A LARGE-SCALE STUDY ON TEACHER NOTICING

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Teachers' noticing of key aspects of instruction is an important skill for learning from and improving their teaching because noticing enables the opportunity for change. We investigated what teachers notice in short video clips of a real classroom teacher's interaction with students around a mathematics problem by conducting the largest survey study on teacher noticing to date. According to our analysis of data collected from 496 fourth- and fifth-grade teachers from 48 states, the key issues that were vital to improving teaching and students' learning caught the attention of only 13.7% of teachers. However, 67.5% of the teachers focused on interpreting issues around content-specific teaching and learning, and 17.7% paid attention to general issues, such as the classroom climate.

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Teacher noticing, or the act of observing and interpreting classroom events (e.g., Sherin & van Es 2009), influences the likelihood for desirable teacher actions such as responding to student mistakes and making a variety of other pedagogical choices. Yet, the act of noticing classroom events that are pedagogically relevant for improving teaching and advancing students' thinking is not a simple skill. During any second of classroom instruction, teachers are inundated with numerous inputs (e.g., each individual student's attention, students' reaction to given tasks, or the impact of his/her choice of sequencing of activities on students' thinking), requiring teachers to be selective in their noticing. Research demonstrates that teachers' noticing of classroom events is widespread; aspects of the classroom that capture teachers' attention include classroom climate, students' math thinking, and the organization of the classroom (e.g., Sherin & van Es, 2009). Furthermore, when teachers attend to one particular classroom occurrence, they are consciously or unconsciously missing other events occurring in the classroom. Effective teaching thus relies in part on noticing and attending to the most pedagogically relevant aspects of the class and filtering out other aspects (Sherin, Russ, & Colestock, 2011).

Researchers acknowledge the importance of noticing for teaching expertise and have conducted explorations of teacher noticing skills that made significant contributions to the field. Yet studies on teacher noticing to date also have certain limitations, namely that they are conducted with limited numbers of teachers, with teachers who were attending a professional development program targeting their noticing skills, or with teachers from only certain school districts (e.g., Jacobs, Lamb, & Phillip, 2010; van Es, 2011). Our current understanding of mathematics teacher noticing is thus informed in large part by research settings that involved prompts and facilitators guiding teachers to attend to certain aspects of classroom events and samples that limit generalizability. We argue that an analysis investigating what teachers across the United States notice independent of a professional development setting or teacher education program seeking to improve their noticing skills is needed to better understand the overall trend in teachers' noticing skills. This analysis will advance not only our general understanding of teachers' noticing, but also our preparedness to help teachers improve their noticing skills to develop more effective teaching.

Objectives

The present study is the first large-scale analysis of mathematics teachers' noticing. Fourth- and fifth-grade teachers ($N = 496$) watched four short videos of classroom mathematics instruction that targeted fraction concepts. The instruction was aligned with the upper elementary mathematics standards (National Governors Association and Council of Chief School Officers, 2010). We consider certain types of noticing to be more beneficial for teachers to make changes to their content-specific pedagogical practices. As such, we intentionally selected videos that showed instructionally problematic teaching moments and/or students' confusion around the targeted mathematical content. Our aim was to investigate whether these key moments would attract teachers' attention compared with other generic issues. Although we did not direct teachers' attention to these specific particular issues, we specifically asked them to report what they noticed around the mathematical content. Again, our rationale was that teachers cannot make content-specific pedagogical decisions if they cannot notice these issues. Building on prior work on teachers' noticing (van Es & Sherin, 2008), we aimed to explore the following research questions:

1. What overall topics of the classroom instruction presented in the video clips caught the teachers' attention? What levels of analysis did teachers' noticing entail?
2. What subtopics of the classroom instruction at each level of analysis did teachers notice?

Methods

This study used data from 496 fourth- and fifth-grade teachers. The teachers completed an online mathematics teaching survey that included four videos of classroom instruction from Kersting and colleagues developed to capture teachers' useable knowledge (2008, 2010, 2012). For each of the four videos, teachers were asked, "Please list the three most significant things that you notice regarding how the teacher and the students in the clip interacted around the targeted mathematical content." The videos were presented in a random order for each participant. For our analysis, we include teachers who provided responses to at least one of the videos.

Analysis

We developed a 4-point rubric to evaluate the depth and topics of teachers' responses. Our goals were to differentiate between teachers' surface-level noticing and more sophisticated noticing, and also to identify responses focused on *content-specific teaching and learning-related issues* that limited students' understanding of the concepts in the videos. Thus, we created our rubric to distinguish among purely descriptive responses, analytical responses, and responses that focused on the problematic content-specific issues in each video. We also coded a subsample of responses to ensure that our rubric captured qualitative differences in teachers' responses. An important distinction between our rubric and those used in prior studies is that we consider both content and depth of analysis within single codes, whereas other rubrics use separate codes to capture content and stance of analysis (e.g., Sherin & van Es, 2009)

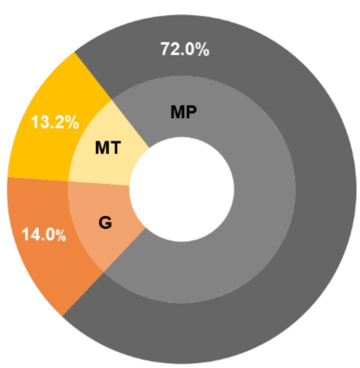
In our rubric, Level 1 responses did not include mathematics-specific events (e.g., describing seating arrangements, describing the teacher's tone of voice); Level 2 responses focused on content-specific aspects that were either purely descriptive or that contained a binary judgment (e.g., restating the problem, stating that the lesson was good); Level 3 responses analyzed some aspect of students' mathematical thinking or the teacher's mathematics pedagogy (e.g., noticing that the students were confused, interpreting why the teacher chose to use a strategy); Level 4 responses included responses that focused on the problematic issues related to students' mathematical understanding or teachers' mathematical instructional practices.

Our rubric also captured the topics of teachers' noticing responses. Adapting the methods of van Es and Sherin (2008), we differentiated among responses related to three topic categories: the mathematics pedagogy code identified responses that focused on teaching actions and strategies, such as the use of manipulatives or questioning techniques; the mathematical thinking code identified responses that focused on students' thinking and ideas; and the general code identified responses that were not related to the mathematical content.

After we finalized our rubric and gained confidence in using the rubric to reliably code responses, we coded the remaining responses by rotating the order and combination of the responses to the videos. Interrater reliability as measured by exact agreement was 95.3% for Noticing Levels and 95.9% for the Noticing topics. Furthermore, coefficient kappa was .927 and .909 for noticing levels and noticing topics. Teachers' responses were scored with a high degree of consistency.

Results

On the basis of our analysis of 5,382 responses, the vast majority of responses (72%) were related to pedagogical content, such as the actions, choices, or strategies the teacher used during the lesson (see Figure 1). 13.2% of the responses were focused on students' mathematical thinking, and 14% of the responses were about the general classroom climate and environment not specific to mathematics.[1] In terms of the depth of teachers' analysis of classroom events, we found that 14.8% of the responses had no focus on mathematics and 33% were purely descriptive (i.e., they did not indicate any analysis or interpretation; see Figure 2). Nearly half of all the responses (47.79%) included some level of analytical thinking about students' learning and teachers' pedagogical choices around the mathematics content but did not identify the key mathematical ideas related to the problematic mathematics content. Only about 6% of responses included an analysis of key mathematical issues around either the teachers' pedagogical choices, students' understanding, or both.



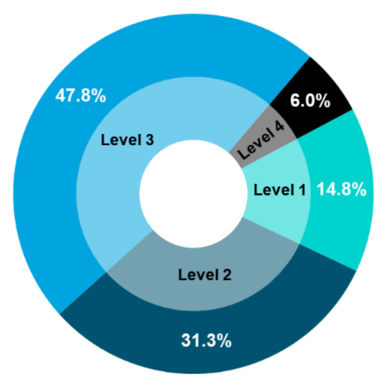


Figure 1. Percentages of overall noticing topics across 5,382 responses. MP = mathematics pedagogy; MT = mathematical thinking of students; G = general. Figure 2. Percentages of noticing depth levels across 5,382 teacher responses.

Aspects of Mathematics Classroom Events Teachers Noticed at Level 1 and Level 2

Level 1. Level 1 of our rubric contained responses that did mention mathematics but merely in a descriptive or evaluative way (e.g., "good" or "important" or "difficult"), without any

[1] Recall that teachers were asked to list three things they noticed. Some listed two and gave no answer for the third one. We assigned the "no answer" responses a score of 0, and we include these responses in the "general" noticing category.

analysis. As shown in Table 1, the vast majority of Level 1 responses (91.4%) focused on teaching-related issues, such as the instructional tools and questioning strategies the teacher used. Among those responses focusing on content-specific pedagogical issues, almost one-third of the responses (30%) mentioned the use of manipulatives, visuals, or hands-on materials (e.g., "The students were working with manipulatives;" "I like that they used the pie fraction pieces").

Level 2. Level 2 responses included analytical or interpretive statements about the mathematics content in the video, but they did not identify the problematic mathematics content. At Level 2, 79.8% of responses focused on content-specific pedagogical issues, whereas 20.2% focused on students' mathematical thinking. As shown in Table 1, teachers focused on a wide range of issues regarding mathematics pedagogy.

Among the issues related to students' mathematical thinking, the majority of responses (74.6%) focused on what students seemed to understand or were struggling to understand ("Students are manipulating the pieces, but I can't tell if they are truly understanding the concept;" "The kids don't seem to have an understanding of parts to whole"). In relation to how students engaged with the problem ("The student used trial and error to find the correct fraction pieces to use;" "I noticed students were engaged in the lesson with the chips and did not seem to give up in understanding in solving the problem"), 8.5% of the responses focused on students' readiness to deal with the given concept or problem ("Her work with one student seemed effective, but I don't think the whole class was ready to tackle this problem;" "The students obviously had background knowledge on how to solve these problems").

Discussion

The concept of teacher noticing has important implications for student learning, research and teacher education because teachers do not address events that do not catch their attention. The majority of prior work on mathematics teacher noticing has been conducted with teachers in a program aiming to improve teachers' noticing skills; thus, the present study is unique by investigating trends in what a national sample of fourth- and fifth-grade mathematics teachers noticed independent of professional development or teacher education programs.

In alignment with prior work, our study indicated that pedagogical topics caught teachers' attention more often than any other topic (e.g., Sherin & van Es, 2009). In fact, more than two-thirds of teachers noticed content-specific pedagogical topics in each video; however, one-third of the teachers did not report anything on students' mathematical thinking.

Our study contributed to the current understanding of noticing in that teachers analyzed pedagogical strategies in greater depth, and their analyses targeted a wide range of pedagogical strategies. In contrast, teachers' analysis of students' mathematical thinking seemed limited. As scholars in several studies have noted, attending to and interpreting students' thinking is an important aspect of quality teaching (e.g., Ball & Cohen, 1999; Jacobs et al., 2010) and one that contributes to students' learning (Carpenter, Fennema, Peterson, Chiang, & Loef, 1989). Thus, teachers' lack of attention to students' mathematical thinking may indicate a lack of attention to their own students' thinking. Therefore, teachers may need more targeted interventions to learn to focus on students and how they analyze students' thinking.

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