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EMPIRICAL STUDY/ANALYSIS

Lesson Plans and the Contingency of Classroom Interactions

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Abstract In their examination of elementary science classrooms, Amerine and Bilmes (1988) found that following instructions requires students to understand the relationship between the projected outcome and the corresponding course of actions. One of the most important resources for instructions is the lesson plan, which prescribes the sequence of teaching. However, there is often a gap between what is planned and what actually happens in the classroom. This raises the question of how teachers come to terms with contingent variants and unexpected outcomes that real-time interactions occasion and how lesson plans are configured into these processes. This study examines a teacher education program that uses lesson plans as a central resource for teaching mathematics. The results suggest that classroom teachers use lesson plans as communicative resources to identify problems, specify assumptions about their teaching and act on the evolving contingency of classroom interaction. The interactional contingency is the locus of teaching practices, not an obstacle to the application of procedures in lesson plans.

Keywords Ethnomethodology · Talk-in-interaction · Plans · Instructional practices · Mathematics education · Contingency

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Introduction

Lesson plans provide classroom teachers with important resources for establishing lesson goals, deliberating about available resources and designing activities accordingly. Although not all teachers use lesson plans, the idea of planning tasks and implementing them is a familiar routine in classroom teaching. In reality, however, it is difficult to view classroom teaching simply as a matter of executing lesson plans through a series of prescribed schemes because teachers are bound to come to terms with contingent circumstances and divergent responses occasioned by real-time classroom interaction. Lesson plans prescribe particular interactional trajectories, but actual teaching may lead to different directions or induce an unexpected turn of events. For example, lesson plans may list a set of questions that teachers intend to ask, but they cannot specify what types of answers students will produce and how.

The discrepancy between what is planned and what actually happens does not always mean that lesson plans are faulty renderings of classroom realities. They can still represent organized and logical schemes. The problem is that previous studies have typically used lesson plans as primary resources for estimating whether and to what extent teaching practices follow the prescribed schemes faithfully (Komoski 1977; Stephens 1982). As a result, such studies have taken for granted that devising and using lesson plans involve an array of judgmental and interpretive tasks for classroom teachers and their students in the face of contingent variants and fortuitous deviation.

Thus, there is a need for a close analytic accounts of the procedures by which classroom teachers use lesson plans while coming to terms with contingent realities of classroom interaction. For example, in what way are lesson plans configured into a diverse array of contingent variants and unexpected outcomes occasioned by real-time interactions? The present paper offers an analytic report from a 2-year-long qualitative study tracing the Lesson Study (LS), a teacher education program that uses lesson plans as the central program resource (Henceforth, LS) (Lewis et al. 2006; Perry and Lewis 2009; Stigler and Hiebert 1999). First introduced by the researchers involved in the Third International Mathematics and Science Study (TIMSS), the LS is considered a durable and effective teacher education program in Japan with a century-old tradition (Stigler and Hiebert 1999). In the LS, teams of math teachers prepare lesson plans, and one team member then teaches a lesson while the entire group observes it. This is followed by a post-lesson discussion in which all LS group members review and analyze the teaching.

Lesson plans are central resources for these teachers in that they constantly refer to, problematize and act on them during the entire cycle of the LS procedure. Instead of examining whether teachers follow their lesson plans faithfully, the present study focuses on what teachers do with lesson plans in contingent and divergent realities of classroom interaction. This is an empirical undertaking of how curriculum resources such as lesson plans are used and acted on in the actual work-practices of teaching in the unfolding contingency of classroom interaction.

Literature Review

The Gap Between Plans and Actions

Previous studies have provided mixed results for the effectiveness of teacher education programs (Ballou and Podgursky 2000; Cochran-Smith and Fries 2005; Darling-Hammond 2000; Wideen et al. 1998). One reason for this lack of consensus has to do with the gap between what is planned and what actually happens in classroom interaction. Teachers typically begin with some type of plan, but they have to deal with the unexpected or unforeseeable contingencies of classroom interaction. Face-to-face interactions in classroom settings involve a certain degree of spontaneity and improvisation that cannot be specified in lesson plans (van Lier 1988). That is, classroom teachers have to respond to unscripted actions in contingent contexts, and thus, enacting a curriculum often involves impromptu and improvised decisions (Borko and Livingston 1989; Heaton 2000; Yinger 1987). Even the use of curriculum materials is subject to the contingent context of classroom teaching (Remillard 1999). Teachers who have participated in TIMSS have also reported a discrepancy between the intended curriculum and the implemented one (Mullis et al. 2000).

In educational literature, however, few studies have provided an in-depth analysis of the contingency of classroom. This is because empirical studies have typically conceptualized the divergent realities of actions and activities into a manageable number of predetermined variables to estimate their influence on various dependent variables (Erickson 1982; Heap 1982). Unfortunately, the presence of particular variables or established routines is helpful only insofar as the researcher makes causal and/or co-relational associations to particular learning outcomes. This makes it difficult to demonstrate what makes these elements work in actual occasions of interactions and how they contribute to the overall success of a program (Maxwell 2004). Moreover, the reliance on variable analyses often portrays teaching in terms of some set routines or procedures (Berliner 2005), and thus, the success of classroom teaching is estimated by the extent to which teachers follow the established routines. In this line of research, the procedural details of teaching are often taken for granted or glossed over.

Whatever plans or routines are set in place, they have to be realized in temporally unfolding sequences of interactions (Schegloff 1996). For example, a teacher may begin a class with a set of questions with a particular direction in mind. However, it is difficult to predict that the student will do with the questions. Clearly, the teacher can predict the types of answers that can be produced, but it is impossible to predict how the answer will be delivered (e.g., reluctantly, explicitly, promptly or with some delay). Students may not even respond at all, which often prompts the teacher to repeat, reformulate, or revise the question. Heritage (1984) characterized this local exigency as follows:

> Since every current action will itself form the immediate context for some next action in a sequence, it will inevitably contribute to the framework in terms of which the next action will be understood. In this sense, the context of

> a next action is repeatedly renewed with every current action. Moreover, each action will, by the same token, function to renew (i.e. maintain, alter or adjust) any more generally prevailing sense of context which is the object of the participants' orientation and actions (242).

Classroom teachers deal with the renewed context that each respective turn at talk generates, and therefore, it is difficult to predict which of the alternative actions the students will take.

In general, lesson plans cannot specify the specific choices and methods of action that classroom teachers and students deploy in the local contingency of real-time interactions. This is why we need to examine teaching practices in the situated and contingent contexts of classroom interaction as Zeichner (2005) argued;

> Both the component of teacher education programs and the programs themselves need to be described and studied in a way that acknowledges their complexity and their ties to the settings in which they are located and the people who inhabit them (699).

This recommendation does not mean that all studies have to describe the minute details of classroom interactions. This would make research findings unbounded, unrestrained and a random amalgam of disparate observations. In what way, then, can we produce focused descriptions of teaching practices in terms of lesson plans in the local exigency of real-time interactions? This analytic dilemma points to the nature of planning and its relationship with situated actions (Suchman 1987).

Lesson Plans and Situated Actions

The above analytic dilemma raises the question of whether and to what extent the actual realities of classroom teaching cab be explained in terms of lesson plans. Classroom teachers are not likely to discard their plans when faced with unexpected and divergent realities of classroom talk. If there is a gap, is it because of inadequate planning or incompetent teaching? Closing the gap is not simply a matter of specifying lesson plans in greater detail. Although lesson plans may not accurately predict the array of detailed, concrete, and ever-changing classroom practices, they constitute particular versions of what should happen. That is, lesson plans are not faulty renderings of what happened; they still represent a body of coherent ideas, reasoned objectives, and systematic processes. What, then, are some of the ways lesson plans are used in coming to terms with the contingent courses of action that real-time teaching generates?

One way to address this issue is to identify the programmatic or theoretical principles embedded in lesson plans. In her comprehensive review of research on teachers' use of mathematics curricula, Remillard (2005) proposed that underlying conceptual issues and fundamental assumptions form particular kinds of teacher-curriculum relationships. For example, the view that values close fidelity to the written curriculum emphasizes the importance of following preplanned schemes accurately in teaching practices. By contrast, an opposite view highlights how teachers bring their own beliefs and experiences to their encounters with the curriculum. These underlying principles then shape and motivate the way classroom teachers make use of curriculum materials.

If we consider the contingent circumstances that face classroom teachers, however, we may have difficulty reducing actual teaching practices of to a set of correlated principles. In this regard, Heritage's argument (1984) is again helpful:

> The *boundaries* of specific, located ordinary actions, their *units* or *segments*, the determination of adequacy in their description or representation – all of these questions and many more pose problems which cannot be resolved *in principle* but which require solution in the context of practical engagement with descriptive tasks (302; emphasis in original).

What we need, then, is an approach that looks into the situated use of conduct and performance by describing how classroom teachers make use of their lesson plans in various stages of teaching, not one that relies on the attributes and properties of particular principles or conceptual grounds.

Lesson plans represent the material ground for teaching practices at the level of interactional specifics. They may reflect particular types of intentions with respect to action sequences based on several factors, including teachers' understanding of the goal, students' content knowledge, group dynamics, and the amount of time allocated. The question is what happens when these plans are subject to the interactional and occasioned use that calls for immediate and improvised handling.

In this regard, the LS offers a very useful research opportunity in that it has a mechanism for obliging teachers to review and revise lesson plans in various stages. This is the procedural aspect of teacher training that Stigler and Hiebert (1999) noted for the LS. Since then, several studies (Chokshi and Fernandez 2005; Fernandez 2002; Lewis et al. 2006; Perry and Lewis 2009; Wang-Iverson and Yoshida 2005) have offered some descriptions of the programmatic principles and procedural details of the LS. While informative, these studies have focused on describing the programmatic features of the LS, not on providing the analytic descriptions of the interactive process by which preplanned schemes in lesson plans are realized in the situated realities of contingent classroom interactions.

Analysis of Discourse-in-Interaction and Teaching Practices

This focus on the situated use of lesson plans is consistent with a recommendations by Sacks (1992) who introduced conversation analysis. He suggested that if we examine the routine practices of a particular occupation or category of individuals, such as teaching or lawyer, we may realize that craftsmanship and work competence are not predetermined but depend on the judgment and interpretation of participants in their contingent handling of interactions.

In adopting this analytic initiative, Goodwin (2000) stressed the importance of examining the temporal development of actions. As actions unfold, particular resources are added while others are treated as no longer relevant. At the same time, each action projects, revises and reframes particular trajectories. That is, actions renew and reorganize the fields in which a vast array of resources is made available along with a new set of constraints. A given action makes particular rational properties relevant for that particular situated context. Discourse-in-interaction is an important analytic resource in that it tells us how members come to terms with the contingent resources the temporal development of action presents. Particularly relevant is the sequential organization of discourse-in-interaction through which the understanding of the talk in a given turn is often evidenced in the next turn at talk (Macbeth 2003; Moerman and Sacks 1971/1988; Lee 2006; Sacks et al. 1974).

If we follow this analytic approach, we can see that the tools and technologies of objects and artifacts are considered, not in their inherent attributes or independent properties, but as resources with which actors produce intelligible actions through rational interpretations (Suchman 1987). If lesson plans are central resources for classroom teachers, then it is a worthy analytic task to examine how teachers make their actions intelligible as they devise, revise and reflect on their lesson plans. An analytic focus will be placed, not on examining whether teachers follow their lesson plans faithfully, but on describing what teachers do with lesson plans and how their use represents, describes, and recognizes teaching practices at the level of interactional specifics.

The present study provides a descriptive analysis of how lesson plans are devised and used in the realities of classroom interaction and collaborative discussion among teachers in the LS. Rather than treating the gap between what is planned and what actually happens as a problem to be solved, the present study considers it to be a research topic (Lynch 1993; Zimmerman and Pollner 1970) that allows for an examination of how material resources such as lesson plans are configured into teaching and learning practices in the contingency of interactions.

Methodology

Participants

This paper is an outcome of a 2-year-long study of an LS group of math teachers from an elementary school in a large Midwestern city. The study took place at a typical inner-city school in the US. Approximately, 70% of the school's students came from low-income families. The LS group was part of a city-wide program that began in 2002. School administrators and classroom teachers from the city volunteered for the program. Initially, the group began with a total of 13 math teachers, but the membership changed over the research period because new members joined and some dropped out. There were at least 9 members who participated in the program for the entire research period. The teachers formed two teams based on the grade level of their students: the lower-grade and higher-grade teams.

Each team held their own meetings to prepare lesson plans before presenting them to the whole group in their biweekly group meetings, in which the entire group reviewed and evaluated the plans. Once the lesson plans were completed, one teacher from each team taught a class by using the plans while the rest of the group members observed it. This research lesson was followed by a post-lesson discussion in which all the participating teachers reviewed the lesson. The entire cycle of the

LS took four to five group meetings, including a couple of planning meetings, a research lesson, post-lesson discussions and occasional revision meetings, in that order. The group was able to have two to three research lessons per semester. For each research lesson, planning teams prepared three to five math problems and then gave students some time to solve the problems individually and in groups. In research lesson demonstrations, outsider observers were often invited.

Procedures

We adopted two main research methods: Educational ethnography (Bogdan and Biklen 2007; Eisenhart 2001; Erickson 1986; Page 2000; Yon 2003) and discourse-in-interaction (Cazden 2001; Garfinkel 1967; Mehan 1979; Sacks et al. 1974; Schegloff et al. 1977). We used educational ethnography to retrieve the participants' interpretive practices at each stage of the LS. The discourse-in-interaction analysis was based on videotapes of all regular meetings and teaching sessions, which were later transcribed. During the research period, one of the authors was a participant–observant as an expert on the LS, whereas the other author was a non-participant-observer. The two researchers held research meetings both before and after LS meetings to analyze and review the data. Most of the research meetings between the researchers were audio taped and used for the analysis. The researchers communicated through face-to-face interactions and video-conferencing.

Unlike traditional discourse analysis, which focuses on the structural and/or functional regularities of classroom talk (Carlsen 1991; Green and Dixon 2002), the present paper examines the methods and procedures by which participants carry out ordinary tasks of classroom teaching and collaboration among teachers (Heap 1990; Macbeth 2003; Lee 2010). Accordingly, the transcribed interaction and field notes became the primary analytic resources because they allowed for an examination of the contingent choices of talk and methods of action the participating teachers demonstrated.

Because this paper does not focus on highlighting the programmatic feature of the LS, this research began with unmotivated looking (Sacks 1992) to identify the recognizable and instructive ways in which lesson plans were used in various interactions among the participants. We placed particular emphasis on examining the types of choices of talk or action the participating teachers showed as they faced the contingent organization of classroom interaction and pre- and post-lesson discussions. The following section is organized according to the principal results obtained through the inductive process of examining field notes and transcribed records of teaching, and discussion sessions and research meetings.

Findings and Discussion

Anticipated Solutions

With respect to the diverse range of contingent variances and local particularities that classroom interaction engenders, the LS offers a built-in system for participating teachers to manage their students' contingent responses. First, planning teams prepare a document named, the *plan of the lesson*, which has three columns. In the first column, planners list math problems for students to work on. The second column is used to describe the possible responses from students to the problems. The third column describes the methods by which the teacher assesses their students' performance. Noteworthy is the second column in which planners are supposed to indicate the anticipated solutions from students (which are referred to as "expected student responses"). This is a programmatic device for the LS to induce teachers to think ahead about students' responses to planned tasks. In fact, how well teachers predict student responses is considered an important indicator of teacher development in the program.

In the present study, all members of the group became better at anticipating student solutions as they became more experienced with the LS. Initially, however, their descriptions of anticipated solutions often became the target of intense discussions in their meetings with a teacher educator who was an LS expert. For example, the lower grade team chose the following task as the first problem for their fifth graders to solve: "I have a box of chocolates. Someone ate 3 of them. There are 5 in the box now. How many chocolates did I start with?" The group's anticipated solution was "Students will work individually to solve the problem and write a number model".

In the planning session with the entire group, the teacher educator asked the team to specify their anticipated solution. The team responded that they had thought about a few candidate number models such as $3 + 5 = 8$ or $8 - 3 = 5$. The ensuing discussion revealed, however, that these answers reflected the team's own mathematical thinking, not necessarily their deliberation of the process by which their students would solve the problem. The following comment by a member of the planning team illustrates the case in point:

> And K (the teacher) is gonna help them (students) explain what each number means. So if they say, like eight minus three equals five, she's gonna help them decide, 'well, where'd you get 8? What's 8? Where'd you get 5, where'd you get 3? And then, the second problem…

The above comment emphasizes what the teacher is supposed to say when they receive expected answers, but, the team realized, it does not probe the thinking process behind such answers sufficiently. In a way, this type of question is similar to going through the motions to fulfill the procedural routines prescribed in the program.

This description is not meant to criticize the team for its inability to predict student responses accurately. Instead, it points out that even the programmatic injunction to write anticipated solutions in the specific column was not sufficient for them to see the various ways in which the column was used.

The series of planning and post-lesson discussions brought out and thus made visible the various possible action sequences that the designated column could refer to. Although the column forced them to generate possible answers from students, it took a series of prompts and discussions for these teachers to make sense of what each answer could mean in the contingent interactional process and to estimate students' thinking processes reflected in the answers. That is, the presence of the column for anticipated solutions in lesson plans was not self-sufficient for the team to realize the lesson goals specified in their plans. Further, these teachers were not able to anticipate all the possible answers from the students.

Nonetheless, this does not necessarily mean that the column is useless. The series of planning and post-lesson discussions revealed that the column became a conceptual anchor through which these teachers could index an array of possible answers, identify the problems and foresee the consequences of each action trajectory. As their discussion unfolded, anticipated solutions became material resources for making sense of the local exigency that students' answers engender. This is something that was not visible in the previous treatment of lesson plans in educational literature.

Lesson Goals and Learning Activities

Problem solving is one of the most frequently used phrases in the LS as a theoretical or conceptual goal for lessons. In reality, however, lesson goals remain conceptually indefinite and thus open for alternative interpretations and continuous negotiations. The following case illustrates the point. In one of their planning sessions, the group discussed a lesson goal that read as follow: "Students will be asked to write what they learned about problem solving". This sentence refers to the culminating activity at the end of the lesson called the *exit slip*, in which students are asked to write about what they learned from the lesson.

A couple of teachers remarked on the difficulty of having students extract important principles from their activities. Several members agreed that it is challenging for students to verbalize this type of insight. In this regard, one teacher suggested that classroom teachers should help students see the implications of what they are doing instead of waiting for them to notice them. Later on in the planning session, this topic was brought up again when the group was reviewing another goal of the lesson, namely, having students go through the multi-step problem. One teacher tried to specify what the *multi-step* means by translating it into actionable steps;

> The point of multiple steps is not to get them to see that you can solve it in different steps but to get them to see the relation among the steps. In order to solve problem 3, you have to do something before.

This led another teacher to suggest that experiencing multiple steps in solving a math problem can be considered problem solving.

At the end of the discussion, one member of the team proposed that the goal should include the expression *appropriate steps* on the grounds that the actions students take have to be appropriate to lead them to the right answer. Only then, may these students be able to verbalize the steps toward the correct answer logically. After this discussion, the team specified the following three goals:

1. Students will determine the appropriate operation to solve the problem.
2. Students will solve multi-step number stories using reasoning.
3. Students will write the correct number model that correlates with the problem.

Note that each successive goal specifies the previous one with more concrete references. When the lesson is completed, students are supposed to write about the following issue on their exit slip: “What did you notice about the steps you and your classmates took to solve the problem?”

This series of discussions did not clarify the nature or attributes of the conceptual goal *problem solving*. Instead, their discussions were directed to specify the abstract goals into actionable steps and make visible these relationships to students. That is, the team’s discussions centered on specifying what was glossed over in the goal, *problem solving*.

The team’s review of exit slips from students showed that a majority simply described what actions they took during the lesson instead of recognizing the principles or goals that the lesson activities were designed to help them realize. Two students wrote that they used different ways to solve the problems such as addition, subtraction, multiplication and division. Others simply noted that there were different methods to solve the problem. Another student recognized that some students used different methods while others used the same method.

It should be noted that the students’ exit slips represented their undertaking of what they were asked to do in reference to what they experienced during the lesson. What they wrote was subject to the logic of the situated contexts in which they came across a variety of resources, for example, the type of interaction they had with their group members, the ways in which the teacher reacted to each group’s solution, and what they thought that their teacher wanted them to say. That is, the students used exit slips to describe their experience with the lesson, whereas the team was looking for any evidence that the students were doing something prescribed in the lesson plan. For example, the teacher who taught the above lesson commented that “Yeah, they basically just said that there were different ways to getting to the same answer. Like again, yeah, I noticed that everybody did multiplication, division, add or subtraction to get their answer”. The teacher related the students’ activities to a few actionable steps the team anticipated and thus considered them to be evidence that the students were doing something relevant to what the team planned.

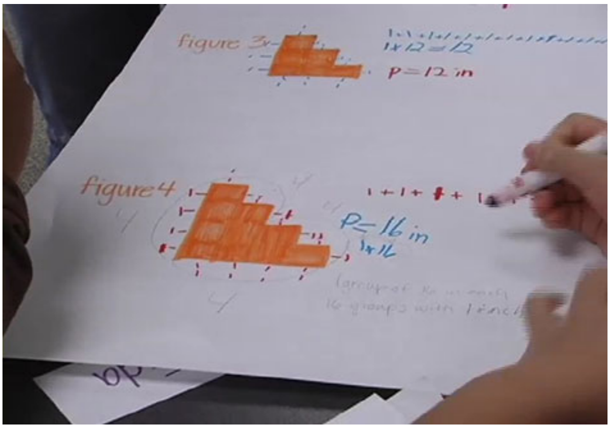
Analytically, it is not sufficient to say that this exit slip activity was not adequately designed just because the students were not able to verbalize the insight as the planning team prescribed in their goals. The descriptive analysis of the LS, however, demonstrated that the students’ exit slips became communicative resources for them to remember the procedural details they took and to estimate their relevance to what they were expected to do. During this process, the teacher and her students treated lesson goals not as definite and fixed entities but as something subject to circumstantial and situated use that contingent interaction presents. This is one of the important reasons why it is difficult to match what was planned to what actually happened directly because the actual discourse-in-interaction brings out a diverse array of competencies, resources, perspectives and constraints.

Order of Tasks

The above discussion indicates that lesson goals cannot specify or regulate the procedural details of how participants recognize, respond to, and act on the tasks that they face in contingent interactional sequences. If lesson goals cannot specify what needs to be done during the lesson, what about the activities used to realize these goals? Routinely, when teachers determine a series of tasks in their lesson plans, they order the tasks in a particular manner. This ordering carries particular assumptions and logic in terms of the nature and difficulty of activities and continuity among them.

However, this ordering may not be sufficient for students to accomplish what is intended in lesson plans. In their examination of elementary science classrooms, Amerine and Bilmes (1988) found that following instructions requires students to understand the relationship between the projected outcome and the corresponding course of actions. In the present study, a number of students did not produce what the lesson plan was designed for, despite their attempts to follow the instructions. The students knew the projected outcome but did not know corresponding course of actions they were supposed to take. As they worked on the first problem, they found one particular strategy that led them to the correct answer, and therefore, they continued to use it for subsequent problems. That is to say, the logic of planners embedded in the order was not self-sufficiently recognizable because there were other possibilities that were plausible to the students. The following example illustrates the case in point.

The following case is from a research lesson for a group of fifth-graders. The students were asked to calculate the perimeters of squares in Figures 3, 4 and 17, in that order. The first problem asked for the perimeters of 6 squares (3 on the vertical line and 3 on the horizontal line). The next question was about 10 squares 4 on both sides. (Picture 1: Students working on figure 3 and 4). The last one was about the Figure 17 in each direction (Picture 2). The students were supposed to infer the



Picture 1 Students working on figure 3 and 4

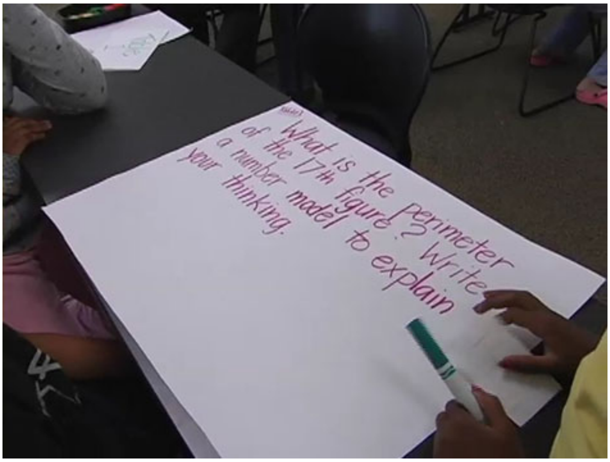
mathematical number models from the first and second problems, and then, using the models, they were supposed to solve the last problem in Figure 17. (Picture 2: The question about 17 figure).

The teacher provided them with the figures on large sheets of paper (Picture 1) but this practice prompted the students to count the perimeters by hand. The students had little difficulty obtaining answers by counting for the first and second problems because the large drawing made the task convenient.

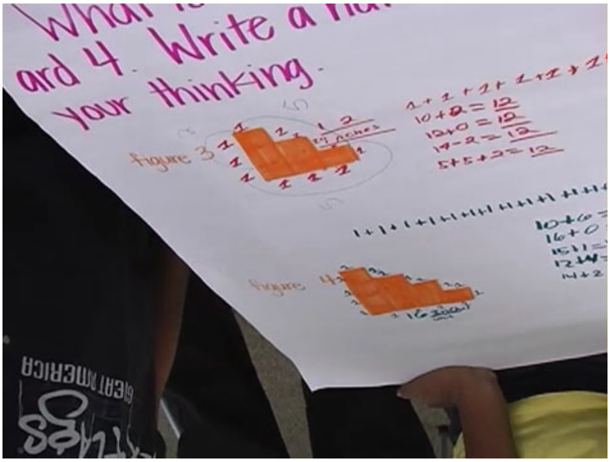
Once they found the answers that they were sure of from counting, they worked to construct the number models that fit the answer for the third problem. The student groups generated a variety of numbers to trace back their process of counting. For example, a couple of groups counted the numbers of horizontal lines (3) and vertical lines (3) and then added the rest (6) by counting the slant, which yielded $3 + 3 + 6 = 12$. Another group simply used $3 + 3$ for 6 to get $3 + 3 + 3 + 3 = 12$. These two solutions were anticipated by the planning team.

However, there were a few solutions that the team did not expect. During the lesson, the teacher noticed that one group used a different model ($10 + 2 = 12$) (Picture 3). When the teacher asked the group how they came up with their model, one of the students pointed out that they first counted 5, followed by another 5, and then included the remaining 2 the number model (Picture 3: Showing the formulae for Figure 3 and 4). This group used $5 + 5$ to make 10 and then added the rest. These students already knew the answer by counting the perimeters by hand and then produced a combination of numbers to calculate the answer. In fact, this group used the same strategy to find the answer for figure 4 by using $10 + 6 = 16$ (Picture 4). The number 10 was an important part of their number model. (Picture 4: Explaining the formulae for Figure 4).

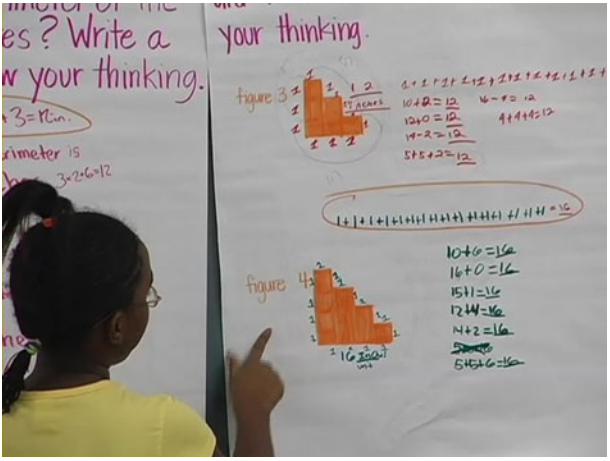
The fact that the students used different methods to obtain answers indicates that the order of math problems produced different resources than what the planning team envisioned. One may propose that this is not the mathematical thinking the



Picture 2 The question about 17 figure



Picture 3 Showing the formulae for Figure 3 and 4



Picture 4 Explaining the formulae for Figure 4

lesson was designed to foster and that the students thus have to be corrected. Pedagogically, this is correct, but we also have to consider that these students relied on contingent and situated resources to address the problems at hand. That is to say, the students responded not just to the mathematics concept embedded in the problems as was prescribed, but also to the interpretive resources that this particular interactional scene afforded (Macbeth 2000) (e.g., the figures on the board and the handouts, the teachers' encouragement of particular types of solutions, and presentations by other groups).

The teacher had to come to terms with these unexpected variants right then and there. After listening to the student's explanations, the teacher offered the recognition "okay" and then, asked "can you think of any pattern?" One of the students in the group responded "everyone got 16" and showed the teacher various ways to get 16 (e.g., $10 + 6 = 16$, $16 + 0 = 16$, $15 + 1 = 16$, $12 + 4 = 16$, and $14 + 2 = 16$). For this explanation, the teacher responded, "Oh, that's the pattern isn't it?" The pattern here is an indexical expression whose intelligibility is subject to how students (and the teacher, for that matter) use it in their account of what happened.

The teacher's search for a pattern yielded an answer different from what she intended, which prompted her to ask a different question. This time, she pointed out the relationship between the first problem in Figure 3 and the second one in Figure 4 (Pictures 3 and 1, respectively): "Okay, can you find the number model that got this (pointing to Figure 3) for this one (pointing to Figure 4)?" This characterization brought out a new resource for the students to find the answer. The teacher then left the table as the group scrambled to start working again. As they worked on the new task, one student suggested $16 - 4 = 12$ for the question and another student asked how she got 4. The student said, "Because I got the 16, I borrowed it from here (The Figure 4) and then added 4 to it (the first question)".

Note that there were other groups who found the mathematical patterns and used them for the third problem (as the lesson plan prescribed). However, the alternative solutions shown above shed some light on the contingent choices these students made in the course of their interaction and what resources they drew from the scene. Instead of using counting to find the patterns as the lesson plans prescribed, they counted to find the answer first and then reconstructed the number models to fit the answer. For the teacher, the order of activities was designed to guide the students to the mathematical patterns in a step-by-step fashion, but the student found different resources from the order.

When actual lessons fail to follow the intended plans, it is often ascribed to the misapplication of the principles behind particular teaching programs (Cohen 1996; Stigler and Hiebert 1999). The above case can certainly be considered an example of inadequate plans or the misapplication of the LS. However, the actual teaching practices might have uncovered a wider range of responses and logical trajectories than the lesson plan anticipated. These alternative possibilities were made visible as the sequences of interactions unfolded in the real-time contingency. For this reason, a close sequential analysis of interactional changes is needed for a better understanding of how such contingent logic and interactional choices are occasioned and then used by participants. Unfortunately, these procedural details are often speculated on (or at most taken-for-granted) in previous studies.

Role of Lesson Plans

Despite the various problems that created a gap between what was planned and what actually happened, the planning teams and the remaining group members in the LS did not complain that the lesson plans were inadequate or insufficient renderings of classroom teaching. When the lesson did not go as planned, the team regarded this either as a procedural matter to be handled during the lessons or as a design problem needing a revision. These teachers knew that their lesson plans could not specify every single detail of what could happen. Therefore, the lesson goals and/or the order of activities listed in the lesson plans were central resources for these teachers to interpret how and why the discrepancy occurred.

The LS offers a built-in system that obliges the participating teachers to delve into their students' thinking process by anticipating their responses to math problems. However, dealing with students' responses to the lesson involves more than identifying what was missing in lesson plans. Lesson plans contain a vast number of unspoken assumptions about what students should know, what types of resources should be made available, what types of prior experiences students should have and what types of information the teacher should draw on from their students' performance and how.

Although lesson plans do not specify and clarify such assumptions, they become communicative resources because the plans offer the conceptual and practical anchors through which teachers estimate the goodness and adequacy of particular teaching practices. A successful lesson implies that what happened was within the parameter of what the lessons prescribed. Even when a lesson goes awry, the lesson plan can be a frame of reference through which teaching practices are problematized and alternative methods are sought out.

Noteworthy is that the conceptual principles or abstract goals listed in lesson plans often become a major topic of intense discussion in the LS because participants try to find practical referents in real-time interactions. It is not likely that there exists a set of activities that can facilitate given goals better. However, the LS can encourage teachers to specify the relevance of these principles and translate them into actionable steps in classroom teaching. In this way, lesson plans can become practical resources for participants in their deliberation of possible actions in coming to terms with contingent variances and occasions.

Conclusions

The results indicate that classroom teaching is not a linear process that moves from planning to teaching. In the linear conception, lesson plans often remain generic and conceptual and therefore, many procedural details are glossed over or simply taken for granted. The presence of a gap between what is planned and what actually happens creates problems because lesson plans may lose their capacity to pull together activities into a coherent scheme. When the logic of lesson goals and the rationale for planned activities fall apart in real-time interactions, the familiar scene of classroom life becomes confusing and unwieldy. Thus, this gap is often ascribed to poor planning or incompetent teaching.

As amply demonstrated in this paper, classroom teaching is imbued with unexpected outcomes and contingent variants. The gap between what is planned and what actually happens is often an unavoidable and thus natural phenomenon. While lesson plans prescribe what should happen, each turn at talk and action can occasion particular courses of action that may go beyond or deviate from what is anticipated by the planning team. Thus, a mechanical comparison of lesson plans and the realities of classroom interaction may not work. Instead, we need an analytic approach to turn classroom interaction and the accompanying procedural details into researchable phenomena so that we can specify the relationship between lesson plans and classroom practices as the participants experience them in contingent and evolving sequences (Lynch 2006).

For this alternative, we want to specify how lesson plans are configured into various instances of actions by which classroom teachers manage contingent variances real-time interaction occasions instead of determining who/what is responsible for any gap. The LS offers a unique research opportunity for this analytic undertaking in that it encourages teachers to use lesson plans to address the contingency of classroom interaction head-on. The LS's numerous discussion sessions are organized to topicalize the gap and make visible the contingent choices of participants.

Readers may remember Remillard's proposal (2005) that the use of curriculum materials by classroom teachers is bounded by the underlying conceptual principles. However, the present study demonstrates that the use of lesson plan cannot be fully captured by referring to the attributes of the underlying principles. Instead, these plans become reflexive resources for teachers to identify, problematize and act on what happens. Teachers in the LS use lesson plans for their collective thinking to make sense of what happens in the course of their interaction (e.g., referring to particular incidents, estimating the continuity of activities, and making use of shared history). The lesson plan is a tool for visualizing and conceptualizing what is happening in the classrooms and for preparing for a diverse array of contingent sequences during everyday teaching. Analyzing these processes in close analytic details can provide a better understanding of how participants make use of lesson plans in navigating the indefinite fields of relevant resources and responses.

Previous studies of teacher education have emphasized the importance of finding and acting on relevant variables or indicators that are considered to lead to visible outcomes (Desimone et al. 2002). Although this approach can uncover many positive features that any successful teacher education program should have, applying them to teaching involves a completely different story. It is not just the presence or absence of these programmatic features that counts in thinking about classroom teaching. Nor is it simply a matter of applying these features correctly. Rather, it is how these elements are recognized, enacted, acted on and even problematized by participants in real-time interactions. Sharrock and Anderson (1982) describe this as a task of assembling:

> We are talking it that the elemental problem is to understand not what patterns activities fall into, but how they are 'put together' into whatever patterns they might make: it is the assembling, not the final shape of the assembly, that is of interest (175).

The professional vision and expertise that education programs aspire to instill in classroom teachers facilitate not just the acquisition of new concepts and knowledge but also the ability to produce the situated actions through which a particular action is identified, enacted, acted on or even problematized.

Then, where does this leave us? The identifying details reported in this study are not missing details or forgotten specifics. Rather, they represent the locus at which professional competence and material resources such as lesson plans become meshed and constitutive of the very action and activities these participants are performing. Whether participants are solving problems or doing proofs, they have to be realized in visible and public activities because such activities offer material resources for co-participants to act on. These procedural details are often taken for granted (or at most speculated on) and typically considered to be assumed knowledge by practitioners and students, although these activities make their teaching and learning what they are. Thus, specifying these procedural details of actions and activities can play an important role in educational research.

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