HILDA BORKO: So I have to say that I started out this morning as I was listening to all the talks trying to write notes about connections between mine and the others. And then I sort of gave up at some point. So there's so many connections and so many different ways to go my head is spinning right now, and I just see other people's heads are spinning, too. So that's one disadvantage of being the last person of a long day. But I'll give it a try. So I'm going to talk today about a project that I've been involved in for a couple of years now. It's a multiyear, multicomponent project to study students' transition to knowledge based reasoning, teachers' roles in facilitating the students' transitions, and professional development which is to help teachers learn to help students make that transition. Fortunately, we're not involved in every one of those different layers. It's a three university project, CU Boulder, Wisconsin and Carnegie Melon. Some of Sharon Dury's work is part of this project, too. The work that I'm doing with the colleagues who are on this side is professional development. We're trying to both design and study a professional development program aimed at helping teachers learn to (inaudible) students transition to algebraic thinking. I am going to try to do something today that may or may not work which is kind of go back and
forth between two of Sharon's hats because we use video both as a tool for professional development and as a research tool in some ways similar to what I think Kathy does and (Inaudible) does. I think I'm just going to (inaudible) a little bit more as I talk than either of them did. At the same time cause I'm going to try to use a (inaudible). So, okay, briefly I want to give you just a little bit of context about the project. We focus on our central goal is to try to help broaden and deepen participants' professional development and also help them change their instructional practices. We focus on two aspects of professional knowledge, mathematical knowledge and teaching the way that (Inaudible) and Bess talk about it and pedagogical content knowledge. In terms of our conceptual underpinnings, we take a situated view of learning and one thing that that means is that we're trying to situate professional development in teachers' classrooms, and we do that by bringing artifacts of practice into the professional development setting and video is one of the major ways that we do that. Another pierce of the situated perspective is the notion of professional learning communities. So we try to pay a lot of attention in our work with teachers on developing a sense of community.
So this really quickly is a model of professional development that we developed over two years. In a sense we've used a design study kind of approach. We've gone through now three iterations of what we're calling the problem solving (inaudible). Really quickly, and I'll talk a little bit more about each one, first, what we do is something that we call doing the mathematics for planning. We have to do work on a mathematics problem. We then videotape all of the teachers as they implement that problem. We then bring video clips from their teaching back into the professional development in the second workshop focusing more on teacher role and pedagogical content knowledge, and the third workshop focusing on student thinking and knowledge of algebraic teaching.

So just a little bit more about each workshop. So this is an image from point of workshop where you can see the teachers are working collaboratively to solve a math problem. And during the workshop they kind of go back and forth between being a mathematical learner and being a teacher thinking about how they're going to take that into their own classrooms. Then what we would do is go into their classrooms and videotape the teachers and the students as they're working on this mathematical problem. I should back up and say that when we're in the
professional development, we have as many as four cameras at the same time so that we can have a camera situated on each one of the groups of teachers as they're working in small groups. When we're in the classroom, we have one camera focused on the teacher and another camera. Then we just make a decision on which small group we're going to videotape on that particular day. And again this is one of the classroom's solving, I don't know if you could tell, but it's the same problem that you saw in the professional development.

Okay. So then back to this second workshop. The central purpose is to extend teachers' pedagogical content knowledge. And we had chosen in our work to focus on how the teacher uses the lesson, then the kind of questioning strategies that the teacher uses in order to orchestrate discourse, and how teachers wrap up the lesson. And to sort of anticipate one of the questions that Barbara asked Kathy, we do this based on the image of mathematics teaching and learning that's grounded in the NCTM standards. And then in the third workshop, the main purpose is to focus on students' mathematical thinking and in teachers' knowledge of the mathematics they're teaching. And one of the things that's been really interesting to us in this project, as we bring in video clips of students'
mathematical reasoning, we've noticed that teachers often end up reworking the mathematics problem trying to use the strategies that they've seen the students use and then talking about affordances and the strengths of various initial strategies. So that's the question of knowledge about (inaudible) teaching that they're doing resurfaces in that third workshop. So a central feature of both the second and third workshop is using our (inaudible) practice to bring the teachers' lessons back into the professional development. Video is a major tool for that in addition, we (inaudible) teachers' lesson plans, their assignments and often we bring in samples of students' work that we collect while we're there. So posters that a group of students might put together. Sometimes we have video shots of students actually working problems.

So some of the research questions that we're asking as part of this, one of the research questions is what is the impact of participation in Star Professional Development on teachers' professional knowledge and their instructional practice? Again, professional knowledge is focusing primarily on knowledge of algebra for teaching and pedagogical content knowledge. And then we're going into looking at changes in their instructional practice over time. What's the nature of teachers' participation in the
professional development program? Generally, in the professional growth development and specifically in the problem solving cycle. And two of the aspects that we were looking at in that are professional learning community, how does the learning community develop and also their use of video as a tool for teacher learning. And the third research question that we're just starting to analyze and just starting to even really think about how to analyze is what's the relationship between their participation in professional development and changes in their knowledge and practice. Then the next phase of our work that we've just really started on is asking questions about the extent to which this problem solving cycle could be adopted and adapted into the context. And where we are on that now is just putting together materials that we can share with other facilitators so that we can tie up the model.

So data collection, we have I think at last count about 500 hours of video which is video records of all the professional development sessions again with four cameras, video records of lessons in the teachers' classrooms. We have over the course of two years about ten lessons from each teacher and two cameras at each of those lessons. That wasn't because we wanted that much for research purposes. Part of it is because we wanted and needed that
much for the professional development purposes. We really felt like we needed to video tape all of the teachers working, enacting those lessons in their classrooms so that we could bring back examples of each of their teaching into the professional development. And we also spent a lot of time after videotaping the teachers watching the videotapes and trying to figure out which clips we wanted to bring back in to the professional development to get teachers exploring certain features of their instructional practices of student thinking. Okay. And we also have interviews with teachers and with the facilitators of the professional development, other artifacts during PD sessions or after, like teachers' reflections on the impact of the PD sessions and also their own mathematical work during PD. And we've got some pre and posttests of their knowledge of algebra. And artifacts of the classroom, we've got again the lesson plans, the instructional materials and the student book.

Okay. So what I wanted to do today, as you can imagine, we have a number of different analyses that we're doing and a number of layers which are analyzing the video to answer our research questions. I just want to highlight a couple of them today. So one of them is to look at changes in instructional practices, and the first thing that we have done is to try to look for broad patterns of
practice. What we did is we had each researcher do essentially a written analytic case of one or two of the teachers right through all the videotaped lessons of those teachers. So as I was listening to one of the (inaudible), in terms of Fred's notion of a comprehensive approach, this would be our comprehensive approach. So we look for key dimensions, overall structure of the lesson, the nature of the mathematical task and how they introduced it and wrapped it up, discourse patterns and the community within the classroom. And then we tried to summarize patterns for each dimension and for each of the teachers. So that's one level of analysis. Then what we wanted to do is look at specific features of instruction, and we're really just beginning this set of analysis. This is what I would call Fred's (inaudible) the cherry picking. So what we do based on those analytic cases is identify and transcribe representative video segments for each of the teachers and then do a more refined grade and we will be doing a more refined grade analysis of those particular segments. And I'm going to show you an example of one of the analyses that we're starting to work on.

So this teacher is Ken. He's the teacher who made very dramatic shifts in the discourse in his classrooms over the course of the two years that he was
working with us. And this video clip was from the first lesson that we observed him teaching before he really participated in the problem solving cycle. And the lesson that we saw was sort of a classic Bud Meehan, IRE pattern. Teacher posed no information question. Students gave either individual or oral responses, and then the teacher evaluated the response. Often what he did to try to include all of the students is he had them do a thumbs up, thumbs down to see if they agreed with the student answer. This is the briefest of excerpts from a transcript of that lesson. So he, Ken, the teacher says, Jordan, why don't you do letter B. Jordan comes up and writes his answer on the board. Ken says to the class thumbs up if you agree, thumbs down if you disagree. He scales the room and observes that most of the students have thumbs up. All right, pretty good. One student wasn't participating so he asked him do you agree or disagree. John chose thumbs up, and Ken moves on. So it focuses on the right answer. It's definitely this kind of IRE pattern. Now, let me back up a second so you don't get distracted by the next one. So then I did a jump across two years and show you an excerpt from one of the final video clips, one of our final videotaping sessions that we have which is Ken doing the problem with his students from the third problem solving
cycle. And it's a window washing problem where students have to calculate the cost of washing all the windows in a skyscraper. Every floor has the same number of windows which is 38, and the cost per window goes up incrementally by 50 cents for each floor. And by now, Ken has abandoned this thumbs up, thumbs down which unfortunately may become famous because a lot of people have seen that clip. And it's much more common to observe him asking a student, an individual student or a group of students a series of questions to probe for explanations of their solution strategies and their mathematical reasoning. And again it's just the briefest. So Ken is now talking with a group of students and a little bit about what Miriam talked about. He's really trying to figure out what they're doing and how they make sense of the problem, and it's a way that he hadn't thought of before nor had any of the teachers in the professional development when they were all solving the problem. So he said, Heather -- actually, I'd like you to read through that. Don't try to figure out the math. So I guess what I want you to notice is really he's asking questions to try to figure out how students are making sense of this problem. And finally, he says okay, I see where you're getting 19. So Ken as well as the researchers saw changes in his discourse pattern, and as he reflected
in his final interview, I feel like I went from a lot of lecture and very broad kinds of questioning to deeper level or higher level thinking questions. And again what we're going to do now is go back. We've identified several clips from across the two years that we want to look at in much more detail to try to trace and be able to talk about the specific changes in his questioning strategy. And that's going to lead us I guess to some of the kinds of detailed coding that Kathy talked about.

Okay. So now, switch gears now. And another thing that we're trying to look at is how teachers are participating in professional development. And one of the questions that we decided to look at first is how do teachers learn to watch and discuss video of classroom teaching. Whether these discussions change over time and how does video (inaudible) to use exploration of mathematics and that approach. And we decided on this for a couple of reasons. One is again our situated notion of learning that we believe that when we situate teacher learning and speed, a number of people argue that when you situate teacher learning in their classrooms by bringing artifacts and practice into the professional development that's a very rich setting for teacher learning. So we wanted to unpack that a little bit. Second is a number of
the research teams have reported difficulty in using video in this way. Resistance from teachers, teacher discomfort, superficial conversations. We didn't encounter those problems, and we were very pleased with the positive response of the teachers to work in the video. So we wanted to try to unpack and understand that.

So the first thing we did to start our analysis is we developed a chronology or a catalog of activities across all of the PD workshops over the two years. So we've got the same book which is our catalog. And we did this by one of the people on our project just sat and watched all the video PD sessions and wrote this great chronology. And the next thing that we did was then identify all of the PD activities in which we used video of teachers' classrooms. And we decided I think similar to Kathy to transcribe all of those sessions. So we have all of those video sessions now transcribed and this level -- so you can see this level of analysis is really different than the analysis I was talking about before. This we decided to code in two-minute segments. You will notice some relationship to Miriam's work cause she really heavily -- her work has heavily influenced ours. So these are the coding categories that we used. And was the discussion occurring, during or after? Who was participating in the
discussion, the facilitator, the video teacher or the other teacher? What were they doing, describing, critiquing, suggesting, asking, identifying with the teacher in the video or setting up the task? What was the content? Teacher role, student role (inaudible) mathematics. Whether they talked about the value of watching video, and the last one that's much more refined is do they make a judgment about whether they seem comfortable with this or uncomfortable with the process. And where we are now in this process is we now code all of those. We code by watching the video simultaneously with the transcribing. And we actually spend a fair amount of time trying to achieve reliability in our coding. And finally, we made a decision that it would be more cost effective, more time effective to do it as a group. So what we do is there -- and part of that is that we come from very different backgrounds. So two of us are cognitive psychologists by background and two of us are math teachers by background. And so what we do is we all code individually, at home, wherever. Then we come with our coding and sit as a group and we resolve all the differences. So this took us a fair amount of time to get through this. But it really felt important to us to do it that way and now, we're really with the coding and the next step is to start to look for
pattern associations. We also know that there's a couple of sessions that we want to come back to and really explore differently, but we haven't yet kind of decided as to really what and how we'll do that. As one example, in the last problem solving cycle based on that window washing problem, in one of the professional development, in the third professional development workshop there's an hour discussion about the mathematics based on them trying to figure out how students were doing these a different way.

So I'm watching and seeing that I'm running out of time. Yeah, and, you know, I'd have to say that the kinds of things that I'm saying here in terms of the affordances of video and considerations are things that other people have talked about throughout the day so I'm going to open it for questions instead of going through those. Okay.

PANELIST: Well, Hilda, thank you. That's great. We're all (inaudible). I just can't imagine going through -- well, I can, but it's really a painful process and a beautiful process as well. I guess what I'm trying to interject maybe is exactly the end that I'd like to find out about. But I'm thinking about the kinds of coding that we all did with tapes and with taking notes and with building categories and then doing things for like, let's
say, (inaudible) research or observational research. Especially with detailed -- especially I guess with linguistics where people were actually looking really at advancements. So what I really didn't denote yet but, and I think maybe it's in that last slide, is really what it was about the video per se that really changed the nature of the whole research project. Like what did you do with video, except that it's more fun to watch perhaps and the coding is more easily sort of -- some time or other, especially group coding, we work quite nicely that way. But what did you do that you couldn't have done with audio tape in this particular instance? What was it that really drove you other than it's a new medium and a fabulous use, you know?

HILDA BORKO: I think two things. First of all, you know, I'm going to have put both hats on. So we needed the video for our professional development group because they were very consciously bringing video back into the classrooms. What we find when we have both -- we've made the decision that for this fine grained analysis, we're going to have both the transcript and the video. And it's been really interesting to watch the people, our people in our research team, as some people start with the video and then go to the transcript, some start with the transcript
and go to the video, but we all feel that by having both the transcript and the video that it's easier to get a richer understanding. So some of the things like the comfort, for sure the comfort we can get a sense of different senses by watching the video than by just reading the manuscript. I think it's easier for us to follow and make sense of their unpacking of the mathematics and the way that they unpack it as a group by watching the video and having the transcript. But I don't know that we can do the same thing with just a transcript.

PANELIST: I think you have some direct competition out there. So I'm going to ask you the question that people always ask me which is this whole notion of, you know, well, did four cameras in the room and all of these cameras, you know, videotaping us right now, does it seem to sort of -- do you account for it in your coding? I guess it would be a question actually for all of you as particularly with (inaudible). But how does the nature of having all of that videotape, especially when there are multiple cameras, like four cameras, five cameras or (inaudible).

HILDA BORKO: Sure.

PANELIST: How do you account for that when you do your analysis that there is a perspective, that there is a
sort of point of view of where the researcher is and how that might affect the data and your analysis? Do you count that or do you just treat it as this is the medium we're using. It's video. It's data. And this is the new data we have. So I'm curious, and I'll pick up on trends.

HILDA BORKO: So I'm going to beg the question a little bit by saying that right now in our analysis of the professional development, we're only looking at full group work so we're only looking at full group conversations and then only one camera is relevant. If we wanted to follow a single teacher's participation, then what we have now by having four cameras, one on each group, is we would have to find that teacher in the small group and trace his or her participation in the two years of professional development. So when we do a case, when we -- what I'm thinking right now is that the first case that we're going to do is going to be Ken because of the kinds of changes he made. And we know that what we would need to do in order to trace Ken's participation in the two years worth of workshops is trace it through whatever camera he happens to appear on. So that's a reason for having all of the cameras so that we can be sure that we have each teacher participating in these small groups.
PANELIST: So two answers to that one are interested cause we use video in two ways. First of all, in terms of showing things to people video is really very powerful and seems to affect people in a deep way. At the same time in terms of analyses of classroom work, I've been really impressed with how privileged (inaudible) the discourse is. For a lot of things that we've done, we've often just used the transcripts that we have and then gone back to the video to just ameliorate that which is really I think quite interesting on a number of levels. You know, I don't know what you do but, you know, I've seen throughout a lot of research that's been done with video really what people are focusing on is classroom discourse. And there are times when that's ambiguous, and it's important to be able to go back and see, well, what were they -- what was written on the board or what did this kid mean when they said that. But it's been impressive to me because somehow I didn't expect that with how primary the spoken word seems to be.