# What Makes a Video

*Wisely chosen classroom video excerpts can strengthen teachers' abilities to understand and analyze students' mathematical reasoning.*

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For many years, we have been using video to help preservice and practicing teachers explore the mathematical ideas that students raise in their classrooms. In our classes and workshops, teachers watch short video clips of real classrooms—their own and others—and then discuss the student thinking portrayed. The ability to analyze and understand students' mathematical reasoning is an essential aspect of teaching expertise and is one that can be strengthened through viewing and discussing video (Sherin and Han 2004). Recent research shows that teachers who learn to analyze student thinking via video also become more effective at responding to student ideas during instruction (Cohen 2004).

Despite the potential of video to support teacher learning, we have found that not all video is equally valuable for prompting teachers to examine students' mathematical thinking. This concern led us to consider the question, What makes a video clip interesting?

## Productive Video Clips

Here we describe three types of video clips that we have found to be productive for teachers to examine. We also describe three dimensions that can be used to characterize the student thinking portrayed in a video clip. Familiarity with these dimensions will help teacher educators who want to identify effective video clips to use with teachers. Moreover, the information will be useful for teachers who want to be able to select productive video excerpts to view with colleagues.

Others have written about different formats to use when showing teachers video excerpts and about different approaches to facilitate video-based discussions, so our purpose here is to focus on the issue of *selecting* video clips—in particular, selecting clips that are likely to lead to productive discussions of student mathematical thinking.

### The *"What?"* clip

Our first instinct is often to share video clips that present us with a dilemma, that is, clips that leave us confused—but intrigued—about the student ideas they contain. We call such clips *"What?"* clips


because they prompt us to ask, "What just happened there?" At the same time, in order for the confusion to be engaging, rather than off-putting, a video clip must contain enough evidence of student ideas that we are able to make some reasonable hypotheses about what is going on. Confusion due to a lack of entrée into student ideas is not "good" confusion, whereas confusion due to the complexity and innovation of student ideas is. In our experience, *"What?"* clips often involve students obtaining the incorrect answer to a problem; mathematical mistakes, particularly in the context of reasoning and problem solving, seem to be ready fodder for exploration.

For example, in one clip, Mr. Novak's class is working on the following problem: If one inch represents fifty miles, then one-half inch represents how many miles?

When Matthew responds that the answer is seventy-five, Novak asks Matthew about his answer (see **fig. 1**). Matthew seems to understand that half of fifty is twenty-five, yet he also says that half an inch represents seventy-five miles. How can he hold these two opposing ideas?

In discussions of this video clip, the confusing nature of Matthew's thinking leads teachers to become engaged in exploring his mathematical understanding. One group of teachers focused on Matthew's mixing of the concepts of "one half" and "one half more" and mentioned that his confusion is one that they have seen before. In particular, the teachers wondered if Matthew's mistake is due to an incomplete conceptual understanding of fractions as part of a whole or due to merely misinterpreting the mathematical language of fractions.

## The *"Wow!"* clip

While dilemmas often prompt us to want to explore a video clip, they are not the only events that do so. In some powerful video clips, the student thinking is easy to follow, but the students' innovation

**Figure 1**

**An example of a *"What?"* clip: "What is Matthew thinking?"**

Problem on the board: If 1 inch = 50 miles,
then 1/2 inch = ____ miles.

| | |
|---|---|
| *Matthew:* | [It's] 75 … |
| *Mr. Novak:* | Talk us through your thinking here…. What are we looking for, Matthew? |
| *Matthew:* | Like, what's one-half more. Like, what a half equals … |
| *Mr. Novak:* | We know one is fifty…. |
| *Matthew:* | I just put fifty and then, till a hundred, and that's fifty, sixty, seventy, eighty, ninety, and one hundred. I just did half of fifty, and it would be like seventy and eighty, and I just added five so it would be equal in the middle. |

still makes us say, *"Wow!"* In other words, with a *"Wow!"* clip, we are able to follow and understand the mathematical reasoning portrayed, but we still regard that reasoning as creative and unique. Rather than simply using a strategy that has been taught, students discover their own method of working through a problem. In fact, one teacher opened the discussion of a *"Wow!"* video clip by exclaiming, "I would never have thought of doing it that way!" *"Wow!"* clips are interesting because they provide us with new insights into how students think about the mathematics presented in the classroom.

**Figure 2** is an excerpt from one of our favorite *"Wow!"* clips. In this clip, Mr. Epson has students share their methods for solving a problem about ratios. Tim's explanation involves converting fractions to their equivalent percents, a strategy Epson has never used in class. By the end of the clip, Tim's work is clear. In one discussion of this clip, a teacher explained, "[Tim] knew that a fourth was half of a half, and then he went over to the numbers [in the problem]." The teachers had an in-depth discussion of Tim's understanding of the relationships among fractions, ratios, and percents, and they also explored whether Tim's ideas would be useful for other students to consider.

## Figure 2

**An example of a *"Wow!"* clip: "Wow! Tim has a really creative approach!"**

Problem on the board: If 1/2 inch represents 30 miles, then 1/4 represents _____ miles.

| | |
|---|---|
| *Tim:* | I knew that one-half is fifty. I also knew that one-fourth would be twenty-five. So then I knew that twenty-five was half of fifty. I did what's half of thirty, and I got fifteen. |
| *Mr. Epson:* | Huh? You want to come up to the board and write that out for us? |
| *Tim:* | I knew that this [pointing to the one-half] equaled fifty, and I knew that that [pointing to the one-fourth] equaled twenty-five. |
| *Mr. Epson:* | But, doesn't it say that half an inch on the map represents thirty miles? |
| *Tim:* | One-fourth equals twenty-five. One-half equals fifty. And then three-quarters equals seventy-five, and then the whole equals one hundred. I know that twenty-five is half of fifty. So, I went on and did thirty divided by two, and that got me fifteen. |
| *Mr. Epson:* | Okay, I see. You made one hundred your whole. |
| *Tim:* | That's the easy way! |

## Figure 3

**Teachers discuss a *"Hmm …"* clip: "Hmm …. I have to think about this."**

| | |
|---|---|
| *Wanda:* | [I noticed] the way he was counting on the card in the later [round]…. He was counting the groups…. I think it was three times six. |
| *Daniel:* | So, what was he doing? |
| *Yvette:* | He was counting it that many times. |
| *Wanda:* | Which I thought was interesting. |
| *Daniel:* | When he counted six and then another six, I mean … |
| *Frances:* | Yes, and he was keeping track. You noticed he was counting with one—one, two, three, four, five, six. And then he was keeping track, so he knew he counted six one time, six the second time, six the third time. |
| *Daniel:* | Well, then he knows what the meaning of multiplication is. |
| *Wanda:* | Which is … exactly. I mean, that's the base. |
| *Yvette:* | He just hasn't retained the facts. |

## The *"Hmm …"* clip

Whereas *"What?"* and *"Wow!"* clips both present student thinking that is out of the ordinary, clips that contain much more routine thinking can be intriguing as well. *"Hmm …"* video clips are, in a sense, less dramatic versions of *"What?"* clips; rather than an initial reaction of intrigue and shock, *"Hmm …"* clips lead us to pause and ponder. Although they portray students engaged in routine, even algorithmic, mathematical reasoning, something about the students' ideas is confusing. Perhaps, as you will see in the next example, students have made a mistake that prompts teachers to explore the mathematics underlying the algorithm used. *"Hmm …"* clips are important to consider when selecting video to prompt discussion because they remind us that student thinking does not always have to be innovative to be interesting.

In one *"Hmm …"* clip, a pair of students is playing a card game designed to help them practice their multiplication facts. The students play many rounds of the game, every round consisting merely of each student turning over a pair of cards, multiplying the two values shown, and stating the product. The person with the highest product wins that round and gets to keep all four cards. Although the mathematical ideas in this clip are not as sophisticated as in a *"What?"* or a *"Wow!"* clip, the students' mistakes and decisions, which are often confusing, prompt us to want to understand what they are thinking. For example, why do students get different answers to the same multiplication problem in different rounds of the game? Why do students sometimes challenge one another's answers and other times let incorrect answers go? Even if these students have not mastered basic multiplication facts, what do they understand?

**Figure 3** provides an excerpt from a discussion about the multiplication game video clip. In this discussion, the teachers recognize that one of the students in the video is counting groups of six and using his fingers to keep track of how many groups he has counted so far. The teachers' conclusion—that the student

## Table 1

**Three Dimensions of Student Thinking**

| Dimension | Description | Questions to Consider |
|---|---|---|
| **Windows** | Evidence of students' mathematics thinking | • Is student written work visible?<br>• Do students explain their ideas verbally?<br>• Do we see students' gestures or facial expressions? |
| **Clarity** | Ease of understanding students' ideas | • Am I confused about what students are doing or saying? *or*<br>• Do I understand the students' ideas or methods? |
| **Depth** | Nature of students' mathematics thinking | • Are students involved in routine tasks based on memorization and rote recall? *or*<br>• Are students engaged in mathematical reasoning and problem solving? |

## Table 2

**Types of Video Clips and Dimensions of Student Thinking**

| Clip Type | Description | Dimensions of Student Thinking | | | | |
|---|---|---|---|---|---|---|
| | | Window | | Clarity | | Depth |
| **What?** | *"What just happened?"* | Evidence of student ideas | *and* | Student ideas are confusing | *and* | Students engage in mathematical reasoning or problem solving |
| **Wow!** | *"I never thought of that!"* | Evidence of student ideas | *and* | Student ideas are clear | *and* | Students engage in mathematical reasoning or problem solving |
| **Hmm…** | *"There's something interesting here."* | Evidence of student ideas | *and* | Student ideas are confusing | *and* | Students engage in routine, algorithmic thinking |

understood what it means to multiply but had not yet retained the multiplication facts—may have powerful implications for future classroom instruction.

## Key Dimensions

In order to recognize and distinguish among different types of video clips, we find it helpful to look at three aspects of how student thinking is portrayed (see **table 1**). First of all, each clip type described here contains a *window* into (i.e., evidence of) what students are thinking. For example, Tim provided a verbal explanation and wrote some of his work on the chalkboard. In the card game example, students did not do a lot of talking, but we are able to see them counting on the cards.

Second, a video clip can be characterized by its *clarity*, that is, by how easy it is to understand students' ideas and methods. *"What?"* and *"Hmm …"* clips, in which student thinking is confusing, may prompt us to want to understand what a student meant by a statement or how a student arrived at a particular answer. On the other hand, we are often prompted to discuss a video clip, even when the student thinking is clear, if the students' ideas are particularly insightful; such is the case with *"Wow!"* clips.

Third, video clips can be characterized by the *depth* of the student thinking portrayed. Both *"What?"* and *"Wow!"* clips involve students who are engaged in mathematical reasoning and problem solving; in these clips, students demonstrate their own unique and personal ways to solve a problem. *"What?"* and *"Wow!"* video clips often lead to exploration of the substantive and innovative mathematical ideas that they contain. In contrast, *"Hmm …"* clips portray students relying on rote recall of facts and on routine algorithms that have likely been presented to them by a teacher. It is important to remember that, in some cases, we can be prompted to have rich discussions about video that contains routine mathematics; in the case of *"Hmm …"* video clips, students' ideas become a jumping-off point for delving more deeply into the mathematics. To summarize, **table 2** characterizes the three video clip types in terms of these dimensions of student thinking.

## Video Clips for Discussion

We have introduced three types of video excerpts that can promote productive discussion of students' thinking about mathematics. We have also described three aspects of video to attend to when

**Table 3**

**Steps in Selecting a Video Clip of Student Thinking**

| | |
|---|---|
| **Step 1: Window** | Locate portions of classroom video that contain evidence of student thinking. |
| **Step 2: Clarity and Depth** | Find an excerpt with a useful combination of clarity and depth—one that makes it a *"What?" "Wow!"* or *"Hmm ..."* clip. |
| **Step 3: Prepare for the Meeting** | • Make copies of the problem or worksheet used in the video.<br>• Make a list of possible discussion questions. |

selecting excerpts to share with teachers: the *windows*, *depth*, and *clarity* of student thinking.

To conclude, we offer a few practical suggestions to help you get started in selecting and using video clips of students' mathematical thinking (see **table 3**). Once you have videotaped a classroom lesson or two, you will need to find an excerpt to share. Evidence of student ideas is always key; start by finding a passage with ample *windows* into students' thinking. Next, decide if the excerpt you are considering has the appropriate combination of *depth* and *clarity* to be a *"What?"* a *"Wow!"* or a *"Hmm ..."* clip. Sometimes a little editing can make a clip much more effective. For example, you might need to cut two minutes that students spend silently working on a problem before they begin sharing their ideas.

Of course, a productive discussion is not based on an interesting video clip alone but also on how you engage your fellow teachers with the video. Providing teachers with some background information about the lesson will allow them to spend their time focused on what the students are thinking about the problem rather than focused on understanding the context for the students' work. We almost always bring copies of the problem or activity sheet that students are working on in the video, and we often have teachers solve—and discuss—the problem before watching the video clip. This "prediscussion" can get teachers to start thinking about complexities of the mathematics that they might otherwise miss (Seago 2004).

Furthermore, prepare a list of some questions you plan to ask. What is it about this video clip that you find interesting? You need not stick to your list of questions, but they provide a starting point for your discussion and can remind you to bring up issues that first-time viewers might miss. Finally, remember that you yourself do not need to have an answer to each of your questions; the best questions often do not have a single answer. As we see it, the goal of discussion is to explore student ideas, not to reach the "correct" conclusion.



## References


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