Orchestrating for Seeing: How Teachers See and Help Others See Student Thinking When Self-Capturing Classroom Video

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Abstract: Recording moments of our lives on video is becoming more commonplace, and it is increasingly part of the professional work of teaching. Yet much remains to be learned about how teachers self-capture video from their own classrooms while teaching, which has important implications for teacher and student learning opportunities. This paper explores how in-service primary grades teachers participating in a professional learning course self-captured video that specifically centered student thinking. Drawing on the theoretical lens of professional vision (Goodwin, 1994), we asked what teachers highlighted as salient for seeing student thinking when self-capturing, and how they orchestrated their recording and classroom activity in service of this seeing. Analyses demonstrate shifts over time in the windows teachers highlighted for seeing student thinking in video and depict the substantial orchestration work teachers engaged in to facilitate both accessing and enhancing student thinking within self-captured video.

Keywords: self-capturing video, professional development, teacher thinking, student thinking

Recording moments of our lives on video is increasingly commonplace today. Many of us now have video cameras in our pockets, making it possible for us to capture events in real time, revisit them later, and share them with others. But the addition of these recording devices does more than enable us to capture moments of our lives; it can also change our lives in important ways. For instance, we might see something differently through the lens of a camera, or use of the camera might invite us to pause and reflect on what is important to see. Sometimes we stop what we are doing to record. More dramatically, we might even change what we are doing in order to produce a particular video.

In parallel with these developments, video has come to play an increasing role in the professional lives of teachers and the work of teaching — as part of licensure and certification processes, participation in professional learning opportunities, and other contexts (Borko, Jacobs, Eiteljorg, & Pittman, 2008; Clark, Chittleborough, & Chandler, 2019; Sherin & Dyer, 2017; Zhang, Lundeberg, Koehler, & Eberhardt, 2011). As part of this work, teachers are being increasingly asked to *self-capture* video from their own classrooms, recording particular interactional facets of instruction while simultaneously supporting a roomful of students. Similar to the considerations raised above, there are a range of possibilities for how this might unfold. At one extreme, it is possible that the recording process might be a relatively fluid addition to the life of a classroom, with teachers capturing events already in motion. At the other extreme, the addition of self-capturing video may require significant re-orchestration of what are often carefully planned routines and interactions in classrooms (e.g., Stein, Engle, Smith, & Hughes, 2008). For instance, if a teacher wants to record a discussion among a particular group of students, what do they want to see in frame? What does this mean for the camera's and students' physical positioning in the classroom? How might teachers change the established practices of their classroom to produce the desired video?

In this paper, we explore how teachers participating in a professional learning course focused on students' mathematical argumentation in the primary grades engaged in the process of self-capturing video from their classrooms. Given the focus of the course, we asked teachers to capture and share videos of student thinking in relation to designed argumentation tasks; we anticipate many certification and professional learning contexts have a similar emphasis on capturing student thinking and discourse. Thus, in our analysis, we specifically focus on teachers' ways of seeing and designing for others to see student thinking in video. Drawing on the theoretical lens of professional vision (Goodwin, 1994), we ask the following entwined questions: *What do teachers highlight as salient for seeing student thinking when self-capturing classroom video? How do teachers orchestrate their recording and classroom activity to facilitate this seeing?* Exploration of these questions will provide insights into some of the specific decisions and considerations that arise for teachers and will offer implications for researchers and teacher educators as self-capturing video increasingly becomes part of the professional work of teaching.

Conceptual grounding

Using video in and for teacher learning

A range of research documents that video can be a valuable resource for teacher learning (e.g., Brophy, 2003; Cohen, 2004; Seidel, Stürmer, Blomberg, Kobarg, & Schwindt, 2011; Tripp & Rich, 2012). In particular, prior research has explored ways in which video supports the development of teacher noticing of classroom events and student thinking (e.g., Barnhart & van Es, 2015; Borko, Jacobs, Koellner, & Swackhamer, 2015; Star, Lynch, & Perova, 2011). Several affordances of video have been found to be key to such learning. For instance, the permanence of the video record along with the fact that video can be annotated and edited allow teachers to examine classroom interactions repeatedly and from multiple perspectives, perspectives that may be different from what is typical during instruction (van Es, 2011). Videos that provide "windows" into student thinking by showcasing students' verbal explanations and/or written work can support productive conversation amongst teachers around student thinking in particular (Sherin, Linsenmeier, & van Es, 2009). Furthermore, research has documented that when teachers learn to attend to classroom interactions in new ways in the context of video, they at times apply these new perspectives in the context of instruction as well (van Es & Sherin, 2010).

In recent work, we have begun to investigate the ways that recording in one's own classroom can also be a source of learning for teachers. Prior research has focused on analyzing and discussing video as the primary contexts for teacher learning with video. However, the act of capturing classroom video itself — specifically with instruction to "capture student thinking" — may promote learning as teachers consider what portions of instruction to record and notice and adjust instruction to promote student thinking in the moment (Sherin & Dyer, 2017).

This paper more deeply explores how teachers engage in self-capturing video of student thinking in their classroom contexts. Scholars who study video highlight how the recording process is never agnostic (e.g., Derry et al., 2010; Erickson, 2011; Vossoughi & Escudé, 2016); at minimum, it involves a series of decisions about how to position the camera in relation to the broader environment that impact what is visible and central in the produced footage. Here, we unpack how teachers themselves engage in this work — how they decide what to have in the camera's eye when the intent is to "see" student thinking, and how they orchestrate their recording and classroom activity to facilitate this seeing while teaching.

Professional vision

Theoretically, we conceptualize teachers' ways of seeing student thinking as socially and contextually situated, and as part of their broader professional vision. In his anthropological study of the work of archaeology and legal argumentation, Goodwin (1994) described professional vision as consisting of "socially organized ways of seeing and understanding events that are answerable to the distinctive interests of a particular social group" (p. 606). He highlighted how professional vision can be constructed, demonstrated, and/or negotiated when events or phenomena (like a patch of dirt, to use an example from archaeology) are shaped into professional objects of knowledge through a series of practices enacted during specific activities (like mapping a site). These practices include *coding* events with socially meaningful categories (e.g., dirt consistency or texture, to continue the example), *highlighting* salient features of phenomena (e.g., a subtle gradation of colors within a patch of dirt indicating a prior event), and *producing and articulating material representations* (e.g., a map).

Applying this frame to our professional context, we theorize that when teachers self-capture video of student thinking to share with colleagues, they demonstrate and perhaps re-negotiate their professional vision as they transform a classroom interaction into an example of accessible student thinking via practices similar to those described above. For instance, teachers may highlight particular features of an interaction, such as a student's facial expression or gesture, as salient for understanding the student's thinking. This paper explores what teachers highlight as salient for seeing student thinking when producing video to share with colleagues, as well as what the production of self-captured video entails in the classroom context.

Study context

This study took place in the context of a six-week online course on mathematical argumentation with primary students, adapted from a longer course created by Lomax, Fox, Kazemi, and Shahan (2017). Each week, inservice teachers in the course were asked to try out a mathematical task designed to promote argumentation in their classrooms (such as showing a set of images and asking students to discuss and justify their position for "which one doesn't belong?") and to capture video of the discussion. Teachers then selected video clips to share with colleagues in the course, with the goal of collaboratively unpacking student thinking. We invited teachers to choose three focal students to trace throughout the course and provided brief instructions on how to use an application for the phone or tablet associated with the course platform, but teachers could ultimately structure the

discussion and videotape however they wished. Additionally, though the argumentation tasks were pre-designed (e.g., a true/false task where students needed to determine and justify whether a given equation was true or false), they included options that teachers could select among (e.g., several equations with more or less complexity).

In total, 20 K-2 teachers participated in the course, 10 in the spring of 2018 and 10 in the spring of 2019. All taught in well-resourced, small suburban school districts in the midwestern United States (e.g., all classrooms had 1-1 iPads). Teachers ranged in experience from one to 28 years, with a mean of 12.5 years of teaching experience.

Data and methods

To better understand teachers' processes of self-capturing video of student thinking while teaching, we conducted short, semi-structured interviews with all teachers two (2018 cohort) or three (2019 cohort) times throughout their participation in the course, for a total of 49 interviews. In the interviews, among other topics, we asked teachers to reflect on how the recording process went from their perspectives and their general plans for recording, as well as more specific questions about issues like timing, device choice, and camera positioning. We also conducted at least one classroom observation of each teacher to watch their recording process as it was happening, and we collected all videos the teachers uploaded in the course.

Analytically, we initially segmented interview transcripts into decision units (e.g., teacher used phone to video record) and engaged in open coding of both the nature of the decisions (e.g., device choice) and the teachers' reasoning (e.g., familiar with how to use; able to hear students well). This round of open coding drew on foci from prior work, such as various windows into student thinking, as sensitizing constructs but also noted emergent considerations from teachers across interviews. We noted many kinds of decisions, considerations, and shifts from typical classroom practice, highlighting the significant re-orchestration that self-capturing classroom video required for this group of teachers.

After this initial analysis pass, however, we began to focus more specifically on teacher decisions that demonstrate how they use video to highlight student thinking. What might at first glance seem to be mundane details of the recording process turned out to be key to our analysis. Unsurprisingly, it was common for teachers to mention the importance of being able to hear students, but several varieties of what teachers wanted to see also emerged. Table 1 reflects our coding scheme for these different windows into student thinking, refined through iterative coding and discussion of interview data by the first and second authors. The scheme treats hearing as a given and lists additional visual windows.

Table 1: Coding scheme for teachers' intended visual windows into student thinking when self-capturing

Code	Description
Hear only	Teacher only discusses hearing students
See students (unspecified)	Teacher discusses seeing students, without further specification of what about the students
See students' faces	Teacher discusses seeing students' faces or expressions
See task/work	Teacher discusses seeing the argumentation task the class is working on and/or how students are interacting with it (e.g., pointing, writing)
See students + task/work	Teacher discusses seeing students and their task/work
See students' faces + task/work	Teacher discusses seeing students' faces and their task/work
Flexible by activity	Teacher discusses seeing different things depending on the activity

Treating interviews as our unit of analysis, the first and second authors independently coded 20% of the interviews that had not been discussed using the scheme in Table 1, obtaining a Cohen's kappa of 1 (almost perfect agreement). The first author then coded the remainder of the interviews. We also explored other decisions that teachers made to facilitate seeing student thinking in self-captured video that came up without prompting by the interviewers, as a proxy for what was most salient to teachers, and cross-checked insights from interviews with classroom observation and video data. Our findings highlight patterns in teachers' actions and reflections on self-capturing classroom videos centered on student thinking.

Findings

When self-capturing video, teachers made multiple decisions in service of seeing student thinking, and they engaged in re-orchestrations of their classroom activity — even in the fairly structured context of filming a pre-designed argumentation task.

What windows into student thinking did teachers highlight?

A central and at times shifting consideration for teachers was what they believed provided access to "see" student thinking in videos. As noted previously, all teachers expressed the importance of being able to hear students in the recordings, but there was variability in the visual windows that teachers highlighted. Further, some teachers' expressed priorities changed as the course unfolded. Table 2 provides an overview and comparison of the windows teachers highlighted and designed for earlier in their course experience versus later. (Since different teachers were interviewed at different timepoints throughout the course, we allowed for an overlapping of Weeks 3 and 4 with respect to "earlier" and "later" for a given teacher to maximize our ability to compare teachers' responses. We removed one teacher from the dataset as they did not complete a second interview.)

Table 2: Teachers' highlighted windows into student thinking over time (N=19 teachers)

"Window"	Earlier in course (Weeks 1-4)	Later in course (Weeks 3-6)	Consistency over time (Weeks 1-6)
See students (unspecified)	7 teachers (37%)	7 teachers (37%)	4 teachers (21%)
See students' faces	6 teachers (32%)	--	--
See task/work	2 teachers (11%)	2 teachers (11%)	--
See students + task/work	*1 teacher (5%)*	*8 teachers (42%)*	1 teacher (5%)
See students' faces + task/work	*2 teachers (11%)*	*1 teacher (5%)*	1 teacher (5%)
Flexible by activity	1 teacher (5%)	1 teacher (5%)	1 teacher (5%)

Of the 19 teachers, seven teachers in total (37%) exhibited consistency in what they prioritized seeing in their videos over time; 63% of teachers demonstrated shifts in what they highlighted within the six-week course. One pattern evident in Table 2 is that earlier in the course, 42% of teachers (eight in total across "See students' faces" and "See students' faces + task/work") explicitly discussed wanting to see students' faces as a window into aspects of their thinking, as demonstrated in the following quotes:

> I wanted to see their faces and their reactions… a lot of times they'll show if they're confused or they're not quite sure what they're going to say. You can see a lot of their thinking, I think, just through their facial expressions too, so I think that's very important to show in the video (Week 1 interview).

> I want to see their facial expressions when they're answering something. Are they turning to a partner and being like, "Yes, I agree with you because of this," or are they doing it, "I agree with you but I'm just pulling it out of the air"? (Week 2 interview).

As one teacher noted, "It's interesting… that you have a view of how you think it should go, and I just automatically thought that viewing, like, their faces would make more sense" (Week 4 interview). However, what became increasingly salient to teachers, including this teacher, later in the course was being able to see students *and* the task or the work that students were engaging with. This was highlighted and designed for by three teachers (16%) earlier in the course but by nine teachers (47%) later (Table 2, italicized text) as they engaged in their own self-capturing processes and interacted with others' video products:

> I wish maybe I had set it up higher so we could have seen the papers so when they were pointing to things, we would know what they're talking about… so I might try that next time… I think I could learn a lot — or people can learn more about what's happening instead of just talking (Week 1 interview just after filming; this teacher started projecting the task and having students interact with it on the board in Week 2).

> I want to see their faces, their hands, and what they're seeing because I've noticed some people

don't—and there was one actually that was an example that you guys put, and you couldn't see what was there, I'm like, "But I want—I need to see that!" So I've just been careful to kind of, like, when I'm holding it, show them, show their hands because they are trying to work it out with their fingers and explaining things and then also what's on the paper (Week 3 interview).

I was trying to see the kids because I felt like that was a big element. You could hear my voice, but I think just watching the kids point, like this is here, if you couldn't see that I felt like I wasn't really sure what they were talking about (Week 6 interview).

While numerous teachers increasingly desired to include students and their task/work, seeking to coordinate multiple windows (e.g., hearing, seeing students, and seeing the task/work) posed orchestration challenges, as we discuss next.

Orchestrating for accessing student thinking

Perhaps most surprising to us was the complexity of the re-orchestrations performed by teachers, and the web of decisions driving these re-orchestrations. In order for teachers to produce their desired windows into student thinking in self-captured videos, they orchestrated both their filming and classroom activity in intentional ways. For instance, *camera positioning* was a consideration and challenge that all but two teachers highlighted. Positioning the camera was particularly challenging when teachers strove to coordinate multiple windows:

I couldn't get it at the right angle. Yeah, so I, I was trying to kind of show what we were doing with the dot cards. But also I wanted you to be able to see them and their conversation… I feel like today with the recording again just trying to get it set up the right way so that you could see everything, um, was- is a challenge, I feel like (Week 1 interview).

I went to [my colleague], and I said, I go, "My video sometimes I feel like all I see is the kids or all I see is the table." I go, "Do you have a trick as to — because I tried it on the counter behind me, but it's not the right level, and I tried it on the table." So she said, "Do you have any carts in your room?" That's why I tried the cart today (Week 4 interview).

In relation to desired windows, several teachers also discussed 1) the device they used to film, 2) the groupings they chose to film, and/or 3) how to orchestrate other students' activity who were not being filmed. This latter consideration of *orchestrating other students' activity* came up increasingly over time and was typically in service of ensuring that students on film could be heard. At times, this shifted teachers' usual classroom practice or students' usual schedules:

… those future-ready tasks for example are more game-based, so when that's going on, the background can get a little bit louder. I don't mind that during math time in general when I do mini lessons, but when I'm doing this, it needs to be quieter (Week 4 interview).

I did it a little differently than I noticed most other people did. They filmed it while their kids were in here. I found the background noise when they did that was very distracting for me and I had a hard time hearing the kids, so I kept my three in from recess (Week 6 interview).

When teachers did not film their whole class, they tended to film when other students were engaged in groups in learning stations, doing quiet independent work, or out of the room (as in the Week 6 example above).

For about one third of the teachers, filming in ways that afforded access to student thinking raised tensions with respect to *inclusivity* and who was — and was not — involved in the filming and mathematical discussions at hand. Teachers mitigated these tensions by filming multiple small groups of students, filming whole class (but not necessarily to share with colleagues), or engaging their whole class in designed tasks:

I've done some as the whole group on the rug because they're like, "What are you doing?"… I thought, okay, we'll do this group and then we do whole group sometimes when I'm like, no one's missing anything (Week 4 interview).

I would do my focus group and then I would videotape other groups because I didn't want them to feel like they didn't have the right answer or they weren't as special, so a lot of times I'd say,

"You know, I'm going to get to everyone, we'll do three at a time" and we get through everybody (Week 6 interview).

Finally, the considerations teachers raised with respect to providing windows into student thinking — camera positioning, device choice, groupings, and other students' activity — were often connected and entangled in teachers' work. For instance, consider how the teacher below described her self-capturing process:

So, I've used my phone to record. I've used my iPad. I've used my computer. So, depending if I do it in a small group or a whole group, I feel like different things work best… The one time for whole group lesson I used my computer, it looked really good, and then I went to go play it and I couldn't hear anything. Like the sound, like I couldn't hear the kids… From a computer in a small group, it works because you're closer, but because the computer was so far, the sound in the video I didn't think it was that good (Week 4 interview).

Here, providing adequate windows into student thinking involved coordinating the capabilities of particular devices with particular groupings and positionings (the computer works well in small groups when positioned closer, but its sound quality diminishes at the distance needed to get a whole group in frame). These are nuanced orchestration challenges that required trial and error in specific classroom settings.

Orchestrating for enhancing student thinking

We also saw that teachers orchestrated their recording and classroom activity in service of enhancing, not just providing access to, student thinking while self-capturing video. They discussed two main decision points in relation to the prevalence and quality of student thinking — *filming particular groupings* to bolster conversation quality and *selecting specific tasks* (within pre-designed argumentation tasks) to promote thinking among particular learners. While these decisions may not be unique to self-capturing classroom video, they were part of the orchestration work and plausibly heightened in this context as teachers were making student thinking public to colleagues.

With respect to filming particular groupings, several teachers discussed when and why to film a whole group discussion versus a small group discussion in relation to the quality of the conversation, which they at times learned through experimenting with both set-ups. For instance, the teacher below tried both groupings but ultimately decided to film her discussions whole group:

I figured out the whole group was the best… my kids are- which is weird, you think they'd be more engaged in a small group, but my class this year, I don't know if it's just my group, but they're more engaged whole group and then I think also to just hear other kids' opinions kinda gets my three focus students, it gave them a little something more to work with than just each other (Week 6 interview).

The kinds of reasoning evident here — students being more engaged, having "more to work with" — were distinct from the kinds of reasoning seen when teachers discussed filming particular groupings in service of accessing student thinking. Discussing groupings in terms of *access* tended to sound like concerns about what would be possible to see and hear within different configurations. In contrast, considering groupings in service of *enhancing* student thinking focused on the nature and extent of students' contributions in different group contexts.

Numerous teachers also discussed intentionally selecting specific tasks among the options provided within pre-designed argumentation tasks based on their understandings of particular learners in their classrooms. For some teachers, this took the form of seeking to enhance students' success on the task, likely to build student confidence and participation: "I may have given them an equation right away that I knew they'd be successful with" (Week 6 interview). Other teachers intentionally challenged their students with tasks they thought would be difficult but motivating: "I picked one of the options that I feel like my kids would mostly struggle with. Or like the most difficult one just to see what they would think" (Week 1 interview). In either case, teachers seemed to be aiming to spark rich thinking among their students.

Discussion and implications

Recording video is becoming increasingly common in everyday life, yet there remain important and open questions about how teachers record video in their classroom contexts while teaching. This study provides insights into what primary grades teachers considered and how they orchestrated their filming and classroom activity when self-capturing student thinking on video.

First, this study highlights the complexity of the processes involved in using self-captured video to highlight student thinking. Teachers in the course did not simply "point and shoot" to capture classroom activity in an unaltered form. On the contrary, they engaged in substantial orchestration work that extended out into parts of the day that seemingly did not have anything to do with the recorded activity (e.g., recess) and extended down into decisions about how to position the camera to best "see" student thinking. While this orchestration was feasible for teachers in the course, it was also non-trivial — teachers commonly faced challenges and tensions in coordinating, for instance, their desired windows into student thinking with the groupings they felt produced the most interesting conversation with how to address students who were not being filmed at a given time. This latter consideration of orchestrating other students' activity seems unique to the work of *teachers* self-capturing classroom video, as they maintain responsibility for all students while recording. This also highlights a potential trade-off for researchers and teacher educators to consider when inviting teachers to self-capture video; when teachers do so, they may need to design activities for other students that, from a learning perspective, are different from what they would do otherwise. These shifts in instructional activities and their implications for students are worthy of future study. We wonder, for example, if some students miss out on opportunities for learning while others are being recorded. Who is selected for these opportunities and why? Further, if teachers are changing practice in service of creating a quality video product, might they elevate video over pedagogy in their decision-making processes? How might pedagogy and self-captured video mutually support each other? Such questions become increasingly important as the professional work of teaching expands to include self-capturing classroom video for certification and professional learning opportunities.

Second, most teachers exhibited changes in their self-capturing processes over the short, six-week timeframe of the course. Some changes seemed related to teachers' experimentation and trial and error as they tried on different camera positionings, devices, and groupings to film in relation to seeing and enhancing student thinking. Others, such as the change in teachers' desired windows into student thinking, seemed more directional in nature, as teachers highlighted seeing students' faces earlier in the course and seeing the task/work students engaged with later in the course. The context of self-capturing and working with video in the course seemed to elevate both the importance of — and trade-offs among — varied windows into student thinking within video for teachers, necessitating consideration and negotiation of what they and colleagues need in order to understand students' activity. An open question remains as to whether such negotiation of what is important for "seeing" student thinking is limited to the context of producing the video, or whether it may reflect an area of new or re-negotiated professional vision for teachers that extends beyond the video production context — a different kind of learning opportunity than those discussed in prior self-capturing work (Sherin & Dyer, 2017).

Further, just as self-capturing classroom video can be a way for teachers to unpack students' thinking, examining teachers' self-capturing processes and products can be a way for researchers and teacher educators to understand aspects of teachers' professional vision (Goodwin, 1994). We can get a view into teachers' socially organized ways of seeing student thinking through what they highlight in their recordings, allowing us to understand and be responsive to the ways of seeing present among given cohorts of teachers in professional settings as well as to anticipate and design for additional learning opportunities. We also propose that the practices associated with teachers' professional vision may involve additional forms of orchestrating that shape not only the professional objects of knowledge but the very events or phenomena themselves. Teachers are not shaping an existing patch of dirt into an object of knowledge; they are shaping dynamic interactions that they are simultaneously part of, often (as in the case of self-capturing) in real time. Thus, to some degree, teachers' orchestrating for enhancing student thinking, for instance, seems connected to but not fully encompassed by previously described practices of coding, highlighting, or producing and articulating material representations.

Finally, we close with another question for future study — what are the implications of teachers self-capturing video to be shared with colleagues, versus doing so just for themselves and their own learning? We heard teachers refer to different purposes and audiences in their interviews and associate specific purposes and audiences with different decisions they made. As video allows teachers to project images of themselves and their students to the larger professional world, we suspect that the endeavor of recording could be elevated into one of significance as teachers seek to represent their classrooms and make their activity intelligible to others.

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