

LEARNING TO SEE IN MATHEMATICS CLASSROOMS

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This paper reports a study that involved teacher education students investigating teaching practice by collecting and analyzing video clips of their own mathematics teaching. One student's case is used to portray what prospective teachers attend to in the process of filming/editing and describing/analyzing their teaching practice. Shifting from noticing what to film in retrospect to noticing and filming what was happening in the moment was key for this student as she began to see her own practice as site for learning. This paper points to the power of opportunities for teacher education students to not only learn to analyze video of other's teaching but to also analyze their own..

Prospective teachers spend a great deal of time observing in real and video recorded classrooms all throughout their teacher preparation programs. Learning to see beyond the surface and mundane features of classroom practice, however, requires more than simply watching. The pitfalls of learning to teach in classroom settings have long been explored and reported (e.g., Feiman-Nemser & Buchmann, 1989; Britzman, 1991). On the one hand, the practice setting provides powerful and memorable experiential learning. On the other hand, the familiarity of classrooms serves to confirm more than to challenge prospective teachers' limited conceptions and beliefs about teaching and learning. Prospective teachers' prior experiences and beliefs about what it means to teach and learn in classrooms, accumulated over many years of being in classrooms as students, play an important part whenever prospective teachers are presented with scenarios of classroom practice whether it be in actual, videotaped, or textual forms. Thus using the classroom setting as a context for learning to teach, therefore, is hardly unproblematic.

The research literature reports on the numerous benefits and potential for the use of video tapes and video-recordings as means to promote and broaden prospective teachers' understanding of teaching (e.g., Lampert & Ball, 1998; Sullivan & Mousley, 1996). Yet, the use of video technology in teacher preparation programs raises important questions about its role and potential. It brings to the fore the need to examine alternatives to simply showing students pieces of classroom video in our teacher education courses. In this study the authors explored a strategy for using video technology in teacher education courses that involves students in filming, editing, and sharing video excerpts of their teaching as a medium for individual and collective analysis of practice. The research we report here investigated the following questions: (a) What do prospective teachers attend to when filming/editing, and when describing/analyzing classroom practice? (b) How do these experiences influence prospective teachers' understanding of classroom practice?

THEORETICAL CONSIDERATIONS

Following Ball and Cohen (1999) we argue for a broad view of teaching practice to include all that is associated with teaching. Opportunities to stand back and reflect on practice, to inquire with others, to prepare for teaching, to analyze curriculum texts, are all aspects of practice. Our role as teacher educators, then, is to consider ways in which we might engage our students in authentic aspects of practice so that they may learn to use teaching practice as a source of inquiry and continued professional learning. Ball and Cohen (1999) refer to this as developing a stance of inquiry in terms of learning both in and from teaching practices. Sherin (2001) refers to this as developing a professional vision of classroom events.

Sherin's research (2001) with teachers analyzing their own classroom videos is one strategy that shows promise for supporting the development of teachers' professional vision or way of making sense of classroom activities. Sherin argues that watching and analyzing videos of their own teaching enabled teachers a different kind of opportunity to learn from practice. Without the pressures to respond to student comments, consider next pedagogical moves, or address immediate management issues, teachers can focus their attention on understanding and interpreting what happened rather than on how they might or should respond in the moment. Unlike real-time practice which requires teachers to be simultaneously aware of and consider many issues and pedagogical alternatives, analyzing video provides teachers opportunities to narrow their attention to a particular issue, activity, or student. Video allows teachers to be observers in their own classrooms; it is a different kind of analysis that enables teachers to *distance themselves*, to use Jaworski's (1994) term, from the immediacy of practice and to shift their professional vision to areas that might not be noticed while teaching.

Mason (2002) conceptualizes this professional vision as being "sensitized to notice things" (p.1). Professional development, according to Mason is about developing the sensitivity to notice. Expert teachers, for instance, notice and see aspects of classroom practice in ways that beginning teachers do not. Mason offers the idea of noticing as an intentional stance—"a collection of practices both for living in, and hence learning from, experience, and for informing future practice" (p. 30). The discipline of noticing is about making the effort to notice particular things, for instance, in classroom teaching or research, and to be able to notice these things when needed or "when it would be useful to have noticed [them] (and not merely later, in retrospect)" (p. 31). And so learning to notice does not just involve noticing aspects of teaching that before went un-noticed but also includes the sensitivity and inclination to be aware.

CONTEXT OF THE STUDY

The context for this study was a Problem-Based Learning [PBL] cohort in a 12-month elementary education program for post-baccalaureate students at a large university in British Columbia, Canada. The PBL cohort is an option for students

entering the teacher education program and uses the principles of problem-based learning and case-based teaching. Students, with the guidance of their tutor, discuss, frame, and research various issues of teaching and learning that they identify in a given written case. After a 13-week teaching practicum, PBL students are required to produce their own written case of teaching and learning as a final assignment in the program. All students are invited to use their own teaching as a context for their final case project.

Ten PBL students volunteered to participate in a study that provided support and access to digital technologies in order for them to film and analyze their own teaching as a context for their final case report. Participants were mainly middle class Caucasians with a small number from Chinese, Indo-Canadian, and Japanese backgrounds. During their practicum participants met regularly (about every two weeks) as a large group or as smaller groups in their respective schools to discuss their teaching and interesting incidents that could frame the context of their final case report. Students were given access to laptop computers, digital cameras, and technical support. With this technology students could document their teaching, capture pupil thinking, interview teachers or parents and edit these clips in order to collectively help each other interpret and make sense of teaching practice. Following their practicum students had three weeks to produce and respond to a case of teaching and learning. Whereas other students in the PBL program produced written cases, these students produced a digital case in the form of a web page that stemmed from the student's particular inquiry question and consisted of edited video data linked with analysis.

Data collection included video recordings of six student group meetings held during the practicum, transcripts of two interviews held with each participant—before and after they completed their digital case, students' completed digital cases, and video recordings of students working on their cases. Data were analyzed for the kinds of questions participants explored in their digital cases, what they chose to video tape and attend to, and their claims to how this process influenced their teaching. This paper reports on a case study (Stake, 1995) conducted with one of the participants. In deciding which participant to focus on we used Patton's (1990) concept of intensity sampling and Stake's (1995) idea of instrumental case study. From this perspective examples or cases are chosen as "intense" in that they are "excellent or rich examples of the phenomenon of interest, but not unusual cases" (Patton, p. 182). We chose to focus on Janine's story, not because her story represents that of others, although aspects of it do, but because it provides an interesting example through which to explore the nature and complexity of prospective teachers' noticing when given opportunities to document and analyze their practice using video technologies.

RESULTS AND DISCUSSION: JANINE'S STORY

Janine entered the teacher education program with an undergraduate degree in Sociology and Women's studies. She chose the PBL teacher education option over

other available options because she thought it would provide her with opportunities to investigate issues of teaching and learning at a more in-depth and critical level than, according to Janine would typically be expected in other options. She came with a strong background in school math and was placed in advanced math school groups but stated that she hated math: “I was good at it but I hated it. In math there was just no room for creativity.” Janine’s practicum teaching was in an elementary school with a high English as a second language population; the school’s population consisted of students from at least 20 different nationalities. Janine was assigned a Grade 1/2 combined class and during her 13-week practicum was expected to teach up to 80% of the curriculum.

Attending to ‘what to attend to’.

In the early stages of her practicum Janine expressed some initial frustration in trying to decide what she should point the camera at. With a Grade 1/2 class, Janine felt that nothing very interesting would be captured, particularly with children at this young age level who, Janine said “were just learning to communicate their ideas.” For more than a month she did little or no filming of her students or her teaching. As she explained:

I just can’t seem to find the time. Sometimes I think of an interesting episode to video but it is always in retrospect that I think I should have video-taped it because it’s hard to predict what interesting thing is going to happen.

Although during her campus course work Janine did participate in viewing and analyzing video clips of young children articulating their mathematical thinking she does not connect this activity with possibilities for her own students. Furthermore the act of filming for Janine seemed to be conceptualized more as a representation of a finished product than as a tool for investigation. That other prospective teachers in her school were filming and sharing their clips did not help Janine consider what she could do with her young students. Janine did notice interesting aspects of her class that could be filmed, however, she noticed these in retrospect.

Shifting attention.

At a midpoint in the practicum it was suggested to Janine and her peers that they select a math problem that they could give to students across grade levels. It was hoped that by having prospective teachers ask the same problem to a range of pupils they would have a shared context through which to discuss their clips. Janine and her peers (who taught Grade 7, Grade 5, and Grade 4) chose the Checkerboard problem that asked students to determine the number of squares in an 8 by 8 square checkerboard. Janine adapted the problem for her Grade 1/2 students and made the checkerboard a 4 by 4 rather than an 8 by 8 board. In order to accommodate both posing the problem to pupils and filming their response, Janine decided to select certain pupils and film them working on the problem outside of the regular class. It was at a group meeting where Janine shared her clips of students working on this problem with the other prospective teachers that a change in what she was attending

to can be seen. During this meeting she excitedly showed what her students were doing, the various ways in which they approached the problem, and how they spoke about it. In talking about the problem with her peers she stated:

I would actually like to give this same problem to different kids, and after seeing how everyone else did it, it would give me some more ideas on how I could approach the problem. Because I struggled with wanting to give them enough information that they could go on and have enough success with it, but without giving them too much information that my guidance was over bearing on their thoughts.

Janine began to see value in using the camera to capture student thinking and although she actively provided commentary on her students' different responses to the task, her interest for further investigation focused on exploring pedagogical approaches to the problem. Interestingly, the video clips raised a question for her regarding the answer to the problem and how she might introduce students to the answer. She commented:

I would have liked to have had an answer for them, but I don't know the answer.... I would have liked to have given them the answer and then had them work backwards. I didn't know the answer and still don't know the answer. I think I do, but I don't know if it is right.

Janine's comments provide evidence of her shift in attention to being concerned about what to film, or noticing in retrospect what might be interesting to film, to considering the value of students' thinking. This seemed to focus her attention on ideas for pedagogical approaches to the problem more so than ideas for thinking further about students and the mathematics involved in solving the problem. She does notice that her not knowing the answer to the problem limited her pedagogical response to students but at this time she does not see the need to act upon but this noticing. Nonetheless, this excerpt also points to the comfort Janine felt in being able to share what it was she didn't know.

Noticing what the same students do in different contexts.

A few weeks later Janine completed a critical thinking science unit on sound with her students and filmed the students' working on it. She noticed that her students were, as she said "able to successfully consider taught elements through a critical lens and put their knowledge to work in a critical activity – designing a better human ear." Through this lesson and through filming/editing her videos she noticed that students were willing to try and test their ideas in the context of a science lesson and how different this was for the same students working on a math problem. In reflecting on this Janine commented:

In science through the challenge of designing the best model ear, they were willing to take risks and had no problem with being wrong or trying something else and really working through the problem. But when I give a math problem that they couldn't find the answer to right away, if getting the answer involved more than one step, they would shut down. It was fascinating.

With this comparison between how students responded in various subjects Janine tentatively defined her case project to focus on students' mathematical dispositions and how she might help students take risks, persevere and solve difficult mathematical problems. It was suggested in a group meeting, when Janine posed her question, that she focus on understanding the nature of the issue, that is students' mathematical dispositions, before she explored ways of improving it. With this, Janine set out to interview students by posing various problems to them and then asking them to describe the characteristics of a good mathematics student or to think of metaphors to describe mathematics. She interviewed parents, teachers, and her own family members. No longer focused only on the ways in which she should engage her students mathematically she sought to explore aspects of why students engaged in mathematics problems differently from how they engaged in science problems and how they saw themselves as mathematical thinkers. Evidence of this shift in attention is also illustrated in Janine's comments made to her peers during one of the prospective teachers' last group meetings before returning to the university campus to work on their cases. Referring to her efforts to make sense of her peer's questions she stated: "I just this intellectual stuff ... I really feel now that I can step back and see my teaching from a different standpoint."

Transformed views of teaching

Over the next three weeks Janine worked with her peers on her case project producing a digital case of linked video clips and analysis around the question of "What is mathematical disposition and how might it be fostered?" In interviews following the development of her case project Janine spoke about the project as something that totally occupied her thoughts. She mentioned that through the response to her questions through viewing and analyzing her video clips, she developed a heightened sense of awareness.

I started carrying a little note pad around with me wherever I'd go because I'd be thinking about it all the time...at the beach, on the bus, or driving at a stop light... it is really hard to put into words but this whole project was life altering, not only for my teaching but for me and for how I view things. My understanding is so much deeper.

When asked to comment on what prompted her to shift from her initial skepticism of using her classroom as a context for analyzing her teaching to the value she now sees, Janine commented that being able to frame and research her own question was key. She continued:

Once I started interviewing students it was really interesting—like what's going on with these kid's thinking. ... But initially I really thought of it as a chore and unrealistic.. There is so much you need to think about in the practicum that I thought I couldn't do this [project] as well ... But that's not how I see it now. ... This whole project has made me think about how to learn from teaching in ways that I didn't see before.

In exploring this further, Janine made links between the question she pursued for her project and her own dispositions toward mathematics and learning. For Janine, framing a question, analyzing her students' thinking, and considering implications for

her practice involved her in taking risks that she normally didn't do. Her interest in understanding her students' risk taking (or lack of it) in math led her to become aware of and examine her own risk taking (and lack of it) in her learning and teaching. This awareness for Janine was transformative.

CONCLUSION

Janine's story is an example of how one prospective teacher through collecting and analyzing video clips of her teaching developed a stance of inquiry that stemmed from her efforts to make sense of aspects of her own teaching practice. She developed Jaworski's (1994) distancing lens of practice and to some extent Sherin's (2001) notion of professional vision by moving outside the immediacy of teaching to take a non-judgmental position as a researcher observer. She moved from not seeing what she could learn from her students to attending to their mathematical dispositions, to noticing parallels between her own learning and that of her students.

Mason (2002) refers to the act of noticing-marking-recording as an initial aspect of disciplined noticing that moves retrospective noticing into noticing in the moment so that we present ourselves with choices for how we could act. Noticing-marking-recording involves the act of noticing retrospectively and marking it, or as Smith (2003) suggests, "naming" it, so that we can increase our awareness and sensitize ourselves to what we would like to attend to. The act of marking or naming what is noticed in teaching practice is an important aspect of owning and authoring the inquiry involved in learning from teaching. In the case of Janine opportunities to film and analyze video clips of her students working in different domains prompted her to notice, mark, and re-mark the differences in students' scientific and mathematical risk taking. This led her to notice and attend to her own learning and the opportunities risk taking provided her. We suggest that for beginning teachers using video to help them notice-mark-record their practice is key to helping them shift their attention. We can only speculate how this noticing will be used for Janine in her practice, nevertheless this study provides insight into how prospective teachers can engage in a meaningful investigation of their own practice.

What seemed to prompt Janine's inquiry and noticing was an opportunity to investigate her own question related to her own teaching, and to do so not only while she was teaching but once her practicum was finished. Although before her practicum Janine had been exposed to and engaged in the analysis of videos of classroom teaching she did not see the value of these for her own teaching while she was teaching. Prospective teachers' past experiences as school students are their main resource when interpreting what happens in classrooms. These extensive experiences make it a challenge for them to explore alternative interpretations for the teachers' and the students' words and actions. This raises questions for us as teacher educators in the use and implications of the use of videos during coursework. The use of video provides opportunities for the analysis of real practice. It offers shared opportunities to examine practice—to replay, rethink, and inquire into possibilities for

teaching. Yet, the results of our study suggest that prospective teachers need not only opportunities to analyze and learn to analyze the practices of more experienced teachers through video, but also need opportunities to study their own practice through collecting and analyzing video of their teaching. The results of our study prompt us to explore alternative ways of using videos of practice in teacher education to help our students broaden their interpretive frameworks and see mathematics teaching, their own and others, as opportunities for learning.

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