An Expert in Novice's Clothing: Classroom Discussions as an Artifact towards Teachers' Professional Community

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This study examines in-service teacher development around leading a group discussion, a practice central to teaching in mathematics education. This structured focus on leading a group discussion operates to support the de-privatization of teaching practice and the development of a teachers' professional community. This model of peer observation positions a middle school mathematics teacher (Erika) as a participant-observer taking on the role of a student at her school for three days. This case study describes Erika's observations, in which she was relieved of teaching duties to allow her to attend a full schedule of middle school courses. In addition to Erika's role as a participant-observer, the study participants also include five middle school teachers in whose classes the participant-observer took on the role of a student. Through the analysis of Erika's journal, clinical interviews, and video recording of a post-study meeting, this study characterizes the presence and development of collegial trust, conceptual change, critique of collegial practice, disciplinary understandings, conceptions of the impact of the institutional setting on teaching and learning, and the capacity to understand the students' perspective. This work supported the development of pedagogical practices central to leading group discussion and created opportunities for teacher collaboration.

Literature Review

Leading a Group Discussion

Leading group discussions is integral to supporting mathematics instruction. Kazemi, Franke, and Lampert (2009) note that "ambitious teaching requires that teachers teach in response to what students do as they engage in problem-solving performances, all while holding students accountable to learning goals" (p. 1). The Common Core State Standards includes the expectation that all students will learn to "construct viable arguments and critique the reasoning of others" (Common Core State Standards Initiative [CCSSI], 2012). This expectation supports students to engage in practices central to mathematics. Group discussions support, leverage, and validate student personal, cultural, and disciplinary knowledge through collective knowledge building. Substantial teacher knowledge is required to support the development of this individual and collective work by students; for instance, teachers must establish classroom environments that encourage student participation in requisite discourse practices (Hufferd-Ackles, Fuson, & Sherin, 2004). Chapin and Anderson (2013) describe the following classroom discourse moves as necessary to support whole group mathematics classroom discussion: revoicing, asking students to restate someone else's reasoning, asking students to apply their own reasoning to someone else's reasoning, and prompting students for further participation. In addition, one challenge in leading group discussions emerges from the complexity in making quick decisions about how to respond to students' unanticipated ideas, assign competence to students' contributions, and orient students to each other's thinking, while keeping the focus on substantive mathematical content (Stein, Engle, Smith, & Hughes, 2008). The complexity of leading mathematics group discussions is a challenge to both pre- and in-service teachers

(PSTs and ISTs). For example, many PSTs and ISTs lack essential skills for leading productive discussions like anticipating and noticing students' thinking and attending to important aspects of the classroom context (Jacobs, Lamb, & Phillip, 2010; Sabers, Cushing, & Berliner, 1991). In order to support PSTs and ISTs in learning the complex work of teaching, there is developing interest in specifying a carefully chosen set of research-based instructional practices that novices can begin to master. However, little of this work on practice-based teacher education has been done with in-service teachers; the examples available in the extant literature come mainly from methods courses (Boerst, Sleep, Ball, & Bass, 2011; Hatch & Grossman, 2009; Lampert et al., 2013). Such work on core practices inside methods classes describe "approximations of teaching" (Grossman et al., 2009) instead of the full enactment of these practices within actual teaching. In order to master practices like leading group discussions, in-service teachers must master many related practices (e.g., eliciting and interpreting students' thinking).

Peer Observation

Though peer observation is a potentially valuable tool for working towards de-privatization within a community of teachers, it is seldom implemented in such a manner as to achieve these results in schools. Too often, it is viewed as an act of evaluation or appraisal (Cosh, 1999), or an act of compliance.

Martin & Double (1998) offer the following as potential aims of peer observations: to extend and enhance an understanding of personal approaches to curriculum delivery; to develop and refine curriculum planning skills in collaboration with a colleague; to enhance and extend teaching techniques and styles of presentation through collaborative practice; to engage in and refine interpersonal skills through the exchange of insights relating to the review of a specific teaching performance; to identify areas of subject understanding and teaching activity which have particular merit or are in need of further development; and to develop personal skills of evaluation and self-appraisal. In boosting the value of professional development for middle school teachers, Sparks (1986) showed that peer observations can be effective; subjects made significant gains on a measure of academic interactions with students as compared to control and alternative treatment groups. The study showed that peer observation among middle school teachers has a critical link to student achievement as well as increased trust in teachers' relationships.

Artifacts towards Professional Community

In order for peer-observation to be used effectively, teachers must engage in collaborative preparation and mutual engagement around aspects of teaching. In addition, Little (1982) notes that "in successful and adaptable schools, the staff have learned social or 'role' skills. Playing teacher to students is different from playing teacher to a teacher. Daily interaction with students in a classroom is not preparation for providing a useful classroom observation for a peer." (Little, 1982, p. 337)

By collaborating around the instructional practice of supporting group discussions, within a larger focus on peer observation, groups of teachers can work to form "professional teaching communities." In defining the widely applied concept of communities of practice (Lave & Wenger, 1991), Wenger (1998) provided three criteria by which to distinguish true communities from mere groups of individuals working together: joint enterprise, mutual engagement, and a shared repertoire. This is to say that a group has achieved the status of "community" if and only if they are working collaboratively on a project in accordance with

a set of norms of practice and with a language and set of tools that are specific to the community. Many researchers have applied the notion of community to teachers' collegial settings, offering definitions of teachers' professional communities (Newmann & Associates, 1996; Secada & Adajian, 1997; Gamoran et al., 2003; Dean, 2005).

Newmann and Associates (1996) and Gamoran et al. (2003) presented five key aspects of a teachers' professional community: (a) a shared sense of purpose; (b) a collective focus on student learning; (c) collaborating to improve students' understanding of mathematics; (d) engaging in reflective dialogue about their instructional practices; and (e) making their own teaching practices public. Teachers' professional communities are necessary in supporting mathematics instruction and purposefully chosen artifacts can help in their establishment and sustenance.

As Halverson (2005) states, "[p]rofessional community results from intentional coordination of social interaction among teachers through the design of structures in situations of practice. These structures, or artifacts, provide the key tools leaders use to develop professional community" (p. 3). In examples put forth by Halverson, as facilitated through specific artifacts, teachers increased their rate of interaction around instruction. This is further shown in the analysis by Brown (1996) of the QUASAR project, which focused on artifacts instantiated by a school principal towards the support of classroom instruction. The school provided teachers with resources, not by providing advice or guidelines to school partners about what they should do with teachers, but rather by establishing an environment where the resource partners could assist teachers.

An artifact towards the de-privatization of teachers' practices could open the door to one of their best resources for collaborative professional learning: their very own colleagues. Professional development focused on classroom discussion, through peer observation, supports the fifth characteristic of a professional teaching community—that is, teachers' observations of their colleagues engaging in this high leverage teaching practice (Boerst, Sleep, Ball, & Bass, 2011) with their students in their classrooms.

The Study

In this study, focusing on classroom discussion within a structured peer observation, operates as an artifact towards the support of the de-privatization of practice. Accordingly, a case study was conducted to document the experiences of a volunteer secondary mathematics teacher taking on the role of a student at their school for three days. The subject was provided opportunities to experience the students' instructional reality and observe colleagues teaching focusing on one high leverage teaching practice (i.e., leading a group discussion) to view the arc of three days' worth of instruction.

I do not claim that such an exercise, by itself, will lead to the spontaneous formation of a professional community of teachers. Rather, I put forth this as a question to be empirically examined. Will this model improve upon the typical model of peer observation in terms of de-privatizing teachers' practices? What can be learned by the teachers and researchers (or even students) from their participation? This proposed case study is not an intervention on the scale of Sparks (1986). Rather, this is an initial step toward possible new understandings on the parts of both researchers and teachers. The innovative feature of this idea lies within its "triple-barreled" nature; teachers practicing leading a whole class discussion, examining

a potentially de-privatizing mechanism, and teachers as researchers, observing the instructional reality of students. It is conjectured that the three components of this layered study might enhance each other, yielding new, even unexpected, insights into teachers' practices, communities, and knowledge of students.

Furthermore, it is conjectured that an artifact such as peer observation (as it has been defined) around an important teaching practice will also contribute to increasing trust among teachers within a mathematics department around the critical work of teaching. By placing the emphasis on the participating teacher becoming a student, the focus is shifted away from assessment or formal observation so that it is situated more naturally, allowing all involved to approach the experience collaboratively. Additionally, it is expected that the protracted period of observation will allow for more authentic study of classroom practice owing to an eventual reduction of the instructor's stress.

It is critical that the participant-observer fulfills her role partially through the lens of a student. This expert in novice's clothing perspective will enable them to perceive critical components of their practice. They will view practice as experts but be forced to participate as novices. Through self-examination as an "expert" learner, and referring to an established protocol for observation, the participant can determine whether their teacher is supporting group discussions (and other teaching practices) in a way that emphasize big ideas, make meaningful representations, and problematize key concepts. She can use her novice lens to see the effect of this lesson and the institutional setting on fellow students and herself. With this perspective, the participant can determine whether the teacher is building the content in meaningful ways, whether pedagogical moves aid the delivery of content, whether the activity structures seem to support instructional goals, and how sensitivity to student thinking serves or impedes the teacher's instructional goals. How will this experience affect the participating teachers' perceptions of their students? And, ultimately, will this form of peer observation further contribute to de-privatizing teachers' practices?

Research Questions

In this study, leading group discussions operates as an artifact to support a novel approach to facilitate peer observation as well as to support de-privatization of practice and teacher professional community. This study investigates the following research questions: (1) how can the pedagogical practice of leading a classroom discussion operate as an artifact towards the development of teachers' professional community; and (2) how can this model of in-service peer observation provide resources that are not present within typical models?

Methods

Participants

The participants are middle school teachers (n = 6) from a public middle school in the Southeastern United States (Table 1). Erika is the participant-observer in this study. She takes on the role of student in the classrooms of her middle school colleagues.

Table 1
Participants

Teacher	Subject	Grade
John	Mathematics	8th
Melissa	Mathematics	5th
Amanda	Mathematics	5th
Erika	Mathematics	6th
Jessica	Social Studies	6th
Amy	Social Studies	7th

These teachers are all employees of Jackson Middle School (pseudonym). Between 60% and 90% of children attending this school qualify for free or reduced lunch from year to year. The teachers in the study are all Caucasian. Erika is a female in her early-thirties. She has taught for ten years in the Centennial Public School District and for four years at her current school. In her ten-year teaching career, she has taught at three different middle schools.

Procedure

Erika was relieved of teaching duties to allow her to attend and be a participant in a full schedule of middle school courses. It was required that Erika take at least three math courses; after that, she chose a schedule based on the teachers she wanted to observe, or the subject matter that she would most enjoy. The two key elements of these participant observations were that Erika had opportunities to (a) experience firsthand the students' instructional realities (e.g., moving from class to class at the sound of a bell, completing assignments, taking quizzes); and (b) observe colleagues focused on leading a whole group discussion, with different approaches to teaching, for three days.

Faculty-researcher meeting. The teachers who were study participants met with PJW (author and project researcher) and CM (project researcher) once before the study began (Meeting 1). This enabled the researchers to characterize the teachers as members of a pseudo-community of teachers (Weinberg, 2018). In addition, the researchers asked the teachers to nominate two aspects of their teaching that they wanted to work on during this intervention. The majority of teachers rated work on leading group discussions as the most popular pedagogical practice (66%; n = 4). The second most popular suggestion was classroom management (50%; n = 3). Accordingly, the researchers oriented the intervention around leading group discussions within the novel model of peer observation.

Participant-observer journal. Before the intervention, the researchers provided Erika with a journal in which to record her thoughts during her participant-observation. Erika was asked to indicate what she believed was significant. She was asked to note the date and time of each entry as well as the class in which she was acting as a participant-observer at the time of her entry. Erika's participant-observer's journal provided insight into the development of her thinking throughout the intervention.

Participant-observer interviews. Clinical interviews (Ginsburg, Jacobs, & Lopez, 1998) were conducted to elicit Erika's thinking at key moments before, during, and after the intervention. She was de-briefed after each class and at the conclusion of the school day. After each class, Erika was asked to provide an account of what she learned as a participant-observer and how her thinking about group discussions was developing. She was not coached towards the perspective of either the participant or the observer. PJW and CM pressed her for clarification: she was asked to provide greater detail and explain concepts she had raised. Although Erika's short debriefs at the end of each class may have infringed minimally upon the authenticity of her student experience, they were necessary in order to present a class-by-class record of her experience.

Teacher feedback session. After the intervention, Erika and CM presented her findings to the group (Meeting 2). These findings were based on the analysis of her journal entries and interviews. This meeting was the only opportunity in this study to capture feedback from the other teachers in the study.

Analysis

The participant-observer journal and interviews are used concurrently to support claims about Erika's and the community's development. These data are presented across six categories: collegial trust, conceptual change, critique of collegial practice, development of disciplinary understanding, conceptions of the institutional setting, and the student perspective. These categories are informed by the work of Newmann and Associates (1996) and Gamoran et al. (2003) and represent challenges to teacher learning and the development of professional community.

Participant-observer journal. The participant-observer's journal was transcribed and decomposed into 184 entries (codable instances). The journal entries were coded according to an analytic framework (Table 2). In addition, the codes were analyzed to determine emergent themes that focused on leading a whole class discussion; these emergent themes are described within each category. For instance, "teacher revoicing" is described within the category of "collegial trust." The following emergent themes were determined by comparing the transcripts with relevant topics in mathematics teacher education literature that focused on supporting whole class discussion (e.g., Evan & Ball, 2009; Horn, 2012): (a) teacher revoicing; (b) discourse norms to increase classroom participation; (c) transitions between activity structures; (d) eliciting student thinking, moving beyond Initiation, Response, and Elicitation (IRE); (e) telling versus eliciting; (f) from patterns to generalizations; (g) supporting diverse learners; and (h) taking up classroom norms. Two researchers coded the instances according to the framework. They showed 89% agreement; all disagreements were subsequently resolved.

Table 2
Journal codes and examples

Codes	Descriptions	Examples
1. Collegial Trust	Response indicates positive or trusting relationships with other teachers.	"[teacher] may benefit to analyze items and cover only those items mostly missed."
2. Conceptual Change	Response indicates Erika has learned something about pedagogy/content.	"good feeling to know I approached the idea of the distance formula and [Pythagorean] Theorem…same way in algebra class"
3. Critique of Collegial Practice	Erika makes comments about another teacher's teaching practice that provides feedback.	"student driver question—could be shared with large group, maybe able to clarify for others, would like to have heard [this] conversation."
4. Development of Disciplinary Understanding	Indicates Erika has mentioned disciplinary content (e.g., math, social studies, etc.)	"connects carrying one to really a group of ten or hundred."
5. Conceptions of the Institutional Setting	Erika experiences the impact of the institutional setting (e.g., classroom-based factors, school-based factors, district-based factors).	"[teacher] didn't conform to schedules—students concerned about not covering material before test [date]."
6. Understands the Student Perspective	Comments indicate that Erika is taking the perspective of a student.	"personally nervous to do a problem on board—double/triple checking my problem"

Participant-observer interviews. The participant observer's interviews were transcribed and decomposed into 478 thematic codable instances. The interviews were coded according to an analytic framework (Table 2). In addition, the codes were analyzed to determine emergent themes that are described within each category. Two researchers coded the instances according to the framework. They showed 91% agreement; all disagreements were resolved.

Teacher feedback session. During this meeting (Meeting 2), Erika's findings were presented to the other teachers. Her findings were compiled from her journal and interview data. Participant talk and gesture, during Meeting 2, was captured by video. The video data were transcribed for further analysis.

Results

Results are reported according to the following categories: collegial trust, conceptual change, critique of collegial practice, development of disciplinary understanding, conceptions of the institutional setting, and understands the student perspective. Subcategories emerged through the analysis of journal and interview analysis; these are indicated within each category. Emergent themes from Erika's journal and the clinical interviews are presented within each category. For example, "teacher revoicing" is a theme that was detected within the category of "collegial trust."

Collegial Trust

During the pre-interview, Erika highlighted the difficulty of trusting and supporting her colleagues. For example, before the study, Erika was not accustomed to discussing teaching and learning with her colleagues. She principally discussed these issues with her husband (a fellow teacher) and a friend who is a professor at a state college. Erika did not use her teaching colleagues as resources:

Interview Transcript 1

CM: Do you talk to your fellow teachers about things? Is there anyone that's particularly helpful for you?

Erika: Okay, my husband; I mean he has taught for 17 years in the school system. …There [are] actually two people… I have a really good friend that's a math professor at [a state college]. We meet on a regular basis and talk math.

During the pre-interview, Erika indicated that neither she nor any of her colleagues had ever been observed by each other; this was confirmed in separate interviews with her colleagues. In addition, Erika noted that she had chosen to not allow the district mathematics coach to observe her teaching.

Interview Transcript 2

Erika: I guess I'm so independent…and all the logistics behind getting all that together would be…hard…to do that…I have never really thought about it, but having to ask for help, does that look like being a failure? You know what I'm saying, not being able to do something [so] that you have to reach out and ask somebody to help you with

These comments indicated minimal trust and the privatization of collegial practice. During her first participant-observation of Melissa's class, Erika indicated further breaches in the community of trust. These breaches revealed the difficulty of collaboratively supporting the practice of leading a classroom discussion. After her role as a participant-observer in Melissa's class, Erika noted:

Interview Transcript 3

Erika: Melissa came up to me and said, "Did I do anything stupid…[today while I was teaching]?" So she wants to know, but then I think to myself, what's my right to say this is what [teaching] should look like?

Teacher Revoicing

Nine instances (4.9%; Table 3) from Erika's journal, during her participant-observation, indicated the presence of collegial trust around leading a classroom discussion. For instance, during her observation of John's class she wrote:

> Journal Transcript 1
>
> Erika: Student driven question …could be shared [with the] large group. Maybe [John would be] able to clarify [these concepts] for others- [I] would like to have heard [the student] conversation.

Here, Erika critiqued how John supported a classroom discussion by soliciting student questions within a small-group activity structure. She indicated that he did not revoice student questions to make them available to the whole group. Further, Erika noted that had John revoiced student questions or supported students to restate their questions, it could have clarified the concept under discussion.

Table 3
Percentage of instances coded in participant-observer journal

Code	Percent (of instances) (n = 184)
Collegial Trust	4.9% (n = 9)
Conceptual Change	4.9% (n = 9)
Critique of Collegial Practice	4.3% (n = 8)
Development of Disciplinary Understanding	22.8% (n = 42)
Conceptions of the Institutional Setting	10.9% (n = 20)
Understands the Student Perspective	40.2% (n = 74)

Raising these questions with the intention of posing them to John during the feedback session (Meeting 2) indicated the beginnings of collegial trust. Erika indicated a higher proportion of trust between her colleagues both during (18%, $p < 0.01$, Chi-squared test) and after the intervention (11%, $p < 0.1$, Chi-squared test; Table 4) than she had during the pre-interview.

Table 4
Frequency of codes in flexible interview during first half compared with second half of intervention

Coding Category	Before Intervention (n = 21)	Intervention (n = 333)	After Intervention (n = 124)
Collegial Trust	0 (0%)	59 (18%)***	14 (11%)*
Critique of Collegial Practice	0 (0%)	34 (10%)***	13 (10%)*
Conceptions of the Institutional Setting	0 (0%)	16 (5%)**	7 (6%)
Understands the Student Perspective	0 (0%)	82 (25%)***	30 (24%)***

Note. *p < 0.1, **p < 0.05, ***p < 0.01

Erika provided substantive feedback for her colleagues that she believed would improve their teaching practices; however, she questioned whether it was her role to communicate this feedback. By the final day of the intervention, it became clear that her role as participant-observer had made her more comfortable providing feedback to some, but not all, of her colleagues. For instance, she stated that she would have no problem providing John with feedback about content that he should have covered for the end-of-year standardized test:

Interview Transcript 4

Erika: Those are going to be questions [on the end of year assessment for which John should be prepared]: "What is the opposite of this number," "What is the reciprocal of this number?" …[Students] mess 'em up all the time. So, that would be something … as a professional I probably need to go to him and say, "You may want to cover those at the same time so they don't mix them up."

PJW: Would you feel comfortable doing that?

Erika: Yeah, I wouldn't have a problem doing that with him, not at all. No problem one bit doing that with him. With other teachers, they would not be receptive to it probably."

Here, Erika made an interesting distinction. She notes that "as a professional" it is her obligation to provide feedback to John, a first-year teacher. However, even on the final day of the intervention she believed that it was not her professional responsibility to have similar conversations with more senior colleagues.

Conceptual Change

Erika's journal indicated shifts in her ideas about leading group discussions. In 4.9% (Table 3) of her journal entries, Erika indicated the learning she had done.

Discourse norms to increase classroom participation. After observing Amy's class, Erika discussed means to manage group discussions in her journal. For instance, Erika writes:

Journal Transcript 2

Erika: [Amy] allow[s] students to "call out" [whenever they have an answer; discourse norms are] totally different for different teachers…I want [students to] answer, so [I] will do group response. [However], others want hand-raised.

Erika considered Amy's discourse norm of allowing students to call out; she conceived of this practice as generally problematic but believed that Amy made it work for her students. Further, in her journal Erika described her own policy of having students work in table-groups, where only a few students would ultimately share out to the entire class. The observation of Amy's class helped Erika consider additional means to increase overall student participation critical to supporting group discussions. For example, as a participant-observer in Amy's class, she noted the importance of systematically calling on all students to increase general participation (the democratization of mathematics) and maintain a high degree of shared knowledge.

Journal Transcript 3

Erika: We have to have [evidence that all students know]…what's going on [in the content].

Accordingly, there was more frequent indication of Erika's conceptual change during the second half of the journal than the first ($p < 0.05$, Chi-squared test; Table 5).

Table 5
Frequency of codes in first half of journal compared with second half of journal.

Codes	First Half of Journal (n = 92)	Second Half of Journal (n = 92)
Conceptual Change	1.1% (n = 1)	8.7% (n = 8)**
Development of Disciplinary Understanding	19.6% (n = 18)	26.1% (n = 24)*

Note. *$p < 0.10$, **$p < 0.05$

Transitions between activity structures. During an interview during her second day as a participant-observer, Erika noticed the need to structure and sequence the transitions between small- and whole-group activities in Melissa's class.

Interview Transcript 5

Erika: I know at my table [group] …I'll be the first one to get [the problem] right ... but then I saw the kids–all three of the boys [at my table] got it wrong the first time they did one of the problems, but they didn't have time to fix it…before the explanation was gone over for it. They didn't have an opportunity to correct their mistakes on the whiteboards…once [we] compared [our work]...They didn't have time to go back and look at it a second time.

Thus, Erika noted that small group discussions needed to be able to support subsequent whole group discussion.

Eliciting student thinking. During that second day of the intervention, Erika also observed a skill that Jessica used to support classroom discussion. Jessica was teaching a lesson that described plant growth. Erika described this in her interview:

Interview Transcript 6

Erika: [I]n Jessica's room…a student…[posed a] question…about why would it matter if we learned how to grow plants in space [which was being discussed]…[The girl was] like, "Why does it even matter. Why are we even talking about space and talking about plants?" And Amanda started [eliciting ideas from] other kids. And then, I liked the fact that she went back to [the original] student and said, "Now can you tell us, is it important [to think about plant growth in space]." So, she had the student answer … her own question…So, maybe rather than just let the student hear all this information, now she wanted to know [if this student tracked the argument]. "Now, why is it? Can you answer your own question?"

Here, Erika was responding to Jessica's capacity to support the beginning of scientific inquiry. Jessica solicited a question from a student. This question instigated subsequent classroom investigation where she had numerous students express their thinking. Eliciting student thinking allowed concepts and strategies to be available to the entire class, in addition, it supported the procession through the inquiry.

Critique of collegial practice

In 4.3% (n = 8; Table 3) of journal entries, Erika provided her colleagues with feedback that included means to improve their work on classroom discussion.

Moving beyond IRE. IRE describes a traditional mode of teacher-student interaction, where a teacher will present a question to the class (initiate), solicit a response (response), and evaluate the student's response (evaluate). This mode of interaction requires short and superficial exchanges and precludes more in-depth group discussions. For example, Erika noted that Jessica's instructional pattern conformed to an IRE pattern of interaction. She indicated that Jessica did not ask questions that elicited student thinking; the majority of her questions were known-answered questions. In her interview, Erika stated that Jessica should "[keep] probing until [she] found the explanation for [student responses]."

During her clinical interviews, Erika provided her colleagues with a higher proportion of substantive feedback about their pedagogical practices during (10%, $p < 0.01$, Chi-squared test) and after the intervention (10%, $p < 0.1$, Chi-squared test; Table 4) than during the pre-interview.

Telling versus eliciting. Erika provided feedback about discourse moves related to leading group discussions:

Interview Transcript 7

Erika: A couple times I did see teachers who were telling versus questioning. They would ask a certain question, but then their questions wouldn't pull the answer out.

Here, Erika highlighted the difference between teachers who teach in a didactic manner and those who elicit student thinking, affording more student agency.

Development of Disciplinary Understandings

In 22.8% (n = 42; Table 3) of journal entries, Erika considered means to support group discussions through her considerations of disciplinary content. Although group discussions can be held in general, the work of teaching is situated in discipline-specific contexts. Thus, this analysis is similarly situated. Initially, Erika's disciplinary noticings were superficial; in John's classroom Erika noted that students were using rational approximation to pi. She wrote the following in her journal, "[There was a discussion of why one would use the] pi symbol vs. 3.14 [and how each] would give different solutions." She considered her own classroom and noted, "[It] might be a good time to discuss this [with my students]." Here, Erika did not consider means to support group discussions. In a clinical interview, Erika stated that the distinction between pi and its rational approximation is about "more than symbols." The difference is between "rational and irrational numbers." This was an important consideration within the discipline.

Towards the second day of instruction, Erika began to note patterns in mathematical content and connect them to her instruction. For instance, in Amanda's class a student in Erika's group had difficulty making sense of the relation between the multiplication and division of fractional numbers; this student did not understand why division is equivalent to multiplication by the reciprocal. After that interaction, Erika began scrawling notes in her journal. She divided a page into two columns. The left column indicated the number 36 divided by various rational numbers (e.g., 8, 4, 2, ½). The right column indicated the equivalence of multiplying by the reciprocal of those fractional numbers (Figure 1). Thus, Erika empirically demonstrated that division and multiplication by the reciprocal are the same process. However, it was unclear exactly how she would engage her students with that content. In this example, Erika indicated what content should be learned, but not how.

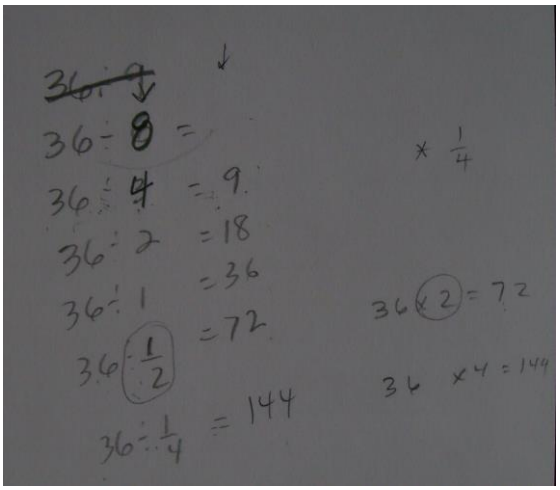

Figure 1. Erika shows, within her journal, empirical examples of the relationship between division and multiplication of rational numbers.

Erika's consideration of mathematical content increased from the first to the second half of the journal ($p < 0.10$, Chi-squared test; Table 5); however, she had difficulty considering how to support mathematical conceptual learning through classroom discussion.

From patterns to generalizations. Erika described how she supported students to recognize and describe mathematical patterns (like those indicated above) and then progressively mathematize and generalize this content. She noted the following in her interview:

Interview Transcript 8

Erika: I try lots of times to not…start with algorithms. It's a building up of [patterns]. [For example,] we're getting ready to find out how many degrees [measure the interior angle sums of] certain polygon – octagon [etc.]. Well, if [students] draw all those regular, irregular [polygons], measure the angles, put 'em together, [students] start seeing patterns. And after we see those patterns, then students can start saying them. Then, they [will be] looking [to determine whether there]…is…[a pattern] that happens every time [that we can generalize]? [For example, one pattern we noticed was that there are the same number of non-overlapping triangles can be composed in a convex polygon as] two less than the number of sides

When Erika endeavored to support group discussions within disciplinary-specific contexts, she was not entirely clear about means to structure classroom activity. She did not discuss how to support students to generalize; instead, she described the generalization that she would like students to develop.

Conceptions of the institutional setting.

In 10.9% (n = 20; Table 3) of journal entries, Erika described how problems within the institutional setting (e.g., the school, the district, the state, the nation) impacted student learning.

Supporting diverse learners. In the pre-interview, Erika highlighted institutional factors that impacted her ability to teach. In addition, before, during, and after the intervention she noted institutional factors that impacted students' abilities to learn.

Interview Transcript 9

Erika: I've been in [the] Centennial Public School District for ten years and [the range of student knowledge and abilities] has been a problem.

Here Erika described the diversity of student knowledge and skills within the school setting as a problem.

Interview Transcript 10

Erika: I…actually did two different lesson plans for the same class period. I tried to meet the needs of my higher achievers...you know the four or five that were in the class that I spotted…and the other kids at the same time…So, that was impossible. You can't keep that going an entire year, to be able to work with one group and turn around and work with the other. So, I actually went to the principal and basically begged for a pre-algebra class.

Erika's description of the institutional setting seemed to impede her propensity to support students with diverse learning needs. Although during her clinical interview Erika indicated a deeper understanding of the impact of the institutional setting on teaching and learning both during (5%, $p < 0.05$, Chi-squared test) and after the intervention (6%, $p < 0.1$, Chi-squared test; Table 4) than she did during the pre-interview, her focus was not explicitly tuned to means of supporting mathematical connections and meaning through discussion.

Understands the Student Perspective

Erika was taking on the role of a student in 40.2% (n = 74) of journal entries. For instance, during her clinical interview, Erika noted how anxious she was when asked to solve a problem on the board:

Interview Transcript 11

Erika: [P]ersonally, [I was] nervous to do a problem on board…was double [and] triple checking my problem

This affective response provided an opportunity for Erika to think about ways to support all students to participate in ways that make them comfortable. Next, Erika described the conflicted emotions she felt when she observed a student cheating:

Interview Transcript 12

Erika: Today I saw one particular student be untruthful two different times…That is definitely something that as a teacher you wouldn't see, but as a student you would see other students doing…I saw her cheating off of somebody else's homework, copying down answers, and I saw her tell the teacher that she couldn't find her homework, but then watched her work on it during class, and then later say, "Oh, look I found it." And I would not have seen that from the teacher's point of view…

CM: So, you're suggesting that students do see this so they have to deal with seeing each other's dishonestly...

After her first participant-observation of John, Erika described the frustration felt by a female student who could not see the board from her assigned seat.

Interview Transcript 13

Erika: [T]here is a bad seat in the house…I kept watching one kid get up and move 'cause she couldn't see.

Taking up classroom norms. During her clinical interview, Erika showed a greater capacity to take the perspective of her students both during (25%, $p < 0.01$, Chi-squared test) and after the intervention (24%, $p < 0.01$, Chi-squared test; Table 4) than she did during the pre-interview. She noted that while teachers explicitly thought about means to develop and support participation norms, a foundation of group discussions, these structures could be difficult for students to learn and comport with.

Interview Transcript 14

Erika: You've got to know your teacher. 'Cause we're all so totally different.

CM: What does that mean do you think for students, going from class to class?

Erika: It's confusing. I mean it takes a while to learn your teacher…I think there are certain teachers, but you may have just come out of my room where I let you kindof call out answers and go into her room where she doesn't. It's a different; it's a different pattern…I was thinking that was…different. You never think about stuff like that.

Teacher Feedback Session

Erika was anxious about presenting the findings from her three-days as a participant-observer to her colleagues. This seemed to be a consequence of the minimal trust present. However, in this feedback session there was an indication of increased trust. For example, Erika was willing to allow CM to summarize her findings and present them, without alteration, to her colleagues. CM positioned the teachers as anthropologists making sense of Erika's research findings.

Meeting Transcript 1

CM: (Distributes questions that were collaboratively developed in Meeting 1) Let's start by refreshing our memories about the questions that came out of our planning session. I have gone through all of the journaling [Erika] did, the interviews I did with [Erika]…to summarize some of the bigger ideas…So I'd like for us to walk through these and as we do so, let's think about what it means to us in terms of instruction and how we approach each day in our classroom, how we approach a week's worth of instruction, or a quarter's worth of instruction. And if anything has been learned here, how it might influence the way kids think about school and our teaching…I want you to interpret…these findings. Let's interpret them together and then let's talk about whether anything could be changed or improved based on any of this

CM then presented two questions that were developed during Meeting 1 to focus the work of the teachers during the intervention and Meeting 2: "How do I know a student is learning," "Am I asking good questions?"

Next, CM summarized a number of points that Erika raised in her journal and interviews in response to these two questions:

Meeting Transcript 2

CM: 1. Sometimes Erika could sense that students wanted to answer but were not confident enough. She noticed the value of students being willing to share "wrong" answers.

2. Some questions would elicit responses such as, "I did it, but I forgot how." Others allowed students to be able to say something, and then subsequent solutions built on each other toward a class-created solution/strategy/definition/understanding.

3. Erika recognized the value of creating tasks that were not so "cut and dry.

These points motivated the following discussion that addressed the epistemology of mathematics and how that supports or disrupts the capacity to engage students in group discussions. The teachers began discussing whether all solutions in mathematics are either right or wrong. When considering classroom discussion, it is difficult to support this form of activity if mathematics is perceived to be a discipline of problems to be answered and not of concepts worth discussing. For example, the teachers stated:

Meeting Transcript

1 Melissa: Math is a lot of times…

2 Amanda: Right or wrong

3 Melissa: Yeah, [but] it doesn't have to always be that way.

4 CM: How can it not be that way?

5 Melissa: Well, a math problem is right or wrong, but you can still ask questions in your class to get kids involved…have some ways to participate without just answering a right or wrong question.

6 Erika: [For example, you could ask], "So does this remind you of anything else we've done in the past?"

Although this question pushed at a central issue within mathematics group discussions, the teachers were considering ways to make mathematics worth discussing. They had not yet considered that mathematics could be positioned as a discipline where the problems that are posed allow opportunities for rich discussions. CM pushed the teachers to consider the nature of mathematics.

Meeting Transcript 4

1 CM: You said that a math problem…is right or wrong.

2 Melisa: Not all the time; most of the time.

3 Amanda: At this point in the year in 5th grade I think so, especially since there's a lot of review trying to get the skills in place to move on.

4 Melissa: A lot of computation…

5 Erika: But there's a lot of ways to get a right answer.

CM pushed the participants to consider the nature of answers in mathematics.

Meeting Transcript 5

1 CM: In a math classroom, what is an answer?

2 Amanda: Would it be a conclusion to a … process?

3 Erika: I always say algebra…math is patterns. That's what math is. Somebody realized…all this stuff kept happening, over and over again. That's how I address what algebra is to my kids. It's patterns…So, if the same things keep happening over and over again, they say it must be true, it must be how it works out…

4 Amy: I have a question about the cut-and-dry, does that always mean like everyone having the same problems and working through it the same way?…I'm going to teach the next week how to calculate population density, but they each have to research their own countries and have their areas and population to do that. So, would that be considered cut-and-dry?

Through these discussions, Erika and colleagues showed trust in their responses to the questions that her participant-observations motivated. This supported Amy to describe her

assignment on population density. In doing so, she was able to reveal that she did not know how to determine if an assignment was "cut-and-dry." Finally, Erika affirmed that Amy's assignment was not cut and dry; this motivated Amanda and Melissa to further develop these ideas. Amy and Melissa did not respond out of feelings of professional obligation, intentions to suppress conflict, or the tacit understandings that it is "against the rules" to challenge others' beliefs and ideas. They did so because Amy provided an example of a mathematics assignment that afforded opportunities for thoughtful responses.

Discussion

In order for in-service teachers to engage in mathematics group discussions, they must develop the capacity to support and facilitate collaboration among students around mathematical content. This collaboration requires that students have opportunities to "share their thoughts, attend and respond to each other's ideas, and generate a shared meaning or understanding through their joint efforts" (Staples, 2007, p. 162). When collaborating, students must be able to listen to each other and understand each other's contributions. Students must feel accountable for the development of shared understandings and have equal opportunities to participate in the discussion. Lampert (2001) notes that this kind of classroom collaboration must rely on the coordination of pedagogical practices (e.g., teacher revoicing, developing discourse norms). This study presents the nascent development of many of these practices, within a community of in-service teachers. Through the use of journal and interview analyses, this study presents Erika and her colleagues' development of the elements of the practice of leading a group discussion, within a model of peer observation. This work focused on how trust among colleagues, conceptual change, and productive critique were supported. Although Erika's consideration of mathematical content and the institutional setting of schooling increased from the first to the second half of the journal, she had difficulty considering how to support classroom discussion through these lenses. However, we have seen in this study that the problematizing of practice and subsequent learning can take place when artifacts (i.e., developing group discussions, within structured peer observation) are created that support peer observation and de-privatized practice. In addition, this work supported the development of many pedagogical practices central to leading a group discussion: e.g., teacher revoicing, transitions between activity structures, eliciting student thinking, as well as conceptual learning and procedural fluency. Conceptual understanding refers to an integrated and functional grasp of mathematical ideas; procedural fluency is defined as knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently (National Research Council, 2001).

Collegial Trust

Newmann and Associates (1996) and Gamoran et al. (2003) indicate that making teaching practices public is critically important to the development of teachers' professional communities, as it requires relationships of trust among teachers. Erika initially indicates minimal trust in her colleagues. In addition, she only discusses her teaching practice with her husband and a mathematics professor. However, by the end of the study she had shared her findings with her colleagues. These findings include feedback that instigated her colleagues to think more deeply and challenge one another about their teaching practices. Thus, peer observations created opportunities for teacher collaboration, where teachers

willingly discussed and made known their instructional practices, successes and failures. In addition, peer observation places teachers in colleagues' classrooms, observing their instruction. Bryk, Camburn, and Louis (1999) note: "When teachers trust and respect each other, a powerful social resource is available for supporting the collaboration, reflective dialogue, and de-privatization characteristics of a professional community" (p. 767).

Teacher as Student

Through the use of classroom discussion within peer observation, Erika was able to take on the perspective of a student in her colleagues' classrooms. She indicates that she was taking on the student perspective for 40.2% of instances in her journal. Thus, her role as a participant-observer seems to have motivated her observations. Taking on the student perspective allowed Erika to experience school as students experience it, the hectic and crowded halls, the dizzying and frenetic pace from class to class at the sound of the bell, and the accumulated piles of classwork and homework. Specifically, taking the student's perspective created opportunities to think about how students experience classroom norms (from class to class); this allowed her to consider what teachers must put in place for these norms to support classroom discussion and student learning. Ball (1996) suggests that a teacher's knowledge of their students is "essential to teaching for understanding" (p. 501).

Study Limitations and Significance of Findings

While this study is of one teacher participant-observer in the classroom of five middle school teachers over a three-day period, it nevertheless raises important questions about de-privatizing teacher practice in the context of leading group discussions and points the way to an intervention that would help change aspects of in-service teacher practice. This study raises the following questions: Would this intervention improve upon the typical model of peer observation in terms of de-privatizing teachers' practices? Would the teachers become more proficient with leading group discussions? What can the teachers, researchers, and even students learn from their participation? In this study, it is conjectured that this "expert in novice's clothing" perspective would enable the participant observer to perceive critical components within the practice of the teachers being observed. Furthermore, it was hypothesized that the participant-observer would view pedagogical practice as an expert but be forced to participate as a novice. Erika and her colleagues' development over these three days shows that these questions have been answered in the affirmative in a short period of time. Future studies should provide additional teachers the opportunity to move through similar cycles of participant-observation over longer timescales. Then, it will be important to identify effective elements of such an intervention and replicate them across other and larger groups of teachers.

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