

Use of Videocases in Mathematics Teacher Development: What are we Learning?

- Organizer:** Babette Moeller, Education Development Center, 212-807-4205, bmoeller@edc.org
Chair: Ilene Kantrov, Education Development Center, 617-618-2545, ikantrov@edc.org
Discussant: Barbara Miller, Education Development Center, 617-618-2546, bmiller@edc.org

Papers/Presenters

1. Designing and Using Video Case Studies for Professional Development on Inclusion in Elementary Mathematics Classroom

Babette Moeller, Education Development Center, 212-807-4205, bmoeller@edc.org
Barbara Dubitsky, Bank Street College of Education, 212-875-4712, dubitsky@bnkst.edu
Ellen Meier, Teachers College, 212-678-3829, ebm15@columbia.edu
Ilene Kantrov, Education Development Center, 617-618-2545, ikantrov@edc.org

2. Understanding the Role of Sociomathematical Norms in Professional Development

Rebekah Elliot, Oregon State University, 206-999-0783, joriott@comcast.net
Judy Mumme, WestEd, 805-388-4415, jmumme@wested.org
Cathy Carroll, WestEd, 650-381-6422, ccarrol@wested.org

3. Turning to the Evidence: Examining the Impact of Two Practice-Based Professional Development Programs

Lynn Goldsmith, Education Development Center, 617-618-2529, lgoldsmith@edc.org
Nanette Seago, WestEd, 951-682-1070, nseago@wested.org

Session Summary

There is much discussion in the literature on teacher education about the need for active approaches in which teachers engage in problem solving and reflective discussion around concrete instances of teaching and learning (e.g., Darling-Hammond & Bransford, 2005; Loucks-Horsley, Hewson, Love, & Stiles, 1998). The case study method is one example of such an approach. It usually entails carefully designed case materials of classroom episodes along with facilitated discussions or experiences created around the case (e.g., Miller & Kantrov, 1998). There now exist a growing literature that highlights the promise of this approach (e.g., Shulman & Mesa-Bains, 1993; Barnett, 1991; Shifter, 1996; Miller & Kantrov, 1998). However, so far the research base that will lend empirical support to these claims is still in its infancy.

The purpose of this session, submitted under submission category A, is to present and share recent empirical work on the use of case studies in mathematics teacher education. The session brings together three teams of teacher educators and researchers who have developed video case-based materials for mathematics teacher education and are conducting research to assess how the video case materials have helped them accomplish their goals for mathematics teachers. The presenters bring a variety of perspectives, as each team works with video case materials for somewhat different purposes (inclusion, professional development), works in different contexts (elementary, middle and high school teachers, math leadership), and uses multiple research methods (qualitative and

quantitative). The discussant will synthesize the emergent findings, relate them to the claims for the efficacy of this approach, and propose questions for future research.

The AERA theme this year highlights the need for producing educational research in the public interest. According to the call for proposals, “Public interest research aims at developing knowledge and technology that increase the commonwealth.” Formative research that accompanies the development of educational materials is often not widely reported and shared. Yet formative research findings can make important contributions to the knowledge base about the development of educational materials and the effectiveness of pedagogical approaches, and can inform and shape the direction of future research. For this research to serve the public interest means for it to be shared, synthesized, and related to the existing knowledge base. The purpose of this session is to do just that.

Session Format. We propose to conduct a 90-minute interactive symposium. The chair will introduce the session, explaining the format and the sequence of events. The presenting teams will then give short (15 minute) presentations about their work and findings. The presentations will be followed by a 15-minute period of round table discussions during which the presenters meet with a small groups of session participants to answer questions and discuss their research. Subsequently, each of the presenting teams will briefly summarize their small group discussions for the entire audience (10 minutes). This will be followed by comments by the discussant (10 minutes) and a general discussion with the audience (10 minutes).

Designing and Using Video Case Studies for Professional Development on Inclusion in Elementary Mathematics Classroom

Babette Moeller, Barbara Dubitsky, Ellen Meier, & Ilene Kantrov

Standards-based reform is bringing increased rigor and quality into mathematics education for *all* students. These reforms, however, have not been fully available to students with physical, developmental, sensory, and learning disabilities because teachers are often not well prepared to implement standards-based mathematics education with heterogeneous groups of students that include students with disabilities. Building on the lesson study approach (e.g., Lewis, 2000; Lewis & Tsuchida, 1998) and utilizing the case method, the Math for All Project is developing five modules of digital professional development resources. Each module consists of at least two multimedia case studies of teaching events involving students with disabilities in mathematics classrooms as well as activities that guide users in their interaction with the case materials.

Research on inclusion (e.g., Giangreco, Cloninger, & Iverson, 1998; Karp, 2000; Mastropieri, & Scruggs, 1992; Wade & Zone, 2000) has helped to identify key competencies that teachers need to help students with disabilities succeed in a general education setting. Among other things, teachers need to know how children with different kinds of disabilities develop and learn; how to analyze students' needs and strengths; how to use a variety of instructional approaches (e.g., explicit strategy instruction, coaching, cooperative learning, inquiry based learning); how to make decisions about and manage multiple instructional strategies; how to adapt curricula and activities and design effective lessons; how to identify, develop, and utilize appropriate resources and materials; how to formally and informally assess student learning; how to seek assistance and guidance from specialists and other resources; and how to work with specialists and families. The case method is an ideal strategy for teachers to experience and learn about the dynamics and complexities of teaching and learning that exist in

mixed-ability classrooms, and to anchor this learning in discipline-specific learning contexts.

To assess the usability and the effectiveness of the materials we are creating, formative research has accompanied the development of the Math for All materials on an ongoing basis. In this presentation, we will report findings from research conducted in conjunction with the use of the Math for All materials for in-service professional development. We will report findings from six professional development workshops that served 116 elementary teachers and administrators. Research methods have included observations of the professional development, interviews and written surveys of workshop participants, and analyses of participants' written work. Data from the various implementations was analyzed to determine whether the activities were effective in helping teachers develop key competencies needed for teaching in inclusive mathematics classrooms.

Our results suggest that the use of video case materials can help raise teachers' awareness of the need to observe children and to analyze their learning and mathematical thinking and to be open to different teaching strategies and offer various ways to modify instruction to support diverse learners. Participants in the Math for All workshops reported that the video contributed to their understanding of children with diverse abilities and disabilities and how to teach them math. They felt the video allowed them to observe how children with disabilities solve math problems and interact with their peers. The video also illustrated that all students, including those with disabilities, struggle in similar ways in the math classroom. Further, participants noted that the video showed how to keep students on task, illustrated instructional strategies that would work with individual students, presented an effective example of how to structure a standards-based math lesson, and highlighted what to look for to understand how children think and learn. We will discuss how this research has helped us refine the design of the case materials and their use for in-service professional development, as well as the questions it raises for further studies.

Understanding the Role of Sociomathematical Norms in Professional Development

Rebekah Elliott, Judy Mumme, & Cathy Carroll

The Leadership Curriculum for Mathematics Professional Development Project¹ (LCMPD) is creating leadership curriculum materials as tools for supporting leaders of mathematics professional development K-12. Videotape from professional development sessions was gathered from across the country and excerpts developed into videocases for leadership development. A key question has emerged in the development and use of these videocases—How do leaders cultivate professional development environments in which teachers' learning of mathematics is central?

Researchers have suggested that the mathematics often was negotiated away in professional development (Wilson & Berne, 1999). These findings were validated in our direct observation of professional development (PD)² during the hundreds of hours of video data collected for LCMPD. We saw this happening especially when teacher leaders were working with teachers. There was a culture of politeness—not wanting to embarrass anyone—or not digging too deep. A result of this negotiating away the mathematics was

¹ ESI-0096672

² We use the abbreviation "PD" occasionally in this proposal to stand for professional development

that teachers missed opportunities to dig into and probe mathematical ideas and develop more robust understandings.

In the process of developing the leadership materials, LCMPD is studying the issue of how teachers' mathematical learning is fostered in professional development. Yackel and Cobb's (1996) research on "sociomathematical norms" and Kazemi and Franke's (2003) research on "norms with a mathematical focus" provides some theoretical perspectives for this work. Both can be described as the specific ways students engage in mathematical work in the classroom. These norms include ideas about what counts as an acceptable mathematical explanation or what constitutes a mathematical justification. Teachers and students through their interactions negotiate these norms, either explicitly or implicitly.

To date most research on these norms has focused at the classroom level (Kazemi & Stipek, 2001), but our research considers the implications for PD leaders, investigating whether our conjecture that understanding the role of sociomathematical norms/norms with a mathematical focus may help leaders understand how they can support teachers' learning of mathematics, and how in turn teachers can push mathematical understanding in their classrooms.

In the LCMPD seminars leader-participants analyze video of PD to consider how sociomathematical norms can be used to interpret and understand when and how teachers engage with mathematical ideas. For example, they might view a video where a teacher presents a confusing explanation. An analysis includes: How does the facilitator handle this? What are the implications for participants' understanding of key mathematical ideas? What is the nature of the sociomathematical norms that might support deeper understanding? How might these norms be fostered?

This paper highlights the efforts of the LCMPD Project to support teacher-leaders' learning about sociomathematical norms, the role of video in providing compelling images to study this construct, and the evaluation findings from studying what teacher-leaders appear to understand about it. The research is based on the evaluations of four pilot and field-test sites of the LCMPD curriculum with 66 leader-participants, K-12, representing a wide range of teaching and leadership experience. The sites were regionally diverse in urban to rural contexts.

Data sources for this study include questionnaires, focus group interviews, facilitators' interviews and structured reflections. Participant data were aggregated across site to identify themes in the data using qualitative analysis methods (Erickson, 1986; Wolcott, 1993). Examining the data set through an iterative and systematic process the authors inductively identified themes.

Results suggest that this is a promising area for further study. Many leaders indicated that sociomathematical norms was a new construct, with pedagogical implications, that allowed them to address their goals of enhancing teachers' content knowledge. However, others, struck by other aspects of PD portrayed in video, did not take up sociomathematical norms as readily and seemed to focus more on a particular new strategy or the mathematics for their own understanding. Many questions remain. What factors contribute to leaders' taking up this construct? What impact does a focus on sociomathematical norms in PD have on leaders' learning about mathematics PD? What impact does learning about sociomathematical norms have on leaders' PD practice? What do teacher-participants in these leaders' sessions make of these ideas? These data highlight the complexity of the issues in attempting to understand the role of sociomathematical norms in PD and the need for further study.

Turning to the Evidence: Examining the impact on of two practice-based mathematics professional development programs

Lynn Goldsmith, Nanette Seago, Mark Driscoll, Johannah Nikula, Zuzka Blasi

Turning to Evidence is a research project designed specifically to investigate what it is that teachers learn by participating in PD programs that are organized around the use of classroom records and artifacts. Seventy-four middle and high school teachers participated in the study; 49 teachers participated in PD seminars and 25 served as comparison teachers for pre- and post-program assessments. The 49 teachers participated in one of two seminars. Eighteen took part in seminars based on Fostering Algebraic Thinking Toolkit (ATT: Driscoll, Zawojewski, Humez, Nikula, Goldsmith, & Hammerman, 2001) and 31 in Learning and Teaching Linear Functions: VideoCases for Mathematics Professional Development (LTLF: Seago, Mumme, & Branca, 2004).

These professional development curricula are both focused on algebra and share an underlying philosophy and several design features characteristic of practice-based professional development programs (Smith, 2001). Like the other programs described in this symposium, both ATT and LTLF seek to promote teacher change by centering PD activities around analysis, discussion, and reflection on classroom records and artifacts. They are both designed to help teachers learn to focus their attention more deeply on students' mathematical thinking and also to connect this work to their own practice.

In the symposium, we will discuss teachers' learning both in terms of changes in pre- and post-program assessments and analyses of changes over time in the nature of the conversation in the seminars. Pre/post assessments included a mathematics instrument (Hill, Ball, & Rowan, 2005; items were based largely on the SII instrument from the University of Michigan) and an artifact analysis which involved commenting on a short video segment of a class discussion and on three student work samples.

Overall, we found no significant differences between the seminar and comparison groups with regard to changes in their pre/post mathematics scores. There were significant differences between the groups on the artifact analysis, specifically in terms of increases among the PD group in the attention paid to students' thinking, the use of evidence to support assertions, and a specifically mathematical focus to their comments (as opposed, for example, to a pedagogical perspective). We will present findings from four case study teachers, and also analysis of PD sessions from the beginning and the end of the project that elaborate on these findings further. (For example, we believe we have evidence supporting some changes in participants' "mathematics for teaching," despite the lack of significant data from the pre/post measure.)

Finally, we want to call attention to the importance of the facilitator in providing "learning opportunities" for teachers during professional development. We will briefly present data regarding the kinds of facilitator moves that are connected with promoting teachers' deeper engagement with classroom artifacts.

References

- Driscoll, M., Zawojewski, J., Humez, A., Nikula, J., Goldsmith, L., & Hammerman, J. (2001). *The fostering algebraic thinking toolkit: A guide for staff development*. Vols. 1-4. Portsmouth, N.H.: Heinemann.
- Erickson, F. (1986). Qualitative methods in research on teaching. In M.C. Wittrock (Ed.). *Handbook of research on teaching* (119-161). New York: Macmillan.

- Giangreco, M.F., Cloninger, C., & Iverson, V.S. (1998). *Choosing outcomes and accommodations for children: A guide for educational planning for students with disabilities (2nd edition)*. Baltimore: Paul H. Brooks.
- Hill, H.C., Ball, D.L., & Rowan, B. (2005). *Effects of Teachers' Mathematical Knowledge for Teaching on Student Achievement*. *American Educational Research Journal*, 42(2), 371-406.
- Karp, K. (2000). Weaving lessons: Strategies for teaching mathematics and science in inclusive settings. In S. E. Wade (Ed.), *Inclusive education*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- Kazemi, E. & Franke, M.L. (April, 2003). *Using student work to support professional development in elementary mathematics: A CTP working paper*. Center for the Study of teaching and Policy: University of Washington.
- Kazemi, E. & Stipek, D. (2001). Promoting conceptual thinking in four upper-elementary mathematics classrooms. *The Elementary School Journal*, 102(1), 59-80.
- Lewis, C. C. (2000). *Lesson study: The core of Japanese professional development*. Invited address to the Special Interest Group on Research in Mathematics Education, at the annual meeting of the American Educational Research Association, New Orleans, LA.
- Lewis, C. C. & Tsuchida, I. (1998). A lesson is like a swiftly flowing flower. *American Educator*, Winter, 14-17 & 50-52.
- Seago, N., Mumme, J., & Branca, N. (2004). *Learning and teaching linear functions*. Portsmouth, N.H.: Heinemann.
- Smith, M.S. (2001). *Practice-based professional development for teachers of mathematics*. Reston, VA: The National Council of Teachers of Mathematics.
- Wade, S. E. & Zone, J. (2000). Creating inclusive classrooms: An overview. In S. E. Wade (Ed.), *Inclusive education*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- Wilson, S. M. and J. Berne (1999). Teacher Learning and the Acquisition of Professional Knowledge: An Examination of Research on Contemporary Professional Development. *Review of Research In Education*. U. o. A. Asghar Iran-Nejad and M. S. U. P. David Pearson, American Educational Research Association: 173-209.
- Yackel, E. & Cobb, P. (1996). Sociomathematical norms, argumentation, and autonomy in mathematics. *Journal for Research in Mathematics Education*, 27, 458-477.
- Wolcott, H. F. (1993). *Transforming qualitative data*. Thousand Oaks, CA: Sage.