KATHLEEN ROTH: Well, I want to start with just a brief history. I was taken with the history of people's uses of video this morning. So that got me thinking about my history. I started using video in research in 1985 when I had just completed my PhD and was interested in seeing what all this knowledge I had gained about science teaching, how it might be useful to a science teacher. So I did a study where I taught fifth grade science across the school year and videotaped a whole lot of it. Just, you know, me. I videotaped myself. There was the camera and as well as some interviews with kids. And that's how I started. In 1999, I got involved with a much larger scale study looking at videotapes of 500 eighth grade science lessons in the Science TIM Study. But I'm not going to talk about either of those today. What I'm talking about is some work we've been doing on an NSF funded project called the Science Teachers Learning From Lesson Analysis Study. And as the title implies there, this project which is studying a professional development program, the program itself uses video. It involves teachers in looking at video. But for the purpose of today's comments, I am wearing my researcher hat, and I'm not going to talk about my professional development hat. And we're looking at changes in teaching practice of fourth and fifth grade
teachers who were videotaped prior to participating in the program. Each was videotaped twice and then after the program. And, of course, we're studying a lot of other things besides these videotapes in terms of teachers learning and students learning. But again for our purposes today, I'm going to focus on changes in their teaching practice. And to capture these changes in teachers' practice, these are the key features of our video analysis approach. I'm going to give you an example that I think will make these a little bit more real. One thing that we do is we do multiple pass coding of the entire lesson. So every teacher's lessons, we looked at the entire lesson many times looking for specific things. And we look for specific frequencies of certain kinds of events. We on some things look for how long do certain kinds of activities or interactions last. So we mark in points and out points. And then we describe some of these things in terms of different kinds of types. We have a team of research analysts who do the coding, who are trained to do the coding. And we call them here a neutral third party meaning that they don't have any interactions with the teachers. They don't have any involvement with the design of the teacher professional development program. They have science backgrounds, and they are trained to look and
reestablish reliability which is a pretty difficult and challenging process. And then as they are watching the videos, they look at transcripts and video simultaneously which we think has a lot of advantages.

Okay. But I want to get to my example. So one thing that we look for in these lessons are changes in the kinds of teacher/student interactions. And by that we mean when the students are working independently, either individually or in small groups, when does the teacher interact with an individual student or a small group of students. And the way this multiple pass strategy, the first pass through the research analysts just look for marking all the places in the lesson, time segments of whole class work and independent work. Pass two, we go back and mark in and out points for each different teacher/student interaction. And, of course, we have a very complicated definition of that process and what counts as a teacher/student interaction. We're looking in this case particularly about interactions that deal with the science content or the science task. And so then we can get the duration of each of those teacher/student interactions as well as the frequency of them. And then we ask a series of questions to get at some of the qualities of these teacher/student interactions.
So I'm going to run through six examples of the kinds of questions we ask, and you should be memorizing them because I'm going to show you a video clip after that and you're going to code it on the spot. So as examples of things we might ask, we might ask is the interaction -- are they talking primarily about the procedures of the task or are they talking about science content? If they're talking about science content, what kind of content? Is it what we might call canonical science knowledge or is it about science inquiry and the nature of science or something else? We look for whether the teacher is primarily telling or guiding the students. Telling would be giving them information, telling them what to do, how to do it. Guiding is more encouraging student thinking, asking students questions, trying to get them to think about what's going on. And we have another kind of guiding which is a more meta cognitive kind of guiding. Getting them to think about specific reasoning strategies, reflect on their own thinking and understanding. We also look at whether the students speak in sentences. And we use this as we're sort of interested in increasing in the teacher's post lessons the amount that the students are involved in the conversation and co-constructing the interaction. So we use the sentences as an indicator for that. And we have
these three different codes for is it just one-word responses. Is there one sentence length utterance or more? Does the teacher ask the students any kind of an inquiry question? And we have here is the teacher asking the students to make an observation, a prediction, to make an interpretation or to do something relative to designing the activity or analyzing and critiquing the method that's being used.

AUDIENCE MEMBER: Is there a (inaudible) ranking of this?

KATHLEEN ROTH: Somewhat.

AUDIENCE MEMBER: Better than one?

KATHLEEN ROTH: Somewhat. Actually, that's related to another code that we have which we look at teacher questions. And we look at them in two different ways. In one way, we have just a sort of -- and this is teacher questions during the whole class interactions. We look at them in terms of sort of cognitive demand level. So we have three levels. The first level is name, state, define. Second level is describe. So on this, these observations would usually fit into a describe kind of level. And then we have beyond so higher level questions. Just to finish that thought, we also go back and ask about the teacher questions some other things. Like we're looking for
particular types of questions. For example, questions that elicit students' ideas and experiences is one that we specifically look for. And then the sixth one, does the teacher probe or challenge student thinking, and by this we mean the student says something and the teacher right back to that same student asks a question that would ask for elaboration or clarification or push the student to say more. Okay. So now, you get to watch the video and you've got all that in mind. And just to give you a context for this video, it's the end of a unit, toward the end of a unit on photosynthesis and cell respiration, and they have big pieces of paper and as a group they're supposed to be making a diagram of a plant and putting all these words they've learned on there to show how everything all fits together. And this is what happens with one group.

(Playing videotape.)

TEACHER: Are we both doing something?

STUDENT: We're doing photosynthesis and they want to do photosynthesis.

STUDENT: And they don't know how to do this.

TEACHER: Well, I think that that's part of working in a group. We need to make sure that we can answer all of the things and we can figure that out so.

STUDENT: (Inaudible) did it because we wanted to do
photosynthesis cause I know (inaudible) cell respiration.

TEACHER: Well, then we need to figure out cell respiration so let's stop for a moment. Okay. Let's think for a minute. Photosynthesis is what, Jason? When we do what?

JASON: (Inaudible) water --

TEACHER: CO₂.

JASON: CO₂. And the sun, light energy and the water.

TEACHER: All right.

STUDENT: (Inaudible) and the photosynthesis makes (inaudible).

TEACHER: And what do we need to do?

(Everyone talking at once.)

STUDENT: It comes from the leaves and goes down to (inaudible) and the rest makes the plant grow.

TEACHER: Okay. What are the names that make it grow?

STUDENT: (inaudible).

TEACHER: So one of your group definitely can tell me...

(Videotape ends.)

KATHLEEN ROTH: Okay. I'm going to stop there. So, of course, you heard everything and now, you have your codes in mind. I think one thing that this highlights is the usefulness of a transcript cause if you could, you
know, listen to it first to really figure out as much as you can hear. There's also some videography technique issues that we need to talk about but. So this is how I coded this interaction. So we have a duration. We have, of those six questions I asked, the content here or the focus was primarily on content, and it was primarily canonical science content knowledge about photosynthesis and cell respiration. The teacher is guiding the students' thinking, in other words asking them some questions to try to get them thinking. But then if you look at five and six, but she's not asking them any inquiry questions and she's not asking these probing, challenging questions. She's more sort of asking questions to kind of guide them to where she hopes that they would be. And then there are multiple sentence length student utterances in here.

So then the question is, okay, out of all this data, how can this be useful in finding revealing patterns and changes in science teaching practice. And so I have again, I'm just going to go through these, first of all I want to say this is fake data. This isn't really data from our teachers. But I just wanted to illustrate the kinds of things that could be reported from this. So, for example, in this figure one what we're hoping to see is an increase in the average length of a teacher/student interaction, and
they spend more time talking with the students about their ideas, about content. But it might not be dramatic growth in the course of one year which this kind of graph is. It shows some improvement but it's not like off the charts. Similarly with our teachers, we want them to be doing more talk about the science content, not so much focusing just on the procedure. So keep in mind that the pre, post could be pre, post of an individual teacher. It can also be a pre, post of a group of teachers. For example, all the teachers in our program, we could look at them as a group and compare pre, post. This one is looking at the is the teaching telling versus guiding. And you could see in this little illustration there's a lot of growth in the area of more guiding but still not very much of the reflective type of guiding. And this would be an example of the question about using multiple students speaking in multiple sentences. And this would be an example of a dramatic change where on the pre, the teacher when inquiry questions are asked they're mostly about observations. Whereas in the post, there's more of a variety of types of inquiry type questions. And then again a modest increase in teacher probing. And the one thing I wanted to emphasize about these modest increases is one of the advantages of this approach to video coding is that you can detect
incremental changes in teaching practice, and we weren't expecting within the course of a year for our teachers to sort of dramatically change from one way of teaching to another but that this approach helps us see some of those changes. Another advantage we think is that it makes larger scale studies possible where to have this kind of system for looking at each lesson. We think it takes advantage of the power of video by revisiting, revisiting, revisiting the same video multiple times. And I guess I want to -- and it provides reliable data to support claims and judgments which I want to emphasize that we still make judgments. For example, after a research analyst has gone through the whole lesson on all these different passes, there are also a series of sort of lesson level judgment questions about science accuracy, for example, is one of them.

Okay. So my end is I think that within the science education research community I think it would be really exciting if we could have a core set of features that multiple studies would use so we can compare across studies. And it might be interesting to actually develop a core video analysis manual for that purpose. And I'll stop so if you have some questions. Yes?

AUDIENCE MEMBER: Well, the first thing is the minute
you start (inaudible) exhibit, of course, (inaudible) he's already asked (inaudible). And please take them this way. And I have (inaudible) related parts. The first is what kind of a theory or (inaudible) guides this kind of works that when Catherine asked the question about is this (inaudible) instruction and you said, well, sort of. So then the second part of the question would be what are the assumptions whereby they fit within this theory that you're developing? And the third has to do with you talked about change and changing over time. And as someone who does a lot of quantitative analysis, I can tell you how many (inaudible) X number of students to get to a certain model or effect which you've translated (inaudible) on the (inaudible) would say this is a meaningful effect. So given that, how many or do you think about how many times that we see something like this happen over and over again, and how would you differentiate certain kinds of these experiences so that it may be that in science the teacher does this but what about the (inaudible) for math or reading? So I'm sorry, but that's (inaudible).

KATHLEEN ROTH: Okay.

AUDIENCE MEMBER: But, you know, so those are the three at least from my perspective that I see and I want --

KATHLEEN ROTH: Okay. I didn't hear three. I only
heard two. Did we get three?

AUDIENCE MEMBER: Well, the first is theory, the second is the assumptions, and the third has to do with the issue of analysis and how many times and what you're comparing in your data notes?

KATHLEEN ROTH: Okay. I'll start with the theory. I wouldn't say that we have a -- I think the theory relates to teacher learning, how teachers learn and how students learn. So I think our theory of teacher learning is built upon looking at a lot of research about effective professional development. Let me go back to our theory of student learning. Our theory of student learning is really very consistent with how students learn science. In our C book, they describe three key features of principles of science learning, and the first one has to do with the importance of acknowledging students' ideas, students' misconceptions, whatever you want to call them. And so that is a core piece of our theory that that has to happen in classrooms for students to develop and grow in their understandings of science. And then we somewhat translate that theory into the way we think about teacher learning. We think teacher learning is also a process of change over time. We're working with elementary teachers so we're particularly interested in their developing about science
content knowledge and our idea is that they're going to, which I think is consistent with the literature in the field is that they're going to develop content knowledge best, this is what we're sort of testing out, in the context of looking at, of talking about specific cases of science teaching and learning. So we're very focused on specific content that they're working on. And we look at video cases and have them do videotapes themselves teaching specific content. I guess I'll sort of leave it at that level.

Now, the second two questions you asked, this is a huge issue, the sort of sample size issue and what was your other question about?

AUDIENCE MEMBER: Number --

KATHLEEN ROTH: How many points in time do you need to look at that the students --

AUDIENCE MEMBER: So just cause you made -- I don't want (inaudible) talking to the people (inaudible). It's not so much the answer, yes or no or X, Y and Z but more general that we're using videography. Here we have a theory of a teacher in (inaudible) times. We made these kinds of assumptions and then we wrote this design in relationship to the video because we think that we can get this kind of information that will shed light on these kind
of (inaudible) of activities or changes over time. And we think that we can get these changes over time because we're seeing X. So I'm much more interested in that kind of, you know, what you would say (inaudible) in terms of that than I am in I need six (inaudible) people, you know, 45 times.

KATHLEEN ROTH: Okay. We're, hm, my hesitation is I don't know how much detail to go into, and I'm trying to think of something helpful really to say. I think our plan for this particular study was to have enough teachers in the study so that we had a good number so we could look at patterns across teachers. And we wanted to challenge -- we did a one-year kind of design where we videotaped them in the spring of one year and then a year later we videotape them again and see where they are. And our idea for that was that that would seem like a very challenging timeline given the amount of time we had to see significant changes. But we thought we might see some change started which goes back to the strategy we used for analyzing. And we thought, well, if we do, that's a sort of reasonable timeline that districts might think about teachers participating in a program like this. So that's why we picked that time length. We're doing this with two different cohorts of teachers, and so the first cohort of teachers actually this Saturday we're having our last
meeting with them, and they were supposed to have been done last spring. I mean officially they were done last spring but they and we were interested in then continuing, and so we've been working with them last summer and this fall. And we'll start with a new cohort in (inaudible).

KATHLEEN ROTH: Okay?

AUDIENCE MEMBER: I wonder if we all agree that video provides us a source of information and extraordinary degree of context and (inaudible) what we see. And to (inaudible) extend the process of video analysis that this showed is a huge effort to strip the context from certain core observations because when we get to see the 15 percent or whatever percentage, we are just looking at a number in line. And I wonder, well, some other outcomes of research or like Tim showed this morning are not (inaudible) what happens in one minute and what are the situations and the gaze and the hand motion in that meaning and that's the outcome. And you show us an outcome in (inaudible) graph. And I wonder what do you think, you think we have to choose one or the other or these are like two world views to -- ways of thinking?

KATHLEEN ROTH: No, I actually, I apologize. I don't see that as inconsistent with each other, but I think -- actually, one thing I'm really interested about in this
approach is that I think it represents a way of looking at video so that we can actually use it as a measure of looking at teacher growth and change. And I think that it in some ways represents a middle ground or maybe partly I'm comparing, in my mind I'm comparing this to a lot of studies that go on in science education which analyze classroom teaching at sort of what I would call a global rating level so that they look at the lesson and then they look at it once and maybe twice. And then there's a series of questions at a global level like was this a inquiry oriented lesson and did the teacher ask higher level questions or whatever their questions are. So what I think this approach does is it pushes to be much more evidence sort of grounded than that approach. But it certainly is a different approach than what we have (inaudible).

KATHLEEN ROTH: Thanks again, Vicki. We need to go on to the next speaker so sorry. Save your questions.