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TEACHER NOTICING VIA VIDEO

The Role of Interpretive Frames

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Introduction

Over the past decade, educational researchers have increasingly explored the construct of teacher noticing by documenting its role in teaching expertise. Teachers are faced with a "blooming, buzzing confusion of sensory data" (Sherin & Star, 2011, p. 69), too much for any one person to process at once. Therefore, teachers must select, either tacitly or explicitly, some elements from the environment to attend to while leaving other elements aside (Miller, 2011). Research indicates that noticing is consequential for teaching; when teachers pay close attention to the details of their students' thinking, there are increased opportunities for student learning (Russ & Sherin, 2013).

The importance of teacher noticing has led to a proliferation of programs designed to tune teachers' attention to classroom interactions in particular ways. Within these programs, video is a key resource for successfully supporting the development of noticing (Borko, Jacobs, Eiteljorg, & Pittman, 2008). While video captures much of the richness of the classroom environment, it does not require an immediate response from a teacher and can instead promote sustained teacher reflection (Sherin, 2004). Moreover, because video provides a permanent record of classroom interactions, it can be viewed repeatedly and with different lenses in mind, promoting new ways for teachers to "see" what is taking place.

Research on teacher noticing has thus far reached some points of consensus: (1) teachers do notice some things in the classroom while overlooking other things, and (2) teacher noticing is not merely a series of isolated events that occur consecutively in time or space. Instead, teacher noticing is contextual and interdependent. Specifically, teachers do not notice one event or

action and then a moment later notice another event, independent of what he or she has already noticed. Instead, what a teacher notices in one moment drives, at least in part, what the teacher notices next. Moreover, as with perception in general, noticing can occur in both a top-down and a bottom-up fashion. Rumelhart (1980) describes top-down activation through the example of recognizing a face, which then prompts one to identify the nose, ears, eyes, etc., in contrast to bottom-up activation, in which one might initially notice a "nose" and assume that it belongs to a face, which then prompts one to be on the lookout for the related elements of a face. For teachers, perception likely happens in a similar way. In some instances, noticing an unexpected student error might prompt a teacher to look for information about why that error arose (bottom-up). In other cases, a teacher might decide in advance to look for different strategies students use to solve addition word problems (top-down).

What is missing from the literature, however, is a sense of the kinds of structures that drive and give rise to this contextuality and interdependence. That is, we do not have an analog to the "face" schema for teaching. In this chapter, we ask: What frames or schemas do teachers typically draw on in making sense of classroom interactions? To address this question, we introduce 13 *interpretive frames* that we have identified in our data and explore the relationship between the frames and teachers' experiences viewing and discussing video excerpts.

The notion of interpretive frames is important both for understanding the nature of teacher noticing, as we have outlined above, as well as for the design of teacher education and professional development opportunities. Understanding the ways in which teachers make sense of what they notice provides useful starting points for supporting the development of teachers' noticing.

Conceptualizing Teacher Noticing

We take a particular approach to the study of teacher noticing that focuses on the construct of "teachers' professional vision" (Sherin, 2007). Drawing on Goodwin (1994), professional vision can be understood as the ways in which members of a professional discipline attend to the phenomena of interest to them. For teachers, this professional vision entails how teachers identify significant interactions in the context of a classroom.

In prior work, we have proposed that teachers' professional vision is comprised of two key processes, *selective attention* and *knowledge-based reasoning*. Selective attention involves how teachers determine where to focus their attention in the classroom. Miller (2011) explains that for novices this may involve "cognitive tunneling," in which one attends to only a small subset of the available phenomena. In contrast, more expert noticing will likely involve selecting from among all the available phenomena, those that are most relevant, what Mason (2011) refers to as "marking." Knowledge-based reasoning, in contrast, concerns how a teacher reasons about what is noticed. That is, what kind of meaning or significance does the teacher attribute to a particular interaction? Teachers have a host of knowledge of their students, school, curriculum, etc., from which they can draw to make sense of (or interpret) what is noticed. In addition to "attending to key events" and "interpreting key events" (Sherin, Jacobs, & Philipp, 2011), some researchers also include the act of planning to respond as part of noticing (Jacobs, Lamb, & Philipp, 2010).

While these three sub-processes can be talked about independently, research highlights the close connection among them. In particular, Jacobs et al. (2010) explain that "attending, interpreting, and deciding how to respond [occur] ... almost simultaneously, as if constituting a single, integrated teaching move" (p. 173). They document that the process of selective attention provides a foundation upon which learning to respond can be built. In our own prior work, we explored the connection between selective attention and knowledge-based reasoning (Sherin, 2007) and found that these processes are cyclic and mutually reinforcing. That is, noticing a particular event or interaction prompted teachers to reason about that event, and subsequently, the ways that teachers reasoned about events in turn prompted them to notice particular kinds of elements in the classroom.

We intend *interpretive frames* to further specify the relationship between the sub-processes involved in teacher noticing. In particular, they are structures that describe the ways in which a teacher's selective attention both grows out of and informs his or her knowledge-based reasoning, and vice versa. That is, the "cyclic" and "integrated" nature of the sub-processes of selective attention and knowledge-based reasoning are formalized by, evident in, and defined by the interpretive frame.

Methods

Much of our prior work on teacher noticing took place in the context of video clubs in which groups of mathematics teachers met to watch and discuss excerpts of videos from their classes. The video clubs were facilitated by a researcher who encouraged participating teachers to closely examine the mathematical ideas that students raised in the video. We found that, as a result of participating in a video club, teachers' professional vision developed in significant ways. In particular, teachers shifted from an initial focus on pedagogy and management to a focus on students' mathematical thinking, and furthermore, they moved from evaluation to interpretation of students' thinking (van Es & Sherin, 2010).

Video clubs purposefully provide scaffolds—in the form of both a knowledge-able facilitator who encourages particular types of noticing and peers who build on one another's noticing—to support participants in noticing substantive student thinking. In that sense, one can understand video clubs as zones of proximal development (ZPD) (Tharp & Gallimore, 1988) for eliciting and studying teacher noticing. While we certainly want and need to know what teachers do when supported in these contexts, the noticing that drives teacher responsiveness during instruction occurs in isolation, often without those supports. As such, we wanted to explore the kinds of classroom interactions that were typically salient to teachers and the ways in which teachers, unassisted by a facilitator or peers, interpret such events.

In this chapter we examine the nature of teacher noticing that is outside of that ZPD by using video-based noticing interviews to investigate how teachers make sense of classroom interactions. We conducted a study of 15 middle and high school mathematics teachers, all of whom taught in the same school district in the western United States located approximately 60 miles from a large urban city. The student population in the district is diverse and includes a large Latino and ESL community. The teachers had a range of teaching experience of between 1 and 15 years.

In the noticing interviews, teachers were asked to view and then comment on four short video excerpts from other teachers' mathematics classes. Specifically, after the first video excerpt was played, the researcher would ask: "What did you notice in the video?" Following the teacher's response, the researcher would ask: "Is there anything else you noticed?" The teacher would again have an opportunity to respond. Next, the researcher would probe "Anything else?" This continued until the teacher responded that he or she had nothing additional to add. This process was repeated for all four videos. The interviews were videotaped and lasted between 20 and 40 minutes.

The focus of these interviews was on soliciting from teachers what stood out to them in the video. Note that the task we engaged the teachers in was not a pedagogical one; at no point did the interviewer ask the teachers how they would respond to the events in the video if they were the teacher. Additionally, the interviewer did not probe the teachers about "why" they noticed the things that they did. As much as possible, we simply wanted to elicit from the teachers what was salient for them in the videos.

Given our purpose for the interview, we selected videos that provided evidence of students engaging in substantive mathematics work. Beyond that initial criterion, we chose four videos that represented a range of participant structures, math content areas, and instructional strategies (see Table 1.1). We did so for two reasons. First, we wanted to ensure that each teacher would find at least one of the videos familiar to them based on their own typical instructional approaches. Second, since teachers can only notice what they have opportunities to notice, we wanted to be sure to present them with a range of opportunities such that everyone would find something worth noticing.

TABLE 1.1 Video Excerpts Used in Noticing Interviews

	Duration	Math Topic	Grade Level	Participant Structure	Summary
Video 1	1.5 minutes	Calculating Slope	High School	Teacher-Student One-on-one	Student and teacher discuss problem that student says she is confused about
Video 2	4.5 minutes	Use of Pythagorean Formula	High School	Whole Class	Teacher poses question to class. Teacher directs discussion with student input.
Video 3	3.5 minutes	Estimating Ratios	Middle School	Whole Class	Student presentation at the board followed by student-to-student discussion
Video 4	6 minutes	Writing Equations	Middle School	Student Small Group Work	Group of students work together to write an equation. Teacher approaches group and asks for explanation of solution.

Analysis

Stage 1: Segmenting the Interview Transcripts

Analysis of the noticing interviews proceeded through several stages. In stage one, the interview transcripts were divided into idea units (Jacobs & Morita, 2002). These were segments of teacher talk in which a single topic was discussed. Two researchers segmented each transcript. Inter-rater reliability was over 85%, and disagreements were resolved through consensus. The individual interviews consisted of between 13 and 26 idea units each, with a total of 229 idea units across the 15 interviews.

Stage 2: Coding for Selective Attention and Knowledge-Based Reasoning

In stage two, each idea unit was coded along several dimensions to explore aspects of the teachers' selective attention and knowledge-based reasoning. Dimensions and codes were both theoretically driven by prior research (etic) and emergent (emic) from the data (van Es & Sherin, 2008). Two researchers coded each interview transcript. Inter-rater reliability was above 80% on all categories across all teachers and averaged 90%. Disagreements were resolved through consensus.

With regard to selective attention, we coded along two categories: topic (what was discussed) and actor (who was discussed). With regard to knowledge-based reasoning, we coded along three categories: stance (whether a descriptive, evaluative, or interpretive approach was used); level of specificity (general or specific); and video-based (whether teachers' comments primarily concerned events that were within or outside of the video viewed).

The application of the video-based category represented a turning point in our analysis. In looking across the idea units from the interviews, a member of the research team noticed that some teachers tended to talk about their own classrooms rather than the classrooms displayed in the clips. At first we were puzzled. Why would teachers talk about their own classrooms when asked to describe what they noticed in video excerpts from other teachers' classrooms? When looking across instances of the "outside video" code, we realized that teachers referred to their own classrooms as a way to explain what they noticed in the video clips. For example, Bill commented, "If this were my school and I handed somebody a ruler, it wouldn't be long before somebody was swinging it at somebody [else]. So, I would be very, very close in monitoring the person with the ruler." Here Bill noticed that a student in the video has a meter stick and explains that if he were the teacher, he would stick close by that student.

Stage 3: Identifying Interpretive Frames

To explore this issue further, in stage three of the analysis, rather than using multiple, mutually independent categories and codes to characterize idea units, we began to look holistically at each unit by treating the entire unit as evidence of a coherent strategy. To do so, we drew on prior research that identified types of strategies that teachers used to discuss instructional situations (e.g., Borko et al. 2008; Carter, Sabers, Cushing, Pinnegar, & Berliner, 1987; Copeland, Birmingham, DeMeulle, D'Emidio-Caston, & Natal, 1994). We also drew on research on reading comprehension strategies (Anderson & Pearson, 1984; Dixon & Moore, 1990), hypothesizing that reading a text and "reading" a video might share some key features (Goldman-Segall, 1998).

Thus, with potential strategies in mind, we began to review a subset of the data, noting both confirming and disconfirming evidence of teachers' use of the selected strategies. Through an iterative process again involving both etic and emic codes, we identified a stable set of 13 strategies—or interpretive frames—that the teachers used during the noticing interviews. Our use of the word framing is intentional; it has both intuitive appeal and grounding in the research. Intuitively, "frames" (like eyeglass frames) invoke the notion of having a lens through which we see the world. Within research in sociolinguistics and anthropology (Goffman, 1974; Tannen, 1993), frames are a person's way of making sense of all that goes on in the world. Additionally, the adjective "interpretive" is meant to centralize and highlight the *active* sense making that teachers engage in as they observe classroom

activity. That is, frames are not imposed on the teachers; teachers actively and dynamically (though tacitly) construct those frames as they make meaning of (or interpret) the video.

Stage 4: Coding for Use of Interpretive Frames

Finally, in stage four, two researchers used the 13 interpretive frames identified in stage three to systematically code the entire data set. This process involved coding each idea unit for the presence or absence of each of the 13 frames. As such, a teacher could be found to use multiple interpretive frames within a single idea unit. Two researchers coded the entire data set. A total of 429 codes were applied to the data. In the final phase of analysis, we noted how many teachers used each of the 13 interpretive frames and the average number of idea units in which each interpretive frame was used.

Results

The main result of our analysis is an observation about the nature of teachers' professional vision. When teachers talk about what they notice, they do not simply provide a list of items or events that were noticed. Instead, they describe their thinking about what they notice. Furthermore, these descriptions are usually embedded within an extended story or an explanation or hypothesis about what is going on.

An Extended Example of Interpretive Frames in Action

Consider, for example, the following comments from Debbie, after having watched the first video clip.

MIRIAM: Okay, so what did you notice as you watched the clip?
DEBBIE: A lot of tapping. I noticed about two or three boys that were constantly tapping, and I wanted to touch them [and say] "Stop!" This young man up in front, for a while he was just, just looking around. ... The teacher was helping a student individually, trying to help her understand how to do something. And for a while it seemed like the student was starting to understand—and then all of a sudden, well, "I don't understand, that's why I'm asking you." I thought that was funny.

Debbie's initial remarks concern two boys tapping their pencils on their desks. She began "I noticed a lot of tapping" and immediately went on to explain that she wanted to stop the boys herself. What is important here is that Debbie did not just tell us that she noticed the tapping. Instead, her comments reveal how she understood what she noticed. In this case, Debbie made sense of what she

noticed as if she were the teacher in the video. For example, it seems possible that the boys' tapping might have stood out to Debbie because, as a teacher, she would have wanted it to stop.

As she continued, Debbie commented that the teacher was helping a student and that the student seemed to be understanding but "all of a sudden" declared, "I don't understand, that's why I'm asking you." Once again, Debbie did not stop after describing these events. Instead, she explains, "I thought that was funny." Debbie's knowledge of what took place in the video appears tightly connected to her feelings about what took place. Likely part of the reason this event stood out for Debbie was precisely because it was funny to her.

These examples reflect Debbie's tacit use of different interpretive frames. She took on the perspective of the teacher in the video and then had an affective response to a student comment. Here, Debbie's comments exemplify that noticing is not equivalent to listing noticed events. Debbie did not merely list the events she observed by saying something like: "I noticed that the boys are tapping their pencils and then a girl makes a comment that she doesn't understand." In this way, Debbie's noticing does not operate under the rules of what Collins & Ferguson (1993) call the "list making" epistemic game. She seems to tacitly take her task to be something more than that by automatically integrating her knowledge-based reasoning into her account of her selective attention.

Additionally, we could imagine Debbie noticing the same events but talking about them in dramatically different ways. For example, we could imagine Debbie discussing the tapping using the affective frame she applied to the student comment about not understanding. She might have said, "Oh, that tapping just makes my skin crawl!" A question for us as researchers is whether these differences in interpretive frames constitute different noticing. In what ways are these differences consequential for supporting change in teacher noticing? We will take up this point later in the chapter.

Debbie's interpretive frames highlight a sort of chicken-and-egg scenario with regards to selective attention and knowledge-based reasoning. In each interpretive frame, the way Debbie makes sense of the video (her knowledge-based reasoning) is both constrained by and contributes to what she notices in the video (her selective attention). For example, she notices the boys tapping because she would want to stop it, and she would want to stop it because she notices it. This issue suggests the need to consider whether and how attention can or should be disentangled from interpretation. For us in this work, interpretive frames eliminate the need to analytically impose boundaries between selective attention and knowledge-based reasoning.

A Summary of the Interpretive Frames

The extended example from Debbie reflects what we saw across the noticing interviews. In what follows, we describe the frames in more detail using selected examples from the data. See Table 1.2 for a summary. Also, in order to help the

TABLE 1.2 Interpretive Frames Used by Teachers to Discuss What They Noticed in Video Excerpts of Math Classes

Interpretive Frame	Definition	Example	No. teachers using frame	No. (and %) of idea units in which frame used
Affective	Describes an affective reaction to video	"I'm jealous of the high ceiling with the use of the overhead. I can't even use one in my class because of the computers."	13	31 (14%)
Alternatives	Offers alternatives to actions in video	"Instead of showing them by drawing lines [herself], she could have used the students to explain the concept."	7	27 (18%)
Anomaly	Identifies something unexpected or surprising	"I was shocked to see a chalkboard. I hadn't seen those in a while."	6	15 (7%)
Casual Relationships	Relates events in the video by cause and effect	"It's almost as if, because the teacher was far away, they didn't have to do what they were supposed to do."	7	47 (21%)
Comparison	Compares video to something that occurred elsewhere	"Her kids are really good at participating. My kids have a lot of trouble with that ..."	14	67 (29%)
Evaluation	Assesses the quality of the video content	"I think it was good how they were all working in groups on different things."	15	107 (47%)
Generalization	Identifies specific behavior or activity that takes place across multiple teaching contexts	"It's hard when you go over to a student and ask, "What don't you understand?", and they're trying to tell you, but they don't know what they don't understand."	13	63 (14%)

(Continued)

Interpretive Frame	Definition	Example	No. teachers using frame	No. (and %) of idea units in which frame used
Familiarity	Identifies aspect of video as recognizable	"I'm a big overhead person so I understand that."	3	10 (4%)
Metaphor	Uses a metaphor to describe aspect of video	"She's the pied piper to them. They're ready to follow her anywhere."	2	7 (3%)
Perspective Taking	Imagines him or herself in position of someone in the video	"If I were the teacher I would have wanted to gather the class's attention. I have a thing that I do to get everybody focused on me with a hand signal."	4	32 (14%)
Principles	Refers to a general principle of teaching and learning	"If the teacher's back is turned, that's when the fun begins."	9	18 (8%)
Storytelling	Relates a series of events as occurring sequentially	"She lectures, they copy down notes, then they practice the problem. Then she walks around to see how they're doing."	3	57 (25%)
What's Not There	Identifies something absent from video	"What I was looking for but didn't see was any mention of the shape of the graph."	4	11 (5%)

reader recognize the relationship among the different frames, we present them here as elements of six cluster groups.

Narrative Frames

This first cluster consists of two frames in which teachers described what they noticed by providing a narrative that connects events in a video to one another. This cluster is closest to the type of "list making" that we might have initially expected

teachers to do while reviewing the video. In fact, in the *storytelling* frame, teachers related a series of events as occurring sequentially in a video. For example, Susan explained what she noticed: "She lectures, they copy down notes, and then they practice the problem. Then she walks around to see how they're [doing]." In previous work, we characterized pre-service teachers as typically describing events that took place in their own classroom by listing chronologically what had occurred (van Es & Sherin, 2002). Here we have evidence that even some teachers with more extensive teaching experience (though only 3 for a total of 25% of the overall idea units) also engaged in this type of list making. However, the relative infrequency of this frame adds support to our assumption that something more complex than list making is going on as teachers describe what they noticed in the videos.

Causal relationships is another frame in which teachers used a narrative to make connections among events in a video. In this case, however, the teachers' statements suggested that the events in the narrative were related by cause and effect. For example, Marie stated, "It's almost as if, because the teacher was far away, [the students] didn't have to do what they were supposed to do." Copeland et al. (1994) identify a similar approach that teachers used to make meaning of video-taped lessons, asserting causal relationships specifically between teacher and student actions. The frame was used by seven of the teachers, across 18% of the total number of idea units.

Normative Frames

The next cluster includes interpretive frames in which teachers assess the quality of the events in a video using normative metrics. In particular, we found that teachers frequently *evaluated* what they noticed in the video excerpts, making comments such as: "I don't think that explanation is going to be very helpful" or "These kids are really good at participating." Across all of these comments was a reaction from the teachers as to the merit of the events they viewed. This type of evaluative approach on the part of teachers has been described extensively in the research literature and may reflect the strong culture of assessment that generally pervades schools in the United States today (Levin, Hammer, & Coffey, 2009).

A related interpretive frame involved teachers offering *alternatives* to the actions that took place in the videos. In some sense this was an extension of the evaluative frame. Before offering an alternative choice, teachers must at least tacitly first have found the existing choice lacking along some metric. Suggested alternatives most often concerned the teachers' actions, such as "Instead of showing them by drawing lines [herself], she could have used the student's example to explain the concept." Because teaching requires making quick decisions about how to respond, it may have seemed quite natural to teachers to offer alternatives related to specific teaching interactions (Sherin & Han, 2004).

All 15 of the participating teachers used the *evaluation* frame in just over 47% of the total number of idea units. This was the most commonly used interpretive frame that we identified. The frequency of this type of frame is not surprising

given the extent to which standards and metrics of "goodness" are regularly discussed with respect to teaching. The *alternatives* frame was used less often, by seven teachers in 18% of the total ideas units.

Personal Frames

The next two interpretive frames we describe involve teachers experiencing a personal connection to the events in the video. In one case, teachers placed themselves in the action going on in the video. We refer to this frame as *perspective taking*. This most often occurred when the teacher imagined himself or herself in the role of the teacher in the video. For example, Dan explained:

> I'm sort of puzzled why he let the girls on as long as he did. ... Once I saw them floundering, I would be tempted not to let them hang that long before kind of stepping in and trying to redirect the class. Just out of a desire to protect their feelings.

It seems likely that these events stood out to the teachers because they were able to imagine how they would react if they had been an actor in the classroom itself.

The *affective* interpretive frame is similar in that teachers express a personal connection to the video, although in this case, the reaction reflects an emotional reaction. For instance, Nick commented, "I'm jealous of the high ceilings," and Dan mentioned being annoyed by the teacher's voice, "[It] gets on your nerves." While we cannot know for sure, it may be the case that a strong affective response serves as an important trigger for teachers to pay close attention to what is taking place in the video.

Despite being reported as a central strategy for text comprehension (Dixon & Moore, 1990), perspective taking was used infrequently in our data set—among only four teachers and in 14% of the idea units. In contrast, many more teachers described having an *affective* response to a video. This occurred in 13 of the 15 teachers, though again in only 14% of the idea units. It may be that teachers place themselves inside the action only when the instruction pictured in the video is consistent with their own pedagogical approaches.

Expectation Frames

Three interpretive frames concern the degree to which teachers were accustomed to seeing, or expected to see, the events that appeared in the video. Specifically, when drawing on the *familiarity* frame, teachers identified an aspect of the video as recognizable, as a kind of interaction or event with which they are well acquainted. For example, Sophia commented: "I'm a big overhead person, so I understand [why she does] that," while Nick explained, "We have that in

our school here too, quite a few children that you need to group with somebody because they don't [speak English]."

Somewhat in contrast to the *familiarity* frame is the *anomaly* frame in which a teacher comments on an unusual or unexpected aspect of the video. For example, Debbie stated, "I was shocked to see a chalkboard, I hadn't seen those in a while," and Matt commented, "I noticed there was a guy wearing a hat. [Students are] not supposed to wear hats in class."

The third interpretive frame, *what's not there*, involved teachers responding to something they recognized as being missing from a video. For example, Marie mentioned, "What I was looking for, but didn't see, was any mention of the shape of the graph." To Marie, it would have been quite natural for the teacher and student in the first video to talk about slope in terms of the graph's shape. When they didn't do this, Marie noticed.

In all three of these frames, teachers reacted to whether or not the actions viewed on the video align or misalign with their expectations. This is not uncommon. A wealth of research cites the importance of our prior experiences and expectations in making sense of situations (Chabris & Simons, 2009). These three interpretive frames echo that work in that teachers' prior experiences in classrooms directly influence the interactions they expect to see. Nevertheless, these frames were used by only a small proportion of the 15 teachers: three teachers used the *familiarity* frame in 4% of the total number of idea units; a few more, six teachers, used the *anomaly* frame in 7% of the total number of idea units; and four teachers applied the *what's not there* frame in 5% of the idea units.

Associative Frames

Next we discuss two frames in which teachers associated the events in a video to other situations or experiences. In the *comparison* frame, teachers made explicit comparisons between an aspect of a video clip and other circumstances. Teachers applied this frame in a few different ways: (1) to draw a comparison to another video clip—"Compared to the last video clip ... this one seemed like a smaller class;" (2) to their own classroom—"These students are bigger than mine, [they] must be high school;" or (3) to highlight differences within a single video excerpt—"The second question seemed much harder for [the students]."

Unlike the expectations frame, in the *comparison frame*, what stood out to the teachers was not whether the events in the video aligned with their expectations but simply whether the events were distinct from other events. This kind of comparison may have been much easier for teachers to make, and in fact, the *comparison* frame was used relatively frequently among the teachers. Fourteen of the 15 teachers used this frame, and it appeared in 29% of the total number of idea units.

A related interpretive frame is the *metaphor* frame. Here teachers also engaged in comparison, but they compared a component of a video to an abstract but

familiar or colloquial idea rather than another concrete event. For example, Theresa describes the teacher in one clip as "the pied piper," able to gather her students together in discussion.

"[The teacher's] dragging them all up there, come on, come on, come on, come out and play. ... She's the pied piper to them. They're ready to follow her anywhere."

Metaphors allow us to think about and articulate ideas that are challenging to define. Specifically, they help us make sense of one situation by drawing on the meaning associated with another experience (Lakoff & Johnson, 1980). We suspect that the teachers' use of the *metaphor* frame structured the ways they thought about and described aspects of the clips that were difficult to succinctly and clearly convey. In all, this interpretive frame was used by only two of the teachers and in just 3% of the total number of idea units.

Abstraction Frames

Two final frames involve teachers looking beyond the details of a video to make abstract claims about teaching and learning. First, using the *generalization* frame, teachers describe what they notice in the video as behavior or activity that takes place across multiple teaching contexts. For example, in discussing what she noticed in the first video, Nicole comments: "Sometimes as a teacher, it's hard when you go over to a student and ask them, 'What don't you understand,' and they're trying to tell you, but they don't even know what they don't understand." Rather than describe an event in the video as salient only in this particular case, Nicole shares an idea she believes to be endemic to instructional situations. These statements are similar to what Copeland et al. (1994) define as "practical generalizations."

Closely connected to the *generalization* interpretive frame is the *principles* interpretive frame. With the *principles* frame, teachers express the generalization or abstraction in a particular form — as a short statement of an overall truth concerning teaching and learning. Shulman (1986) described this as a type of propositional knowledge held by teachers, "maxims [that] represent the accumulated wisdom of practice" (p. 11). Marie's comment that "Communication is the key to teaching" is one such example from the data. Both of these frames were used by the majority of teachers, 13 teachers utilized the *generalization* frame in a total of 14% of the idea units; 11 teachers applied the *principles* frame in 8% of the total number of idea units.

Discussion

While the above summary of each of the frames tacitly puts them all on equal footing, there are some frames that were used more frequently and/or used by more teachers than others. First, the *affective*, *comparison*, and *evaluation* frames were used by 13, 14, and 15 teachers, respectively. Furthermore, *evaluation* was also the most

frequently used frame; it was not only used by all of the teachers, it was also the frame used most often by each individual teacher. This is not surprising given the extent to which evaluation has been highlighted by previous research as a stance teachers take to discuss teaching episodes. However, it may be of concern given current efforts to move teachers away from initial evaluations of teaching episodes and toward more in-depth analyses of what is taking place (Borko et al., 2008).

To be clear, we suspect that the frames we have identified above may be particular to the interview context in which we elicited teacher noticing. That is, the ways that teachers engaged in the task and explained their reasoning was likely influenced by the fact that they were in an interview with researchers. However, we contend that the phenomenon of teachers using interpretive frames to reason about classroom events is durable beyond the interview context. Although the specifics of the frames would likely change if we examined attention and reasoning during instruction, we believe that interpretive frames would continue to shape teacher noticing.

It is intuitively obvious that teachers cannot notice everything that happens in their classrooms. Just as everyday people go through the world selectively paying attention to what they encounter, so too must teachers in the classroom. Research confirms this intuition and has in the past explored the "what" and "how" and "why" behind teacher noticing. In this work, we describe teacher noticing in the context of noticing interviews. In these interviews, teachers were given the luxury of time to notice and interpret events in video but did so independently without the modeling and support of peers or an expert facilitator. As such, these interviews give us extended access to some of the reasoning that underlies teacher attention.

In other work we have described two distinct sub-processes of noticing: selective attention and knowledge-based reasoning (Sherin, 2007). In this chapter we have used the construct of interpretive frames to highlight a connection between the two. Specifically, we suggest that these two sub-processes occur neither separately nor sequentially. That is, teachers do not first attend to a classroom event, then use their knowledge to reason about that event, then attend to another event, and then reason about that event. If attending and interpreting were related in this way, we would expect teachers in our interviews to list off a moment that that they notice, then talk about that moment, then list off another moment that occurred after the first, talk about it, and so on. Teachers' talk in our interviews, however, resembled something different. It was a wandering trek through a network of interconnected ideas—some about normative metrics, some about expectations, some about personal feelings, and some about abstractions. Linearity is not a common feature in teachers' conversations about what they notice. This lack of linearity in their talk suggests that for teachers, classrooms likely cannot be reduced to a chronological series of events from which they pick the most important ones to attend. As such, researchers may no longer be able to characterize teacher noticing as a set of events that together make up "the teacher's view of the classroom." Instead, we will need to develop more sophisticated ways to

characterize the network of ideas that teachers bring to bear in reasoning about their classrooms. Our interpretive frames are an attempt at such a characterization.

It is in this sense—interpretive frames as networks of ideas that support both selective attention and knowledge-based reasoning—that the construct of framing becomes particularly powerful. Other education researchers have explored how framing can dramatically influence the actions and interactions of both teachers and students (Rosenberg, Hammer, & Phelan, 2006; Russ & Luna, 2013; Scherr & Hammer, 2009). The idea that teachers adopt interpretive frames during noticing highlights how quickly interpretation enters into classroom dynamics. There is no objective "blooming, buzzing confusion" (Sherin & Star, 2011, p. 69) that teachers see and then reason about. Instead, seeing and interpreting happen together at the same time that classroom interactions are unfolding and playing back into that seeing and interpreting.

This notion of interpretive frames also has important practical implications. Much of our professional development work with teachers has been in the context of preparing teachers to "see" certain kinds of events in their classrooms. As have others, we have attempted to develop materials and programs to focus teachers' attention on some of the most consequential aspects of instruction, students' thinking, classroom discourse, explanation and argumentation, for example. However, focusing a teacher's attention on particular aspects of classroom interactions and events does not tell the whole story. We need to consider the reasoning strategies that are used in conjunction with these noticing habits and how to help teachers develop these noticing networks in productive ways.

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DIGITAL VIDEO ANALYSIS TO SUPPORT THE DEVELOPMENT OF PROFESSIONAL PEDAGOGICAL VISION

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> "We don't see things as they are, we see things as we are."
>
> —*Anaïs Nin* (attributed)

Introduction

Teaching is both a culture and a cultural activity. Teacher educators engage pre-service teachers in activities designed to change their interpretations of teaching in an effort to change who they are as teachers and, by extension, who they are as human beings. As reforms in science education point increasingly toward a "thinking curriculum" (Resnick, 2010, p. 183), the differences between the status quo teaching culture and the culture of ambitious, reform-oriented teaching continues to grow. While for science teacher educators there are particular challenges that have been well documented (e.g., Davis, Petish, & Smithey, 2006), the overall challenge of cultural transformation is one that all teacher educators face. Goodwin (1994) frames differences in cultural understandings of activity in terms of professional vision. He refers to it as "socially organized ways of seeing and understanding events" (p. 606).

Pre-service teachers have spent decades developing a socially organized way of seeing and understanding teaching (and learning) simply by being students in classrooms, something Lortie (1975) called an apprenticeship of observation. Teacher educators, on the other hand, have mere months to try and re-enculturate these same pre-service teachers into a new kind of seeing and doing type of teaching. For science teacher educators this means: (a) helping pre-service teachers value students' ideas as productive starting places for deeper conceptual understanding rather than misconceptions to be corrected; (b) reframing engagement in science as a process of building evidence-based explanations