Situativity: A Theoretical Lens for Designing and Studying Programs of Professional Development

Hilda Borko, Stanford University
Karen Koellner, University of Colorado at Denver

How can we design high-quality professional development (PD) that substantially increases teachers' knowledge of mathematics for teaching, supports the improvement of their instructional practices, and promotes student achievement? From a theoretical lens, situative views on cognition and learning offer a focused direction for such an endeavor. Scholars within a situative perspective argue that knowing and learning are constructed through participation in the discourse and practices of a community, and are shaped by the physical and social contexts in which they occur (Greeno, 2003; Lave & Wenger, 1991). To understand learning in school settings, researchers analyze the conditions under which successful participation in one type of situation facilitates successful participation in other settings, and they explore the processes of *recontextualizing* resources and discourses in new situations (Adler and Reed 2002; Ensor 2001). With respect to teacher learning, it is particularly relevant to consider how practices learned in a PD setting can be recontextualized in elementary and secondary school classrooms. A situative perspective supports the growing consensus regarding the value of creating opportunities for teachers to work together on improving their practice, and of locating these learning opportunities in their everyday classroom activities (Ball & Cohen, 1999; Putnam & Borko, 1997; Wilson & Berne, 1999).

Guided by principles derived from a situative perspective, our research team designed and studied the Problem-Solving Cycle model of mathematics professional development. In this paper, we describe the three major design principles that provided the conceptual framework for our PD program and research: establishing a professional learning community, using artifacts of practice, and establishing community around video.[1]

The Importance of Establishing a Professional Learning Community

Situative theorists draw our attention to the social nature of learning and the central role that communities of practice play in determining what and how people learn (Greeno, 1997). From a situative perspective, learning is both an individual process of coming to understand how to participate in the discourse and practices of a particular community, and a community process of refining norms and practices through the ideas and ways of thinking that individual members bring to the discourse (Lave & Wenger, 1991). In educational settings, a situative perspective suggests that strong professional learning communities can foster the enhancement of teachers' professional knowledge and improvement of practice (Little, 2002).

To create an environment in which teachers collectively explore ways of improving their teaching and support one another as they work to transform their

---

[1] The conception of "knowledge of mathematics for teaching" developed and elaborated by Ball and colleagues (e.g., Ball & Bass, 2000; Ball, Thames, & Phelps, 2005, April) also informed the conceptual framework for the PSC (see Koellner, et al., 2007; Jacobs, et al., in press).

practice, PD programs must establish trust, develop communication norms that enable challenging yet supportive discussions, and maintain a balance between respecting individual community members and critically analyzing issues in their teaching (Seago, 2004; Wilson & Berne, 1999). Although conversations in PD settings are easily fostered, discussions that support critical examination of teaching are relatively rare. Such conversations must occur if teachers are to collectively explore ways of improving their teaching and support each other as they work to transform their practice (Ball 1996; Frykholm 1998; Wilson & Berne 1999).The QUASAR project's site-based PD programs are illustrative. At schools where strong professional learning communities evolved, teachers increased their use of cognitively challenging tasks and students' mathematical explanations, and students grew in their ability to solve problems and communicate mathematically (Stein, Silver, & Smith 1998; Stein, Smith, & Silver 1999).

Using Artifacts of Practice to Provide a Meaningful Context for Learning

Situative theorists also posit that the contexts and activities in which individuals learn are fundamental to what they learn (Greeno, Collins, & Resnick, 1996). A focus on the situated nature of knowing and learning suggests that teachers' own classrooms are powerful contexts for their learning (Putnam & Borko, 2000). It does not imply, however, that PD activities should occur only in K-12 classrooms. Alternatively, artifacts of classroom practice—such as videotapes of lessons and student work produced during a lesson—can bring teachers' classrooms into the PD setting (Kazemi & Franke, 2004; Little, Gearhart, Curry, & Kafka, 2003; Sherin & Han, 2004; Sowder, 2007). Such artifacts make the work of teaching a central focus of professional learning experiences and anchor conversations in specific classroom events. They enable teachers to examine one another's instructional strategies and student learning, and to discuss ideas for improvement (Ball & Cohen, 1999).

Video records of classroom practice are becoming increasingly popular as a tool for teacher professional development (e.g., Brophy, 2004; Clarke & Hollingsworth, 2000; Sherin, 2004a). As Sherin explains, "Video allows one to enter the world of the classroom without having to be in the position of teaching in-the-moment" (p. 13). Video records are particularly powerful because they are immutable, collectable, and can be edited and recombined (Latour, 1990). Clips can be created to address particular PD goals. They can be viewed repeatedly and from different perspectives, providing "the opportunity to develop a different kind of knowledge for teaching—knowledge not of 'what to do next,' but rather, knowledge of how to interpret and reflect on classroom practices" (Sherin, 2004a, p. 14). Video clips enable teachers to closely examine one another's instructional strategies and student learning, and to discuss ideas for improvement.

Any video of classroom instruction can situate PD in a setting that is likely to be meaningful for teachers; however, there are theoretical and empirical arguments for using video from participants' own classrooms. Video from teachers' own classrooms situates their exploration of teaching and learning in a more familiar, and potentially more motivating, environment than does video from unknown teachers' classrooms (LeFevre, 2004). This theoretical position is supported by empirical evidence that teachers who watched video from their own classroom, in a computer-based PD environment, found the experience to be more stimulating than did teachers who watched video from someone else's classroom. The teachers whose PD was organized around their own videos also reported that the program had greater potential for supporting their learning and for promoting instructional change (Seidel et al., 2005).

Establishing Community around Video from Teachers' Own Lessons

Research indicates that the development of teacher communities is difficult and time-consuming work; often teachers are reluctant to engage in discussions that involve a critical examination of their teaching (Grossman, Wineburg, & Woolworth, 2001; Stein, Smith, & Silver, 1999). Because video clearly exposes actual teaching practices, sharing video in PD settings is likely to seem more threatening to teachers than sharing other artifacts such as lesson plans and student work. Sherin and Han (2004) reported that of the four teachers who participated in their year long "video club" meetings, only two were willing to be filmed and to share video from their classrooms. Grossman and colleagues experienced an even more serious problem with the video club in their Community of Teacher Learners project; they explained, "We had only a single meeting of the video club because the majority of the teachers in the project decided not to continue with it" (p. 1002).

Establishing and maintaining a strong community is particularly important when teachers are asked to share video clips from their own classrooms with colleagues. Teachers must feel confident that their videos will provide valuable learning opportunities for themselves and their colleagues, and that the atmosphere in the PD setting will be one of productive discourse. In a carefully structured PD setting, analyzing video from teachers' own classrooms can help to foster a more tightly knit and supportive learning community. By making their own actions and voices a core component of the PD, teachers can feel empowered and take ownership of their own learning. As teachers share video records of their teaching with colleagues, they have the opportunity to create an atmosphere of openness and bonding that is rare in professional learning environments (Sherin, 2004b).

Situativity in Practice: The Problem-Solving Cycle Model of Professional Development

Through the Supporting the Transition from Arithmetic to Algebraic Reasoning (STAAR) project[2] we worked with a group of 8-10 middle school mathematics teachers for two years, developing, implementing and refining a model of mathematics PD we call the Problem-Solving Cycle (PSC). The PSC model is intended to enhance teachers' knowledge of mathematics for teaching, improve their instructional practices, and support increased student achievement. Each PSC is a series of three interconnected PD workshops in which teachers share a common mathematical and pedagogical experience, organized around a rich mathematical task. This common experience provides a framework upon which teachers can *build a supportive community* that encourages reflection on mathematical understandings and instructional practices. Throughout the workshops, teachers delve deeply into issues involving mathematical content, pedagogy, and student thinking, as they pertain to the selected task. All three workshops emphasize *using artifacts of practice* to situate teachers' learning opportunities in the context of their everyday work (see Table 1).

[2] The professional development program featured in this article is one component of STAAR, supported by NSF Proposal No. 00115609 through the Interagency Educational Research Initiative (IERI). The views shared in this article are ours, and do not necessarily represent those of IERI.

During the first workshop of the PSC, teachers collaboratively solve a rich mathematical problem (“the PSC problem”) and develop plans for teaching it to their own students. The main goal of this workshop is to help teachers develop the content knowledge necessary for planning and implementing the PSC problem, and the majority of the time in Workshop 1 is spent by teachers solving the problem and debriefing their solution strategies (see Table 1). Teachers also discuss ideas about teaching the PSC problem and develop unique lesson plans that they will implement prior to Workshop 2.

Between Workshops 1 and 2, each participant teaches the PSC problem in one of his or her classes, and the lesson is videotaped. Subsequent workshops focus on the teachers’ experiences using the problem in their classrooms and rely heavily on video clips and written student work from their lessons. To this end, after the videotaping occurs, the facilitator selects short video clips and examples of student work to serve as anchors for discussions during Workshops 2 and 3.

The major focus of Workshop 2 is the role played by the teacher in implementing the problem. Video clips serve as a springboard for exploring topics such as how the teachers introduced the task, posed questions to elicit and extend students’ thinking, and managed the classroom discourse. When planning the workshop, the facilitator creates guiding questions for the teachers to consider as they watch and discuss the video.

Activities in Workshop 3 are centered on critical examination of students’ mathematical reasoning. In addition to watching video clips, teachers study their students’ written work on the PSC problem. Guiding questions are again provided to focus the exploration of issues such as unexpected methods the students used to solve the problem and ways they explained and justified their ideas.

The PSC is designed to be implemented by a facilitator who plans and conducts the workshops. The three design principles—establishing a professional learning community, using artifacts of practice, and establishing community around video—guide the planning and enactment of each workshop. These principles provide a framework for the facilitator to make decisions about ways to establish trust and to develop communication skills that will enable productive discussions about teaching and learning. In addition, they guide the selection of video clips to help teachers learn important mathematical content, investigate their own instructional practices, and study their students’ work. (Borko et al., in press)

The PSC model is intended to be an iterative, long-term approach to PD. One iteration corresponds to an academic semester, during which time the group focuses on a unique mathematical task and considers selected aspects of the teachers’ instructional practices and their students’ mathematical thinking. The PSC model capitalizes on the power of video to situate PD activities in teachers’ instructional practices, and to help teachers deeply investigate issues around teaching and learning a specific mathematics problem. Participating in the PSC provides teachers with the opportunity to work together in a professional community, share their knowledge, and support one another. Successive iterations build on one another and capitalize on the group’s expanding knowledge of mathematics for teaching and developing sense of community.

Our initial experiences implementing and studying the PSC as part of the STAAR project suggest that, over a two-year period with increasingly focused and challenging facilitation, the teachers established a strong professional community, respectful and productive discourse norms, and an expanding ability and willingness to learn by analyzing and sharing ideas about classroom video (Borko et al., in press). Furthermore, our data suggest that participation in the PSC positively impacted teachers' professional knowledge and classroom instructional practices (Jacobs et al., in press; Koellner et al., 2007). These findings signal optimism for the use of design principles grounded in situative theory when designing and studying models of mathematics professional development.

Table 1. Central Goals and Key Activities in Each Workshop of the PSC

	Central goals	Key activities
Workshop 1	Develop the content knowledge necessary to teach the PSC problem effectively in the classroom.	1. Solve the PSC problem and debrief solution strategies. 2. Plan to teach the PSC problem to their own students.
Workshop 2	Analyze the role played by the teacher when implementing the PSC problem in the classroom.	Watch and discuss video clips using guiding questions that focus on the role of the teacher.
Workshop 3	Analyze student thinking in terms of the mathematics of the PSC problem.	Watch video clips or examine student work; discuss artifacts using guiding questions that focus on the students' mathematical thinking.

References

Adler, J. & Reed, Y. (2002). *Challenges of teacher development: An investigation of take-up in South Africa*. Pretoria, South Africa: Van Schaik.

Ball, D. L. (1996). Teacher learning and the mathematics reforms: What we think we know and what we need to learn. *Phi Delta Kappan, 77(7)*, 500-09.

Ball, D. L., & Cohen, D. K. (1999). Developing practice, developing practitioners: Toward a practice-based theory of professional education. In L. Darling-Hammond & G. Sykes (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 3-32). San Francisco: Jossey-Bass.

Borko, H., Jacobs, J., Eiteljorg, E., & Pittman, M. E. (in press). Video as a tool for fostering productive discourse in mathematics professional development. *Teaching and Teacher Education*.

Brophy, J. (Ed.) (2004). *Advances in research on teaching: Vol. 10. Using video in teacher education.* Oxford, UK: Elsevier.

Clarke, D., & Hollingsworth, H. (2000). Seeing is understanding. *Journal of Staff Development*, *21*(4), 40-43.

Ensor, P. (2001). From preservice mathematics teacher education to beginning teaching: A study in recontextualizing. *Journal for Research in Mathematics Education, 32,* 296-320.

Frykholm, J. A. (1998). Beyond supervision: Learning to teach mathematics in community. *Teaching and Teacher Education, 14*(3), 305-322.

Greeno, J. G. (1997). On claims that answer the wrong questions. *Educational Researcher, 26*, 5-7.

Greeno, J. G. (2003). Situative research relevant to standards for school mathematics. In J. Kilpatrick, W. G. Martin, & D. Schifter (Eds.), *A research companion to Principles and Standards for School Mathematics* (pp. 304-332). Reston, VA: National Council of Teachers of Mathematics.

Greeno, J. G., Collins, A. M., & Resnick, L. B. (1996). Cognition and learning. In D. Berliner & R. Calfee (Eds.), *Handbook of educational psychology* (pp. 673-708). New York: Macmillan.

Grossman, P. L., Wineburg, S., & Woolworth, S. (2001). Toward a theory of teacher community. *Teachers College Record, 103*(6), 942-1012.

Jacobs, J. K., Borko, H., Koellner, K., Schneider, C., Eiteljorg, E., Roberts, S. A. (in press). The Problem-Solving Cycle: A model of mathematics professional development. *Journal of Mathematics Education Leadership.*

Kazemi, E., & Franke, M. L. (2004). Teacher learning in mathematics: Using student work to promote collective inquiry. *Journal of Mathematics Teacher Education, 7,* 203-235.

Koellner, K., Jacobs, J. K., Borko, H., Schneider, C., Pittman, M. E., Eiteljorg, E., Bunning, K., & Frykholm, J. A. (2007). The Problem-Solving Cycle: A model to support the development of teachers' professional knowledge. *Mathematical Thinking and Learning, 9*(3), 271-300.

Latour, B. (1990). Drawing things together. In M. Lynch & S. Woolgar (Eds.), *Representation in scientific practice* (pp. 19-68). Cambridge: MIT Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge, UK: Cambridge University Press.

LeFevre, D. M. (2004). Designing for teacher learning: Video-based curriculum design. In J. Brophy (Ed.), *Advances in research on teaching: Vol. 10. Using video in teacher education* (pp. 235-258). Oxford, UK: Elsevier.

Little, J. W. (2002). Locating learning in teachers' communities of practice: Opening up problems of analysis in records of everyday work. *Teaching and Teacher Education, 18*(8), 917-946.

Little, J. W., Gearhart, M., Curry, M., & Kafka, J. (2003). Looking at student work for teacher learning, teacher community, and school reform. *Phi Delta Kappan, 85,* 185-192.

Putnam, R. T., & Borko, H. (1997). Teacher learning: Implications of new views of cognition. In B. J. Biddle, T. L. Good, & I. F. Goodson (Eds.), *International handbook of teachers and teaching* (Vol. 2, pp. 1223-1296). Dordrecht, The Netherlands: Kluwer.

Putnam, R., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher, 29*(1), 4-15.

Seago, N. (2004). Using video as an object of inquiry for mathematics teaching and learning. In J. Brophy (Ed.) *Advances in research on teaching: Vol. 10. Using video in teacher education* (pp. 259-286). Oxford, UK: Elsevier.

Seidel, T., Prenzel, M., Rimmele, R., Schwindt, K., Kobarg, M., Meyer, L., Dalehefte, I. M., & Herweg, C. (2005). *Do videos really matter? The experimental study LUV on the use of videos in teachers' professional development.* Paper presented at the Eleventh Conference of the European Association for Research on Learning and Instruction, Nicosia, Cyprus.

Sherin, M. G. (2004a). New perspectives on the role of video in teacher education. In J. Brophy (Ed.), *Advances in research on teaching: Vol. 10. Using video in teacher education* (pp. 1-27). Oxford, UK: Elsevier.

Sherin, M. G. (2004b). Video volunteers. *ENC Focus Review, 11*(3), 4-6.

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

Sowder, J. T. (2007). The mathematical education and development of teachers. In F. K. Lester, Jr. (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 157-223). Charlotte, NC: Information Age Publishing.

Stein, M. K., Silver, E. A., & Smith, M. S. (1998). Mathematics reform and teacher development: A community of practice perspective. In J. Greeno & S. Goldman (Eds.), *Thinking practices in mathematics and science learning* (pp. 17-52). Mahwah, NJ: Erlbaum.

Stein, M. K., Smith, M. S., & Silver, E. A. (1999). The development of professional developers: Learning to assist teachers in new settings in new ways. *Harvard Educational Review, 69*(3), 237-269.

Wilson, S. M., & Berne, J. (1999). Teacher learning and the acquisition of professional knowledge: An examination of research on contemporary professional development. In A. Iran-Nejad & P.D. Pearson (Eds.), *Review of Research in Education* (Vol. 24, pp. 173-209).