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Video as a catalyst for mathematics teachers' professional growth

Ronnie Karsenty[1] · **Miriam Gamoran Sherin**[2]

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In today's world, characterized by rapid technological advancements occurring on a day-to-day basis, using video as a means for learning seems almost unavoidable. Laptops, tablets and smartphones enable us to access videotaped instruction almost everywhere and with regard to almost any topic. However, most of such video-based learning enhances the kind of knowledge we might refer to as "first-order knowledge", i.e., acquisition of various kinds of information. Whether we learn about global economics, solving quadratic equations, attributes of Shakespearean sonnets or how to make an origami bird (all of these subjects available in hundreds of web videos), the point is, in principle, that we watch an expert explain concepts or demonstrate procedures, and we try to follow, understand or apply what is being discussed or shown. The attainment of first-order knowledge through video is already deeply ingrained in the culture of the twenty-first century. However, the use of video for attaining or improving "second-order knowledge", i.e., our knowledge about what we know, what we need to know, what we want to know, is less prevalent. Second-order knowledge involves reflective skills, and the issue of how to recruit the powers of video for the improvement of such skills lies at the heart of up-to-date programs for professional development worldwide, in various domains such as health, social work, psychotherapy and education (e.g., Todd et al. 2015; Gaudin and Chaliès 2015). Specifically, a growing number of professional development (PD) programs for mathematics teachers around the world centralize video as a catalyst for teachers' reflection on their

✉ Ronnie Karsenty
ronnie.karsenty@weizmann.ac.il

Miriam Gamoran Sherin
msherin@northwestern.edu

[1] Science Teaching Department, Weizmann Institute of Science, Rehovot, Israel

[2] School of Education and Social Policy, Northwestern University, Evanston, IL, USA

teaching and on their students' learning (e.g., Borko et al. 2011; Geiger et al. 2016; Seidel et al. 2011; Simpson et al. 2017; Taylan 2017).

Even within this specific context, the aims of reflection may vary considerably, for example: identifying good practice; noticing students' mathematical thinking; sharpening mathematical knowledge; improving particular aspects of teaching, such as posing problems or managing discussions, etc. (Blomberg et al. 2014; Sherin and Han 2004; Star and Strickland 2008). Accordingly, the rapidly expanding research literature on video as a resource for mathematics teachers' professional development encompasses a wide range of foci. Research has advanced our understanding about several key issues: What might mathematics teachers learn from sustained engagement with video in professional development settings? How should video-based professional development sessions be designed in order to enhance teacher learning? What is the role of the professional development facilitator? What kinds of conversational norms enable productive peer discussions around video? (Coles 2013; Lesseig et al. 2016; Santagata and Yeh 2013; Sherin and van Es 2009).

Nevertheless, new technologies and new PD programs give rise to more questions yet to be explored. For example, what frameworks can assist us in articulating the dimensions along which teachers can productively view video? How do recent advances in technology (e.g., video cameras becoming smaller and smaller) affect opportunities for teachers' professional growth, and to what extent do such opportunities shape the way teachers learn from video? What is the role that teachers' agency might play in creating video artifacts for learning?

The five papers included in this Special Issue of the Journal of Mathematics Teacher Education, dedicated to *Video as a Catalyst for Mathematics Teachers' Professional Growth,* propose various perspectives about these topics.

First, the issue of designing a framework for discussing classroom video with teachers is comprehensively examined: In the first article of this volume, Alan Schoenfeld presents the TRU (Teaching for Robust Understanding) framework, comprised of five dimensions to be considered while watching a videotaped lesson. These include first and foremost the quality of the mathematics explored in the lesson, which is, as Schoenfeld notes, a necessary (though not sufficient) condition for ensuring that students are learning what he terms "powerful mathematics". The other four dimensions are cognitive demand; equitable access to content; agency, ownership and identity; and formative assessment. Readers of this article may notice that the focus of the TRU framework is on *students*. Schoenfeld asserts that using these five key dimensions in PD settings may help both prospective and practicing teachers to plan and review instruction, by way of a careful consideration of how the lesson looks through a student's eyes. Thus, TRU-based PD sessions use questions such as "Which students get to explain their mathematical ideas?", "What do we know about each student's current mathematical thinking?", "Do students have the opportunity to make the content their own?" In contrast, the framework introduced by Karsenty and Arcavi, in the second article of this volume, focuses on the *teacher*. This framework, named SLF (Six-Lens Framework), includes, as its name suggests, six viewing lenses through which teachers are advised to analyze videotaped lessons. These are mathematical and meta-mathematical ideas discussed in the lesson; the teacher's goals; tasks and activities chosen by the teacher for the lesson; dilemmas faced by the teacher and the ensuing decision-making processes; interactions; and the teacher's beliefs. In an SLF-based PD session, observations of videotaped lessons of unknown peers are directed by questions such as "What may be the goals that the teacher is attempting to achieve?", "How does the teacher navigate students' responses during the mathematical activity?", "How does the teacher perceive her role and what may be her ideas about what 'good

mathematics teaching' is?" Clearly, these questions define a different perspective of looking at videos than the one suggested by TRU. Another framework reported in this Special Issue is described by Hollingsworth and Clarke in the third article of this volume. Hollingsworth and Clarke developed a five-dimensional observation instrument that emphasizes a dual focus on the relationship between teachers' actions and students' learning. The five dimensions include communicating expectations; questions and discussions; tasks; building understanding; and using assessment. Interestingly, while some features are shared by different frameworks, others are unique. For instance, assessment of students' understanding, as perceived in the video, is emphasized in both Hollingsworth and Clarke's observation instrument and Schoenfeld's TRU framework; characterizing tasks is centralized in Karsenty and Arcavi's SLF and in Hollingsworth and Clark's instrument; however, looking at the video for evidence of students' agency, ownership and identity is a distinctive feature of TRU, whereas analyzing teachers' beliefs is highlighted only in SLF. These similarities and differences make interesting food for thought for readers of the first three articles.

Second, looking across the third article, by Hollingsworth and Clark, and the fourth article, by Sherin and Dyer, reveals that teachers' agency in selecting and viewing classroom video is becoming more and more central. Research on professional development has, for quite some time, emphasized the need for teachers to be actively engaged in their learning (e.g., Wilson and Berne 1999), yet what this means has varied. Garet et al. (2001) reported that such experiences include

> the opportunity to observe expert teachers and to be observed teaching, to plan how new curriculum materials and new teaching methods will be used in the classroom, to review student work in the topic areas being covered, and to lead discussions and engage in written work. (p. 925)

Given the accessibility of video cameras and video annotation tools today, new forms of "active engagement" must be considered. In particular, the articles by Hollingsworth and Clark, and by Sherin and Dyer, present opportunities for teachers to select the video that is the focus of their professional development. A key feature of the design of Hollingsworth and Clark's study is that individual teachers were able to choose which part of their own lesson they wanted to investigate. In addition, teachers chose which components of the observation instrument would serve as focus of their reflection on the selected video. This degree of teacher agency proved quite important to the participating teachers, as the authors illustrate, with teachers describing the process as both "engaging and empowering". In Sherin and Dyer's study, teachers were asked to capture and select video from their classrooms that highlighted student mathematical thinking. Sherin and Dyer report on several different strategies that teachers applied in order to successfully do so. Furthermore, the authors argue that teacher learning occurred not only in the viewing and reflecting on the captured video, but in the preparation for, and act of, recording one's classroom. In this way, Sherin and Dyer illustrate new ways of increasing teachers' influence on their learning in professional development.

Third, this volume offers intriguing perspectives on novel ways to create and use video artifacts for teacher learning. In the fifth article, Vogler and Prediger introduce a unique model, utilizing a double-layer design of a video-based PD program focusing on classroom interactions: First, the classroom video is shown to *students*, and their reactions are videotaped. Then, selected excerpts from this video material serve as artifacts for discussions with *teachers*, with the aim of increasing their awareness of teacher–student interaction and of students' diverse perceptions of these kinds of interactions. The fact that

classroom video is not watched directly by teachers, but is rather "mediated" by students' perspectives, creates new opportunities for significant learning, as Vogler and Prediger show. Sherin and Dyer discuss advanced technologies that allow teachers to create video artifacts in real-time instructional situations. For instance, teachers use small digital cameras worn on the brim of a hat, with a recording module held by hand or attached to a belt. While recording, the teacher can press a button to have specific moments digitally marked, later to be easily accessed in the video file created. The result of this technology is that, as mentioned above, teachers are preparing their own artifacts for sharing and discussing their practice with peers and researchers. As Sherin and Dyer demonstrate, there is a lot to be learned from these new possibilities.

Together, the five articles in this volume illustrate the power of using classroom video not as a set of practices to be replicated, but as a resource for learning to reflect on teaching in deep and meaningful ways. In addition, the articles cover an interesting range of PD contexts: teachers watching their own video and teachers watching video of unknown colleagues; teachers watching whole lessons and watching selected clips; rubric-based video inspection by teachers leading to a systemized feedback, and teachers' observations that discard evaluations all together. The subjects of study also vary and include prospective and practicing teachers in the elementary and secondary school levels. Moreover, the articles draw on mathematics teaching in four different countries: Australia, Germany, Israel and the United States, providing a unique opportunity to explore video-based professional development across an international set of studies.

References

Blomberg, G., Sherin, M. G., Renkl, A., Glogger, I., & Seidel, T. (2014). Understanding video as a tool for teacher education: Investigating instructional strategies integrating video to promote reflection. *Instructional Science, 42*(3), 443–463.

Borko, H., Koellner, K., Jacobs, J., & Seago, N. (2011). Using video representations of teaching in practice-based professional development programs. *ZDM—The International Journal of Mathematics Education, 43*(1), 175–187.

Coles, A. (2013). Using video for professional development: The role of the discussion facilitator. *Journal of Mathematics Teacher Education, 16*(3), 165–184.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(4), 915–945.

Gaudin, C., & Chaliès, S. (2015). Video viewing in teacher education and professional development: A literature review. *Educational Research Review, 16,* 41–67.

Geiger, V., Muir, T., & Lamb, J. (2016). Video-stimulated recall as a catalyst for teacher professional learning. *Journal of Mathematics Teacher Education, 19*(5), 457–475.

Lesseig, K., Elliott, R., Kazemi, E., Kelley-Petersen, M., Campbell, M., Mumme, J., et al. (2016). Leader noticing of facilitation in videocases of mathematics professional development. *Journal of Mathematics Teacher Education, 19*(5), 1–29.

Santagata, R., & Yeh, C. (2013). Learning to teach mathematics and to analyze teaching effectiveness: Evidence from a video-and practice-based approach. *Journal of Mathematics Teacher Education, 17*(6), 491–514.

Seidel, T., Stürmer, K., Blomberg, G., Kobarg, M., & Schwindt, K. (2011). Teacher learning from analysis of videotaped classroom situations: Does it make a difference whether teachers observe their own teaching or that of others? *Teaching and Teacher Education, 27*(2), 259–267.

Sherin, M. G., & Han, S. (2004). Teacher learning in the context of a video club. *Teaching and Teacher Education, 20,* 163–183.

Sherin, M. G., & van Es, E. A. (2009). Effects of video participation on teachers' professional vision. *Journal of Teacher Education, 60*(1), 20–37.

Simpson, A., Vondrová, N., & Žalská, J. (2017). Sources of shifts in pre-service teachers' patterns of attention: The roles of teaching experience and of observational experience. *Journal of Mathematics Teacher Education*. doi:10.1007/s10857-017-9370-6.

Star, J. R., & Strickland, S. K. (2008). Learning to observe: Using video to improve preservice mathematics teachers' ability to notice. *Journal of Mathematics Teacher Education, 11*(2), 107–125.

Taylan, R. D. (2017). Characterizing a highly accomplished teacher's noticing of third-grade students' mathematical thinking. *Journal of Mathematics Teacher Education, 20*(3), 259–280.

Todd, L., Landor, M., & Kennedy, H. (Eds.). (2015). *Video enhanced reflective practice: Professional development through attuned interactions*. London: Jessica Kingsley Publishers.

Wilson, S. M., & Berne, J. (1999). Teacher learning and the acquisition of professional knowledge: An examination of research on contemporary professional development. *Review of Research in Education, 24*(1), 173–209.