

## **Teachers' Sense-Making Strategies While Watching Video of Mathematics Instruction**

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Recent years have seen an increase in the use of video for teacher education and professional development accompanied by widespread recognition that to be beneficial, video must be used in activities that induce particular modes of inquiry. However, little is known about how teachers typically watch video. The present study investigates the use of five strategies that teachers use for making sense of classroom instruction that they have watched on video. Data was collected from 15 middle and high school mathematics teachers who watched four 3-8 minute clips of instruction and described what they had just viewed. Results indicate that teachers employ a variety of sense-making strategies while interpreting classroom video. Implications for teacher research and professional development are discussed.

Recent years have seen an increase in the use of video for teacher education and professional development accompanied by widespread recognition that to be beneficial, video must be used in activities that induce particular modes of inquiry (Brophy, 2004). In other words, simply providing opportunities for teachers to watch video of classroom instruction cannot be expected to transform teachers' practices. Instead, to reap the benefits that video has to offer, teachers must participate in structured activities around the use of video.

Although researchers have begun to develop various activities and protocols for using video with teachers, little is known about the strategies for and predispositions towards watching video that teachers might be bringing

to the table. In today's media saturated culture, teachers come to the task of watching classroom video having already viewed many different kinds of video for a variety of educational and entertainment purposes. We believe that understanding the ways that teachers typically watch video is critical if we are to effectively use video to support teacher learning. Specifically, an awareness of how teachers typically make sense of classroom video might suggest key approaches that are likely to be successful when using video with teachers. In addition, such information could prove useful in identifying challenges that teachers must overcome to adopt an analytical lens for viewing instruction. To begin to address this issue, this study investigates the strategies that teachers use for making sense of and describing classroom instruction that they have watched on video. In particular, we identify the kinds of events to which teachers typically attend. We also investigate teachers' use of five strategies that prior research suggests are frequently applied to interpret situations.

### THE USE OF VIDEO TO STUDY TEACHING

Over the past 20 years video has come to be used for both supporting and studying teacher cognition. First, having teachers watch video of instruction has been used in various forms in programs of professional development. Much of this work draws on the use of video cases. Following in the footsteps of the medical and legal professions, teacher educators argue that written cases provide concrete episodes that give teachers the opportunity to struggle with the dilemmas that teaching may pose and discuss how general precepts and principles might be applied to specific instances (Sykes & Bird, 1992). Cases first took the form of written documents but more recently video has been adopted as an effective means to convey cases because of its ability to capture the richness, simultaneity, and complexity of classroom instruction.

For example, Sherin (2004) used a form of video cases in video clubs to enhance teachers' ability to notice certain kinds of events in the classroom. A video club involves a group of teachers who meet on a regular basis to view and discuss videos from their own classes. Similarly, Lampert and Ball (1998) developed multimedia cases of their own instruction as a resource for student reflection in teacher education classes. Still other models for professional development include commercialized ventures such as Lesson Lab ([www.llri.org](http://www.llri.org)) whose website provides streaming video case studies that can be used as part of lesson study activities.

Second, video has also proven to be a useful tool in helping researchers understand teacher thinking and learning. Following the burgeoning interest in teacher thinking in the late 1970s and early 1980s, there was a se-

ries of studies that explored teacher thinking by having teachers watch and react to video of instruction (Peterson & Comeaux, 1987). More recently, Speer (2005) advocated the use of video-clips in interviews with teachers as a tool to elicit teacher knowledge and beliefs. She claimed that this approach offered the advantage of being much more contextualized than survey questions or other types of interviews such as retrospective recall. In other work, Jacobs and Morita (2002) used video-clip interviews in a cross-cultural study as a means to uncover differences in the ways that American and Japanese teachers think about mathematics instruction.

Although video has been used both as a record of practice in professional development settings and as a research tool to elicit teacher thinking, little research has been done to date in an effort to document the ways that teachers typically approach the viewing of video. More common has been research that attempts to influence the ways that teachers view and interpret video. For example, Santagata, Zannoni, and Stigler (2007) developed a three-step lesson analysis framework in which preservice teachers focused specifically on: (a) goal(s) and parts of the lesson; (b) student learning; and, (c) teaching alternatives. Similarly, Borko, Jacobs, Eiteljorg and Pittman (2008) developed a cycle of viewing activities for inservice teachers that involves: (a) working on a mathematics activity and preparing to teach the activity to their students, (b) viewing video excerpts from the lesson to study their own teaching, and (c) viewing video excerpts from the lesson for the purpose of investigating student thinking. Such research suggests that the ability to meaningfully view video of classroom instruction is a skill to be learned.

While we believe that much can be gained from helping teachers learn to use video as a resource, we claim that such work should be based on an understanding of the process through which teachers make sense of classroom instruction viewed on video. What kinds of events typically stand out to teachers as they view classroom video? What common interpretation strategies do teachers use when watching video of instruction? We should not assume that all teachers initially watch video in unproductive ways and therefore a particular analytical lens needs to be imposed on teachers. Instead, we maintain that it will be useful to conduct a close examination of teachers' approaches to making sense of classroom video. Understanding how teachers approach this work will add to what we know about teacher cognition and put us in a better position to use video as an effective resource for teacher learning.

In the present study, we begin to explore these issues by addressing the following research questions:

1. What do teachers choose to talk about when asked to describe what they noticed while watching video of instruction?
2. What kinds of strategies do teachers use to make sense of video of classroom instruction?

## CONCEPTUAL FRAMEWORK

To address these questions, this study draws upon two areas of research that shed light on the cognitive processes taking place when teachers watch video of instruction.

### Professional Vision

Goodwin (1994) proposed that people involved in professional activity build and utilize *professional vision*, or “socially organized ways of seeing and understanding events that are answerable to the distinctive interests of a particular social group” (p. 606). Sherin (2001) applied this notion to teachers and suggested that teachers develop the ability to notice and interpret key aspects of classroom interactions. In particular, as teachers view classroom practices, they attend to certain events and use what they perceive to reason and make sense of what is happening in the classroom.

Several researchers investigate how teachers pay attention to classroom events while watching video. Some studies explored what expert teachers attend to in video or still images of classrooms, often in contrast to that of novice teachers (Copeland, Birmingham, DeMeulle, D’Emidio-Caston, & Natal, 1994). Analysis reveals that expert teachers, like experts in other domains, generally discussed teaching and learning in more connected ways than novice teachers. More recent studies (Jacobs, Lamb, Phillip, Schapelle, & Burke, 2007; Star & Strickland, 2008; van Es & Sherin, 2008) have begun to examine the content of teachers’ noticing, specifically, the broad categories under which teachers’ comments about video fall. Overall, such work revealed that novice video viewers tended to “focus on superficial matters such as teacher and student characteristics, fleeting classroom management issues and global judgments of lesson effectiveness” (Castro, Clarke, Jacobs, & Givvin, 2005, p. 11). The current study extends such work by investigating both the kinds of events that stand out to teachers as well as the extent to which the same events are noticed across multiple teachers.

### Sense-Making

In addition to exploring the events that teachers notice as they watch video, this study also begins to examine the strategies that teachers use to interpret classroom video excerpts. In particular, we claim that as teachers

watch video, they are engaged in a sense-making process in which a video represents a kind of text that must be read and interpreted by the viewer (Goldman-Segall, 1998). Decades of research on reading comprehension suggest a variety of strategies that effective readers use to comprehend a text (Duke & Pearson, 2002). Here we discuss several of those strategies that we believe have the potential to be particularly relevant for considering how teachers might read a video.

First, a great deal of research suggests that successful readers bring their prior knowledge and experience to bear in interpreting what they are reading (Duke & Pearson, 2002). For example, readers with higher levels of prior knowledge are more likely to comprehend and recall a text (Langer, 1984). Studies have also shown that priming people to activate their prior knowledge improves comprehension (Langer; Spires & Donley, 1998). Anderson and Pearson (1984) argued that this interaction between new information and old knowledge occurs in two main ways: (a) by relating the text to abstract knowledge embodied in schemas, that is, making generalizations or (b) by connecting the text to memories of specific experiences, that is, making comparisons.

Research on teaching has also emphasized the important role that drawing on prior knowledge plays in learning how to teach and how to effectively interpret instances of instruction. In particular, Copeland and D'Emidio-Caston (1998) claimed that the generalizations that teachers created while discussing a video clip of instruction were indicators of their practical theories of teaching. Similarly, other research suggests that professional development is most effective when teachers can relate the content of the professional development directly to their own classrooms (Putnam & Borko, 2000).

Second, research highlights that readers often view a text from the perspective of an agent acting in the text, enabling them to understand the reasoning behind that person's behavior and thereby develop a more complete explanation of what happened. For example, Black, Turner and Bower (1979) found that readers prefer to interpret narrative and descriptive discourse from a consistent perspective or point of view. Research has also demonstrated that people's memory for events and details in a story differ depending on the perspective from which they are asked to read them (Anderson & Pichert, 1978). Dixon and Moore (1990) isolated two separate aspects of perspective taking and look at how they contribute to the development of perspective taking. They argued that perspective taking depends on making a judgment about what information is available to the other individual (Information effect) and how the use of the information might differ from one's own (Weighting effect). Research on teaching has also considered the issue of perspective. For example Lobato, Ellis, and Munoz (2003)

claimed that having teachers consider what is transpiring from the point of view of the student can help to elucidate sources of student confusion.

Third, readers' personalized responses to a text have been demonstrated to play a key role in determining how readers understand and remember a passage. Schraw and Bruning (1996), for example, found that some people were more likely to read a text through affective engagement and by making personalized interpretations and doing so was positively related to text recall. This is similar to the notion of reflective thinking that has been applied to teachers' ability to use surprise, puzzlement, or confusion as a valuable catalyst for considering a situation (Shulman, 1996).

There is also one sense-making strategy that extends beyond research on reading that we want to highlight here—the tendency to analyze a situation through a problem-solving lens. This process of analyzing a complex problem involves several features. In particular, one must identify the salient characteristics of the problem space including goals and possible actions (Newell & Simon, 1972). In addition, at a deeper level one might consider the tensions and trade-offs among competing goals, establish criteria for a “best solution” and develop a means for monitoring progress towards a goal. People engage in this kind of problem solving on a regular basis as they deal with complex decision making in everyday life (Sinnott, 1999). The same is true of teachers. In fact prominent teacher-researchers characterize teaching as an activity involving complex problem solving in which multiple goals are competing simultaneously and in contradictory ways and for which there is not a single correct solution to a problem (Lampert, 2001).

In sum, we found little research that examined strategies specific to the way that teachers make sense of classroom events. In contrast, a wealth of prior research, particularly on reading comprehension, offered insights into key approaches that are used to make sense of texts and situations. Therefore, in this study we begin to explore whether such strategies are also applicable to understanding how teachers view video of classroom instruction.

## RESEARCH DESIGN

### Data Collection

The data used to explore our research questions were collected from 15 middle and high school mathematics teachers. All 15 teachers taught in the same California school district located on the outskirts of a major metropolitan area. The student population was diverse and included a large Latino and ESL population. Participants had teaching experience that ranged from 1-15 years. Each teacher was interviewed individually and shown a series

of four video clips of mathematics lessons that were between 3-8 minutes long. While the four clips varied along several dimensions including mathematical topic, student population, and teacher experience, there were also important similarities. All four clips showed teacher and students discussing mathematical ideas in the context of a whole class or small group activity. After each clip was viewed, the participating teacher was asked "What did you notice in the clip?" and prompted with "Anything else?" until the response was "Nothing else." Each interview lasted anywhere from 20 to 40 minutes and the interviews were video-taped and transcribed.

### **Data Analysis**

Following the research questions, the analysis of the data consisted of two phases. The goal of the first phase of analysis was to characterize the main features or events within each video clip that were noticed by each of the 15 teachers. Specifically, using the transcripts of the interviews, we generated a comprehensive list of those features of each clip that the teachers identified and how many teachers mentioned each one. To facilitate cross-clip comparisons, these features were sorted according to the following categories (Table 1): pedagogy, climate, management, mathematical thinking, classroom characteristics, and student characteristics. In general, pedagogy concerned the instructional strategies selected and used by the teacher; climate concerned the atmosphere within the classroom and the ways in which students and the teacher interacted; management had to do with the timing and pacing of the lesson, and mathematical thinking related to the mathematical ideas that students discussed during the lesson. These four categories build on Frederiksen, Sipusic, Sherin, and Wolfe's (1998) framework for describing mathematics classrooms. The fifth category, classroom characteristics referred to physical features such as seating arrangement or display tools that comprise the classroom environment, and the final category, student characteristics referred to comments about student backgrounds including age, ethnicity, and social status. In addition, we wanted to understand whether the content of teachers' comments about specific events were similar. Therefore we noted those features commented on by more than 50% of the teachers and examined to what extent the teachers made different claims about the same events.

**Table 1**  
Categories for Features of the Clips that Teachers Mentioned

Category	Definition	Example
Pedagogy	Refer to the teacher's decisions and actions and the teaching strategies used.	"And I really liked the strategy used at the end which was to ask someone...who didn't get it before but now [does], to explain [the idea]." (Walter)
Climate	Refer to the classroom atmosphere and the way in which teacher and students interact.	"[There is] a good environment where the kids feel free and comfortable to share their ideas." (Susan)
Management	Refer to the pace and timing of the lesson, the general organization of activity in the class or disciplinary issues.	"While [the teacher] is going and giving her undivided attention to that one student... the rest of the class is just kind of waiting aimlessly." (Susan)
Mathematical Thinking	Refer to the mathematical ideas discussed by students during the lesson.	"I don't think that [the student] truly understood the concept...I think she understood one part of the concept, like the 10. But I don't think she understood the 10X." (Diane)
Classroom Characteristics	Refer to the physical features of a classroom.	"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." (Nick)
Student Characteristics	Refer to student background characteristics including age, ethnicity and race.	"And this little boy here, I guess couldn't speak English...and the other ones were speaking in Spanish [and English]." (Nancy)

In the second phase of the analysis, the goal was to examine teachers' use of a subset of sense-making strategies identified in the literature as potentially relevant (Table 2). Following the previous discussion of sense-making, the selected strategies were as follows: comparison, generalization, perspective-taking, reflective thinking, and problem solving. In brief, comparison involved contrasting elements of the video clip with events that occurred elsewhere. Similarly, generalization consisted of making claims about events in the video that take place across multiple settings. The perspective-taking strategy involved considering events in the video from the viewpoint of an actor within the video while the reflective-thinking strategy involved personal responses from the viewpoint of the teacher viewing the video. Finally, the problem-solving strategy involved considering the events in the video in light of corresponding instructional means and goals. We refer to this as problem solving because identifying means and goals in the complex environment of a classroom is a critical step in the decision making required to analyze and improve teaching and learning.

**Table 2**  
Sense-Making Strategy Codes

Code	Definition	Example
Comparison	Compares an aspect of the video clip to something that has occurred elsewhere.	"One thing I noticed in this [clip], and I thought of it from the last one too, her kids are really good at participating. My kids have a lot of trouble with that..." (Nicole)
Generalization	Identifies a behavior or activity that takes place across multiple settings.	"And then 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..." (Nicole)
Perspective-taking	Considers the information available to a particular agent in the clip or speculates as to their state of mind (emotional or cognitive)	"The kids were frustrated. And honestly I think they were just willing to accept any explanation." (Linda)
Reflective Thinking	Refers primarily to the respondent as the subject of the comment (does not include "I noticed" statements or comparisons).	"Well, I am surprised to see manipulatives at this age." (Debbie)
Problem Solving	Focuses on teaching as a series of decisions and actions required to accomplish a set of educational goals	"Uh, she used the students, you know, as—in the math class—she brought them up to participate. She's making them think of ways to solve the problem instead of just telling them "this is how you do it", she's making them figure it out." (Debbie)

*Applying the sense-making strategies.* Each interview was then coded in terms of these five categories. Specifically, a teacher's comments on the first video clip were reviewed for evidence of the *comparison* strategy. Each application of this strategy was noted along with the corresponding idea offered by the teacher. Next, the teacher's comments on the first clip were reviewed for evidence of the *generalization* strategy, and each instance was recorded. This process continued until the teacher's comments on the first video clip had been reviewed for all five strategies. A similar procedure took place concerning the remaining three video clips. The process resulted in a table that listed each instance of strategy use for a teacher across the four video clips. Note that if a teacher used a strategy multiple times for the same purpose (that is, the teacher returned to a point made earlier using the same sense-making strategy) it was recorded only once.

One researcher coded all 15 teachers' comments in this way. To examine the reliability of the coding, two other pairs of researchers coded the comments of five teachers to one of the clips. Percent agreement with the pri-

mary coder was 84% for the first pair of researchers and 92% for the second pair. Disagreements were resolved through discussion.

To investigate the relative frequency with which individual teachers tended to use the different strategies, counts of each teacher's use of each of the strategies were made and compared to the total number of comments made by that teacher. We also looked across all teachers to determine whether some strategies were used more frequently than others.

Next, we looked more closely at the teachers' comments within the three most common strategies: (a) problem solving (32%), (b) perspective taking (24%), and (c) comparisons (19%). For each, we assigned subcodes that more specifically detailed how that strategy was being applied. Specifically, we identified four subcodes for the comparison strategy. When drawing comparisons, the respondent might compare something in the clip to: (a) their own experiences teaching in a classroom, (b) one of the other clips they had viewed, (c) their experiences as a student, or (d) something else. The perspective-taking code had two associated subcodes. When adopting the perspective of an agent in the clip, the respondent might: (a) adopt the perspective of either the teacher or (b) adopt the perspective of the student(s).

Finally, the problem-solving code had four associated subcodes. When using the problem-solving approach to view a clip, the respondent might: (a) identify a teaching action exhibited in the clip, (b) suggest an alternative teaching action that the teacher might have performed, (c) identify the goal or goals that were at play in the teacher's decision making or (d) describe the kinds of dilemmas that arise from competing educational goals. The frequency and distribution of these subcodes were considered to be able to further describe the teachers' strategy usage.

## RESULTS

Analysis yielded two sets of findings concerning the teachers' professional vision for watching video of mathematics instruction. We summarize each finding and then in what follows discuss them in more detail.

1. There was substantial overlap in the classroom events and objects that teachers talked about as they commented on the video excerpts. Overall, the teachers focused on issues related to pedagogy, climate, and management rather than on student understanding of mathematics. In addition, in those cases where teachers noted the same classroom event in a video clip, they often attributed different, even contradictory, meanings to these events.

2. There was also substantial overlap in the sense-making strategies that teachers employed to describe the video excerpts they viewed. In particular, two-thirds of the teachers used all five of the strategies that we investigated. At the same time, however, the extent to which teachers used these different strategies varied, with some teachers emphasizing one strategy in contrast to other teachers who consistently used a variety of strategies. Finally, looking more closely at three of the strategies allowed us to characterize teachers' sense-making approaches in more detail.

### **Convergent and Divergent Professional Vision**

Analysis revealed that the teachers commented on a range of events that were visible in the video excerpts. In fact, across the first three video clips that were viewed, their statements related to issues within each of six content categories (pedagogy, climate, management, math thinking, student characteristics, class characteristics). In responding to the fourth video clip, their comments were coded in all but the "class characteristic" category. This is reasonable, given that the fourth video clip portrayed a small group of students, rather than showing elements of the whole class as was the case in the other three video excerpts.

Most common, across all 15 teachers, were comments concerning issues of pedagogy (25%), climate (23%), and management (24%). Mathematical thinking was a focus of the teachers' noticing to a lesser degree (15%), with even fewer comments about student (7%) or classroom (7%) characteristics. These findings are in line with prior research that suggests that mathematics teachers' attention is initially drawn to issues of classroom organization and general instructional practices when viewing video, rather than to the substantive nature of the mathematics that is being discussed (Frederiksen et al., 1998; Sherin & Han, 2004).

In addition to categorizing what the teachers said they noticed in the video clips, we also looked specifically at which events they mentioned. This analysis highlighted the shared aspects of the teachers' noticing. In particular, while there were over 300 coded statements, the events or features mentioned in these statements could be compiled into a list of only 73 items (see Appendix for the complete list). Less than 3% of the events noticed were mentioned by only a single teacher and over 30% of the events/features noted were mentioned by at least 40% of the teachers viewing the clip. Furthermore, within each video clip there were several core events that were noticed by over 50% of the teachers. Reflecting the pattern of noticing previously mentioned, the majority of these (86%) were related to issues of pedagogy, climate, or management.

Interestingly, when teachers noticed the same event, they did not always describe what they viewed in the same way; and in fact their comments diverged substantially at times. Consider, the following example from the first video clip. Near the beginning of the video, the teacher is working with an individual student named Anna. They are discussing how to calculate the slope of a line given a graph of the line. Anna appears to get frustrated and responds to a question from the teacher by saying, "I don't understand, that's why I'm asking you." Rather than continue to work with Anna, the teacher reclaims the class' attention and asks for a volunteer of "somebody who didn't understand before but thinks they get it now" to explain the procedure of calculating slope to the class.

Most of the teachers noticed this transition in classroom activity but their comments about the event differed substantially. For example, Nancy explained "[The teacher] tried to get another student to explain how to do it. Because a lot of times, we think that it makes perfect sense but [they need] another student to explain it. Cause they explain it in student-ese, rather than in teacher-ese. It can make perfect sense to me and I don't understand why they don't understand it, but another kid can [explain] it." Here Nancy emphasized that the teacher may have decided to return to the class and ask a student to explain the slope method because hearing explanations from their peers can often be helpful for students. In contrast, Walter suggested that calling for a student explanation had nothing to with Anna's difficulty understanding the concept but rather was intended to help the student volunteer. "Sometimes...when they explain it, they learn it even more because they have to put it into words."

Other interpretations were offered as well. Several teachers mentioned that the students with whom the teacher is not working seemed to be off task and therefore the reason that the teacher reclaimed the class' attention was to help the class refocus and return to the lesson. A fourth explanation was that it was the teacher who had become frustrated working with Anna. Returning to the class was intended to send Anna a signal that she had not been listening closely enough to the teacher. "That might be a strategy the teacher is using with her, to get her to focus," explained Marie.

Another example of teachers noticing the same event but commenting on it in different ways comes from their viewing of the second video clip. In this video, the teacher poses a question to the class concerning how to find the distance between two given points on the school grounds. Students respond by calling out various ideas without raising their hands and the teacher selectively takes up some of the ideas that students suggest. Almost all of the teachers commented on the high degree of student engagement and participation in the class. In addition, several teachers specifically noted that students were not required to raise their hands and be called on by the

teacher. In commenting on this fact, they offered a variety of different interpretations and evaluations of what had occurred. Several teachers spoke positively about the classroom culture indicating that the informal environment allowed for a great deal of student engagement. For example, Susan exclaimed "I love that!...she's created a good environment where the kids feel free and comfortable to share their ideas." Similarly, Nancy indicated "Everybody's engaged. They're shouting out answers and she's encouraging that. Not saying, 'No, you've got to raise your hand.'...[She's] allowing kids to communicate with each other and talk."

Other teachers' comments were more skeptical of the classroom discourse pattern. For instance, Diane expressed concern that some students may have needed a bit more time to develop their answers to the question that was posed to the class. Yet the pattern of calling out answers was not conducive to providing students with the thinking space that they needed. Along the same lines, Dan suggested the activity would have been more beneficial if done in small groups, "It's too many [ideas at once]...and then it turns to chaos." He believed that small groups would have been a more manageable format for students talking freely together. Finally, some teachers commented that having students call out answers made it difficult to assess whether their contributions were productive mathematically. This was both because of the high level of noise in the classroom as well as the lack of probes into student statements. Linda remarked, "I have no idea whether or not they were on the right track because I couldn't understand them, there were too many yelling out at once."

In sum, though there was variation in what teachers noticed, most of their comments centered on a set of particular features of each clip. The features that teachers focused on most often were related to general observations about management, pedagogy and climate but even when taking note of the same event in a clip, the comments that they made about those actions or behaviors often diverged.

### **Distribution of Strategy Usage**

The second set of findings relates to the teachers' use of sense-making strategies. First, it is notable that in describing the video clips, teachers used all five of the strategies identified from prior research as being applicable in sense-making situations. Ten out of the fifteen teachers used each of the five strategies at least once, four used four of the five strategies at least once and one used three of the five strategies at least once. Table 3 displays, for each teacher, the relative frequency of each of the five strategies in relation

to the total number of times that a sense-making strategy was used. The most commonly employed strategies include problem solving (32%), perspective taking (24%) and making comparisons (19%).

Though all five strategies were used, teachers varied in how frequently they made use of these strategies. The total number of comments that employed the use of a strategy for each teacher ranged from 10 to 33. Additionally, the distribution of strategy usage differed amongst teachers (Table 4). Some teachers, for example, Debbie and Nick, exhibited a generally balanced strategy usage pattern whereas other teachers tended to specialize in the use of a single strategy. For example, in at least 50% of their comments that employed a strategy, Nicole made comparisons, Linda adopted the perspective of someone in the clip, and Diane and Emily used a problem solving approach.

A further analysis of the distribution of the subcodes associated with the three most frequently used strategies, problem solving, perspective taking, and making comparisons, reveals a few more interesting results. First, most of the comparisons that teachers made were fairly evenly divided between comparisons to their own classrooms and comparisons to the other clips that they had viewed. When making a comparison, teachers compared the clip to their own classroom about 53% of the time (“[Students] are working together in cooperative groups. Something that I don’t do much”) and to one of the other clips about 38% of the time (“The class seemed more engaged in this video”). Taking into account that there were no opportunities for clip comparisons after viewing the first clip, these percentages are comparable.

Second, when taking the perspective of an actor in the clip, the teachers adopted the perspective of the student 84% of the time (“[The students] are not afraid of doing the math problem—they may be frustrated, but they are not afraid”) whereas they adopted the perspective of the teachers only 16% of the time (“[The teacher] already knows that the kids aren’t getting the concept”). This was somewhat surprising to us since they are teachers, we expected that perspective to be the most accessible to them. In fact prior research suggests that it is common for teachers to adopt the perspective of the teacher in the video (Sherin & Han, 2004).

And finally, when using the problem-solving strategy, teachers tended to mainly focus on teaching actions that were or could have been made without going into the situation in more depth by focusing on educational goals or the dilemmas that competing goals can present. In fact, 77% of the statements made that involved the problem-solving code consisted of simply identifying teaching moves that the teacher was making (“[The teacher] used the students to explain the concept”) and an additional 16% focused on alternative moves that could have been made (“[This activity] could have been better done in small groups”). Teachers rarely identified the educational

**Table 3**  
Sense-Making Strategy Distribution by Teacher

	Gener- alization	Com- parison	Reflective Thinking	Perspec- tive- Tak- ing	Prob- lem Solving	Total*
Bill	22%	26%	4%	26%	22%	23
Dan	19%	16%	6%	23%	35%	31
Debbie	26%	19%	23%	16%	16%	31
Diane	7%	0%	0%	33%	60%	15
Eileen	8%	8%	8%	46%	31%	13
Emily	0%	10%	10%	30%	50%	10
Linda	0%	7%	14%	50%	29%	14
Marie	17%	9%	13%	22%	39%	23
Nancy	20%	3%	10%	27%	40%	30
Nick	19%	25%	19%	19%	19%	16
Nicole	20%	50%	10%	10%	10%	20
Sophia	8%	8%	4%	32%	48%	25
Susan	6%	33%	3%	15%	42%	33
Theresa	25%	33%	0%	25%	17%	12
Walter	31%	38%	0%	13%	19%	16

purposes at play (5% ; “[The teacher] wants his students to be independent thinkers”) or identified the teaching dilemmas (2%; “[The teacher] wasn’t correcting the kids because she was paying attention to just that one. And it’s not that she was neglecting the other ones. It’s just difficult to take care of two things at the same time”) that lie at the heart of conceptualizing teaching as a complex problem-solving domain. We wonder if the use of prompts other than “What do you notice?” are required to have teachers engage in this deeper kind of analysis (Santagata, Zannoni, & Stigler, 2007).

**Table 4**  
Sense-Making Strategy Subcode Distribution Across All Teachers

Primary Code	Subcode	Percent of Comments	Total Comments*
Comparisons			
	Own Teaching	53%	32
	Other Clip	38%	23
	Experience As Student	3%	2
	Other	5%	3
Perspective-Taking			
	Student	84%	63
	Teacher	16%	12
Problem Solving			
	Observed Teaching Action	77%	77
	Suggested Teaching Action	16%	16
	Goal	5%	5
	Teaching Dilemma	2%	2
*Indicates the total number of comments made across all teachers that employed this strategy. Percents indicate percent of comments using that primary strategy that were instances of the subcode strategy.			

## Discussion and Implications

Results from the first analysis indicated that to some degree teachers do share a common professional vision for classroom instruction. They noticed and described many of the same events in the clip. However their professional vision was not completely consistent with each other. The teachers often developed different opinions as to what transpired in the video clips that they viewed. The variability suggests the question, “What accounts for the varying interpretations of the instruction?” This question warrants consideration for both its practical and theoretical significance. From a practical standpoint, if a group of teachers are all going to be viewing and discussing video together, then understanding how different opinions of the same sequence of classroom interactions are formed can be helpful for moderation purposes. Theoretically, the question represents an interesting line of inquiry into teacher thinking and professional vision and could help to explain how teachers think and make decisions in a classroom setting.

There are at least two plausible and perhaps related explanations for why teachers interpret the same event differently or arrive at different impressions of climate and engagement. One possibility is that the information presented in the clip does not represent overwhelming evidence that would support one viewpoint as opposed to the other. In this case, the ambiguity of the situation makes any of multiple interpretations acceptable. For example, in the first clip there might not be enough information conveyed that would

allow the viewer to impute the teacher's motivation for shifting her attention back to the entire class. In such a case, it may be that the teacher selects from among the multiple interpretations of the situation through the lens of their own practice, that is, for what reason would I have made such a teaching move?

A second possibility is that teachers have particular conceptions or mental models of classroom instruction and to make sense of what they are viewing they are looking for particular kinds of information. Once some sort of global judgment about a particular classroom has been achieved, this might shape subsequent processing in a way that biases a particular interpretation of events in a direction that supports that conception. Essentially, this would constitute a sort of confirmation bias as applied to teacher's professional vision. However, a question of interest that warrants further consideration might be "What is it that teachers use to develop these initial judgments and to what extent does it vary?" The data analyzed in this study makes it apparent that student engagement and teaching strategies are, understandably, components of an episode of classroom instruction that teachers focus on. Is it possible that consideration of one may shape the other? Do teachers initially focus on student engagement and develop descriptions of teaching practice based on whether or not the students appear to be interested? Or conversely, are teachers biased to interpret student behavior as more or less engaged depending on their opinions of the activity structure, math problem, and teaching strategies depicted in the clip? These questions present a potentially interesting line of inquiry into the structure of professional vision that would require further investigation.

Within this sample of teachers, there was a widespread willingness to think about what was happening from the student's perspective. The teachers frequently made comments involving descriptions of the knowledge or mental states of the students depicted in the clip. The ability to look at instruction "through" the eyes of their students is an important component of professional vision that teachers probably develop and use on a daily basis in their practice. In contrast, there were very few comments made by the teachers in which they adopted the perspective of the teacher in the clip. Perhaps the opportunities for them to do this within their own classrooms are extremely limited because they already know that teacher's perspective in a sense and do not have to try to put themselves in their own shoes. Therefore, considering the teacher's perspective in watching video might be a productive way to help teachers articulate their own practical theories of teaching that they might not otherwise make explicit to themselves.

In fact, it is possible that the ability to consider the teacher's perspective could play an important role in learning from video. If this were the case, such a skill would constitute an important component of teacher's profes-

sional vision for watching video. It could be that the conditions under which teachers work make it quite likely that they will consider the student perspective without considering the teacher's perspective.

Results also indicated that teachers are much more likely to describe teaching strategies that are being used without explicitly discussing the goals that they were intended to accomplish, competing goals that are at play, and alternative strategies that might have been employed. The limited extent to which they fully explored the complex problem space within which the teachers in the clip were operating might be related to their resistance to considering the teacher's actions from the teacher's own point of view. Developing activities that encourage teachers to more fully articulate the teacher's point of view might help them to develop their capacity to think about teaching as a complex problem with multiple competing goals and imperfect information for the problem-solving agent, that is, the teacher.

Finally, the data indicate that there were some sense-making strategies that some but not all of the teachers used. Further research might investigate whether the use of these strategies are beneficial for teachers who are trying to learn to improve their practice by watching video. A good candidate for investigation might be the role that comparisons and generalizations play in developing knowledge that is more accessible and usable. Research on teacher thinking has recently stressed the importance of not only characterizing what teachers know but also how that knowledge is stored and accessed. (Sherin, Sherin, & Madanes, 2000) Being able to connect particular instances of teaching to other representative cases or general propositional knowledge of teaching might play an important role in enabling teachers to use video watching to change their practice. Making connections between the knowledge/beliefs about teaching or experience in the classroom with the novel instances of instruction that are presented on video might help store those vicarious teaching experiences in ways that facilitate being drawn upon in the midst of instruction.

## CONCLUSION

From a practical point of view, this study confirms that teachers do indeed view and make sense of video in different ways. With the increase in online opportunities for professional development and graduate education that make video analysis a central part of the curriculum, designers find themselves thinking about how they should best structure activities to improve teachers' practices. For those interested in designing professional development opportunities that involve watching video of instruction, it may be useful to attend to and exploit these capabilities that teachers are bringing to the table. A closer study of such strategies might suggest new ways of

asking teachers to look at video. It may be that part of the reason that teachers watch video in these ways is because to do so is beneficial for them in some way. If this is the case, then simply asking teachers to adopt new ways of looking at video may be both difficult and unproductive. Perhaps teachers express personal reactions, make comparisons, and relate what they are seeing to generalized propositional knowledge because it is by filtering video through all of these different sense-making strategies that they are able to build useful connections between what they are viewing their own teaching experiences.

From a theoretical point of view, the construct of professional vision has been demonstrated to be both convergent among teachers and divergent. Developing explanations about teacher thinking and learning that can help explain why and how teacher's professional visions diverge from one another involves further refinement of our models of teacher cognition. One way to begin to do so is to try to better understand the role that teacher's beliefs play in shaping how they both perceive what takes place in a classroom and choose to react to those perceptions. Furthermore, expanding beyond the limited set of sense making strategies looked at here might allow us to better characterize the nature of teachers' professional vision.

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## Appendix

### *Events and Features Identified by Teachers in the Video Clips*

#### Clip 1

- Students are trying to figure out the slope. (4)\*\*\*
- Students are using rulers, calculators and graph paper. (1)
- Attitude of the student being helped. (2)
- Students' enjoyment of the class. (1)
- Students are in HS. (1)
- Class is mostly minorities. (2)
- Student is asking the teacher questions. (1)
- Teacher is focusing her attention on helping one particular student. (15)
- Teacher reclaims attention of the class. (6)
- The teacher doesn't reprimand the students misbehaving. (1)
- There is an overhead in the classroom. (3)
- The seating arrangement. (4)
- Classroom has parquet floors. (1)
- Student understanding of the teacher's explanation. (9)
- Teacher's explanation for the student. (6)
- Students that the teacher isn't with are off task. (15)

The three girls in the back are more on task than other students. (1)

Teacher asks another student to explain. (3)

### Clip 2

The students are engaged and participating. (11)

Some students are not on-task. (1)

The teacher asks students to generate solutions. (8)

The teacher asks very general questions. (2)

One boy is called on to answer the problem. (1)

There is a chalkboard in the classroom. (5)

The classroom is crowded. (1)

Students are sitting in rows. (2)

The students are all calling out answers. (8)

The teacher calms the students down. (4)

The teacher has a side conversation with a student. (3)

The teacher starts talking before students are settled. (2)

Students are wearing hats. (2)

Students are in HS. (2)

The classroom climate is relaxed and friendly. (8)

Students are motivated but not being challenged. (1)

The teacher's attitude. (2)

The teacher talks in a monotone. (1)

The problem is a real life situation. (9)

Students must apply the Pythagorean theorem. (2)

Teacher asks the student to be precise drawing a right angle. (1)

Students are using calculators and rulers. (1)

Students are involved as props in the problem. (4)

### Clip 3

Many of the students on not on-task. (6)

Students are engaged and participating. (5)

Students don't respond to the teacher's questions. (6)

The teacher asks the students for feedback about student ideas. (10)

The teacher spends a lot of time listening to student ideas. (1)

- The teacher didn't indicate whether students are right or wrong. (2)
- Students realize that there are multiple ways to approach the problem. (2)
- Students are using an overhead projector to present. (3)
- The seating arrangement is arranged for group work. (2)
- The classroom has a lot of stuff in it. (4)
- A student is rocking back in his chair. (1)
- Students are wearing hats. (1)
- The class size is small. (2)
- Students are younger than HS. (3)
- The solution that the girls present is clarified and critiqued. (4)
- The classroom climate is relaxed and friendly. (5)
- The students are trying to estimate the number of dots. (6)
- The boy suggests taking the average of multiple squares. (2)
- Students are presenting their group's solution to a problem. (14)

**Clip 4**

- The students are working together in a group. (9)
- The teacher asks the students to explain the solution to the problem. (7)
- The boy understands the concept and is helping to explain it. (7)
- The girl can't explain the answer to the teacher. (8)
- Students don't understand the concept. (3)
- Students understood the concept by the end. (3)
- Seats are arranged for groupwork. (1)
- The students are speaking Spanish. (10)
- The students are supportive of one another. (7)
- The teacher's attitude towards the students. (1)
- The students are using manipulatives. (12)
- The students are working on an algebra problem. (1)
- All students must understand to get a stamp. (7)

\*\*\*Numbers in parentheses represent the number of teachers who mentioned that event/feature at least one time.