this skill only through hours of experience teaching a class? Of particular interest are questions related to the use of video. In what ways can video be used as a tool for helping teachers gain expertise in noticing?

2. *What trajectories of development related to noticing expertise exist for prospective and practicing teachers?* There are many questions that have to do with the nature of the learning trajectories associated with teacher noticing. How does the noticing of expert teachers differ from that of novices? How long do novices need to acquire more expert noticing? Is the learning curve steep or shallow? What benchmarks exist to identify growth?

3. *How context specific is noticing expertise?* How unitary a skill is teacher noticing? If a mathematics teacher has expertise in noticing, will he or she have noticing expertise for all mathematical domains and instructional contexts? For example, do the teaching of algebra and the teaching of fractions require different noticing skills? Will a teacher who has expertise in noticing student thinking necessarily also have expertise in noticing classroom climate?

4. *How can researchers most productively study teacher noticing?* The study of teacher noticing poses particularly thorny methodological challenges. Noticing is a fleeting phenomenon in the midst of an often complex environment. Given these challenges, what techniques are most productive for us, as researchers, to gain access to teacher noticing? For example, what can we learn from studying teacher noticing in the act of teaching, and what can we learn from studying teacher noticing in university classes and professional development contexts?

5. *Why do we (or should we) study teacher noticing?* Finally, there are the ultimate questions of the real importance of teacher noticing. If teachers have more expertise in noticing, will they have more effective classrooms, ones in which students learn more?

We close by sharing that our own interest in teacher noticing grew out of our commitment to helping teachers improve their practices. Because teachers are bombarded with a “blooming, buzzing confusion of sensory data” (B. Sherin & Star, chapter 5), we believe that for teachers to consider all the ways to respond in a particular context is a hopeless task. Therefore, instead of trying to teach teachers how to deal with all possible contingencies, we focus on ways to help teachers better understand their learning environments so that they can make more informed instructional decisions. Through our research and professional development experiences, we have found that, when teachers are making this transformation, they are seeing and making sense differently of things that are happening in the classroom. In short, teachers’ changing practices are accompanied by new and enhanced teacher noticing, and it is this idea that we try to capture and explore in the book.
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