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Table of Contents

Teachers' Perceptions of Observing Reform-oriented Demonstration Lessons

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The primary goal of professional development programs is to support teachers in increasing student achievement. In many cases, this requires a significant change in how mathematics is taught (Sowder, 2007). In turn, this demands not only a change in teachers' beliefs (Pajares, 1992) but also a new vision for what mathematics teaching entails (Ball & Cohen, 1999). Unfortunately, professional development often fails to support teachers in making these changes, as it does not provide opportunities for teachers to view reform-oriented teaching practices with students similar to their own (Santagata, 2011).

Recognizing this deficit, we designed our professional development project for middle grades mathematics teachers to include opportunities for observing reform-oriented demonstration lessons. In some instances, the lessons occurred in project teachers' classrooms. We referred to these classrooms as established classes. At other times, project teachers observed demonstration lessons occurring during the summer months and utilizing a group of students from a local youth organization. These represented non-established classes. Following the demonstration lessons in established and non-established classes during the 2010 – 2011 school year, we sought to document the impact of these demonstration lessons by gaining insights into the project teachers' views. Specifically, the following research questions were posed.

1. How does viewing reform-oriented demonstration lessons impact teacher practice as reported by teachers?
2. What are teachers' perceptions of the benefits of demonstration lessons in established classes?
3. What are advantages of demonstration lessons in established classes versus non-established classes as perceived by teachers?

Researchers have indicated that teachers need opportunities to observe reform-oriented instruction (Borasi & Fonzi, 2002; Santagata, 2011). Including observations of reform-oriented instruction in professional development programs seems to be a logical means for providing these needed opportunities. By examining teachers' perceptions of demonstration lessons in two different settings, the significance of this study lies in its ability to identify characteristics of classrooms that are valued by teachers and therefore necessary to support transference of instructional practices from the professional development setting to teachers' classrooms. In addition, the results point toward specific instructional practices that are enhanced in this setting.

Background Literature

A review of the literature revealed that while a strong case can be made for using demonstration lessons as a part of professional development and there is common agreement on key characteristics of these lessons, there is a lack of research documenting the impact of demonstration lessons on teachers' beliefs and practices. These ideas will be discussed in the paragraphs that follow.

THE NEED FOR DEMONSTRATION LESSONS

When faced with implementing innovative pedagogical skills, teachers need to see classroom instruction modeled.

According to Casey (2011), teachers who are expected to implement these new pedagogical strategies express three common concerns. First, teachers often have difficulty visualizing certain approaches being utilized in their own classrooms. As a result, they question whether or not these new strategies could work in their classrooms. Second, teachers question whether the strategies would be appropriate for their students. In turn, teachers express the desire to see the strategies being used with their students. Finally, teachers expect to see evidence of students showing success with new strategies before they are willing to try the strategies in their classrooms. These concerns described by Casey (2011) suggest that teachers need opportunities to observe reform-oriented instruction and demonstrations lessons may be one means for doing so.

According to Loucks-Horsley et al. (2010), a demonstration lesson has as its purpose to improve teaching and involves a group of teachers observing an effective teacher's lesson either in person or via video. To be successful, the demonstration lesson should be part of a "prelesson discussion, classroom demonstration lesson observation, and postlesson debrief cycle" (p. 197) with the discussions led by a facilitator. Miller (2011) argued that one of the benefits of demonstration lessons is that the lessons provide teachers with the opportunity to view lessons that they might not have otherwise considered to be effective. For example, teachers often desire to have the perfect lesson as opposed to allowing misunderstandings to be revealed in a way that might not have been planned and could be considered a deviation from an ideal plan. Demonstration lessons allow for teachers to view lessons which might not run according to a lesson plan, but allow students to learn beginning from their current understandings and misunderstandings. Unfortunately, teachers seldom have these opportunities to view classroom lessons for the purpose of growing professionally (Santagata, 2011).

SUCCESSFUL DEMONSTRATION LESSONS

Recognizing the need for teachers to observe reform-oriented instruction, professional development programs often include demonstration lessons (Balfanz et al., 2006; Gersten & Kelly, 1992; Gigante & Firestone, 2007; Vesilind & Jones, 1998; Wallace et al., 1999). Many aspects must be in place during the demonstration lessons to ensure teachers have a meaningful and informative experience. Two aspects are particularly germain to this discussion as they served to inform the study. First, demonstration lessons should occur in classrooms that are similar to those of the teachers who are observing the lesson (Casey, 2011; Math Science Partnership Knowledge Management and Dissemination (MSP), n.d.a). Teachers should see lessons in classrooms that they view as similar to their own so that they realize the classroom lesson could happen in their own room (Casey, 2011). Second, a lesson debriefing must follow the demonstration lesson (Loucks-Horsley et al., 2010; MSP, n.d.a; Santagata, 2011). Without the lesson debriefing, the teacher is left with only his or her thoughts about the lesson (MSP, n.d.a). As a result, the teacher might not have identified highlights or features of the lesson that are necessary for ensuring effective implementation. Being able to collaborate, discuss, interpret, analyze, compare, and contrast instances in the lesson and students' understandings with fellow teachers is crucial for teachers to find value in the observation (Santagata, 2011).

RESEARCH ON DEMONSTRATION LESSONS

When demonstration lessons are included with other types of instructional support such as classroom observations or professional development workshops, research has shown a positive impact on teachers' classroom pedagogy (Gersten & Kelly, 1992; Gigante & Firestone, 2007; Vesilind & Jones, 1998). However, there is a lack of documented evidence of the impact of demonstration lessons without the other types of instructional support. MSP (n.d.b) examined fourteen studies from all grade ranges aimed at improving pedagogy or content knowledge. In these studies, the demonstration lessons were part of a comprehensive professional development program that included other types of instructional support. They concluded the following:

> Studies in this set provided evidence of teacher leaders who provided demonstration lessons or modeling as one of their support strategies had positive impact on teachers' classroom instruction and student achievement. However, none of these studies was designed to investigate the unique influence of this teacher leader activity, indicating a fruitful area for future research (MSP, n.d.b, section 3, para. 3)

The aim of the current study was to examine teachers' perceptions of demonstration lessons in two different settings. In doing so, our intent was to offer some clarity to the classroom characteristics that must be considered in delivering demonstration lessons. In addition, we sought to address the gap in the current literature resulting from a failure to examine the benefits of demonstration lessons

by examining how teachers utilized the information taken from demonstration lessons in their own classrooms.

Methodology

Phenomenological research has as its goal to identify the perception of participants who have experienced a phenomenon (Gall, Gall, & Borg, 2007). In this study, the phenomenon under consideration was the reform-oriented demonstration lessons in established and non-established classes. As a result, we utilized a qualitative approach to gain insight into teachers' perceptions of these demonstration lessons. In the paragraphs that follow, we will first present the context of the study followed by a description of the selection of participants. Next, our instrumentation and procedures are described. Finally, an overview of the data analysis is provided along with the limitations of the study.

CONTEXT

This research occurred within the context of a professional development project for mathematics teachers in grades four through eight titled Promoting Innovation in Mathematics Education or Project PrIME. The project was an externally funded project affiliated with a small research university located in the southeastern region of the United States. We, the authors, served as two of the project staff involved in implementing the project and were employed at the university: the first author as a tenured faculty member and the second author as a graduate student.

The primary goal of Project PrIME was to improve teachers' mathematical content knowledge. Simultaneously, we aimed to support teachers in improving their own instructional practices. As this was a multi-year project, teachers were invited to return to the project each year for up to four years. Teachers were then referred to by the number of years of participation. For example, a teacher who was participating in the project for the first time was called a "year one teacher" while someone returning to the project for his fourth year was referred to as a "year four teacher."

Project PrIME teachers began each year by participating in a 10-day summer institute. Time within the institute was devoted primarily to content instruction with topics varying according to the year of participation. For example, year one teachers focused on number and operations while year two teachers focused on geometry. Through this content-focused instruction, project teachers were given the opportunity to experience reform-oriented instruction as a learner. We recognized, however, that to strengthen this experience the teachers needed the opportunity to observe reform-oriented instruction in action with middle school students. Therefore, through a partnership with a local youth organization that served at-risk youths, middle grades students visited the summer institute and participated in mathematics demonstration lessons led by project staff. Collectively, these students comprised what we refer to as a non-established class. The class was non-established in the sense that the students did not meet in this classroom setting on a regular basis and classroom norms were not in place.

In addition to a lack of classroom norms, students from the non-established class were different from a "typical" class in that they were students from a variety of grade levels. Although we knew from the literature that demonstration lessons should occur in classrooms similar to that of the teachers observing the lessons, we were hopeful that if teachers saw the reform-oriented instruction methods successfully implemented within what appeared to them to be a challenging teaching situation, they would be likely to believe the methods would work in their more realistic classroom settings. Recognizing this limitation of the non-established classrooms, however, Year 1 teachers observed only a single lesson with the non-established class during the summer institute while other teachers had opportunities to observe multiple lessons with the non-established class.

During the school year, teachers attended a conference and participated in online discussions of assigned readings or student solutions to assigned problems. In addition, teachers attended academic follow-ups. During an academic follow-up, project teachers visited a school site where a fellow project teacher (the host teacher) taught. Here, they participated in the demonstration lesson cycle, including the pre-lesson discussion, the lesson, and a post-lesson discussion. During the demonstration lesson, project teachers sat along the perimeter of the room while a project staff member conducted one or two demonstration lessons with the host teacher's classes. These classes represented what we refer to as established classes. They were established in the sense that the students met in this classroom setting on a regular basis and the classroom norms were in place. During a school year, a total of nine academic follow-ups were conducted. Each group of three follow-ups constituted one round and project teachers were expected to attend one follow-up within each round. As a result, project teachers had the opportunity to

observe reform-oriented demonstration lessons in three different established classrooms during an academic year.

PARTICIPANTS

In selecting participants for this study, our goal was to select year one teachers that had attended the same three academic follow-ups. We elected not to consider year two, three, or four teachers as length of time in the project would introduce different, unaccounted for influences on their perspectives. Also, by identifying year one teachers that had participated in the same three academic follow-ups, we aimed to further eliminate unaccounted influences.

To begin the selection process, we compiled a list of the year one teachers who had attended three academic follow-ups. Of the 31 year one teachers, 15 had attended three follow-ups. Next, we eliminated special education and high school teachers from the list because we were interested in the perspectives of middle grades mathematics teachers. This reduced the number of prospective participants to twelve. Using a numbering system, we then noted which of the nine academic follow-ups each of these remaining teachers had attended. We grouped the teachers according to the academic follow-ups they had attended. Three teachers had attended follow-ups two, six, and seven. In addition, two teachers had attended follow-ups two, five, and seven. Given the overlap between these two groups of follow-ups two and seven and the desire to have at least five participants, we decided to invite both groups of teachers to participate in this study, recognizing the difference in one follow-up might impact the two groups' perspectives. All five teachers agreed to participate. Table 1 contains background information on the participants.

INSTRUMENTATION

In order to gain insight into participants' perspectives, we designed a set of open-ended interview questions (see Appendix A) to specifically address the research questions. Within the set of questions, we included follow-up questions in case participant responses were vague.

PROCEDURES

Recognizing the need to provide teachers with the opportunity to observed reform-oriented teaching (Santagata, 2011), we designed our professional development project to include a lesson demonstration component that occurred in two distinct settings. In both settings, project teachers observed reform-oriented demonstration lessons. The lessons were considered reform-oriented as a result of the following.

1. Lesson tasks addressed topics across more than one content strand.
2. Lesson tasks were open-ended and often resulted in multiple solutions and solution strategies.
3. Lessons focused on students constructing their own knowledge through tasks and student discourse.

These lesson descriptors have been identified as "chief characteristics of math education reform" (Ross, McDougall, & Hogaboam-Gray, 2002, p. 125). To insure that demonstration lessons consistently adhered to these descriptors, lessons were led by project staff members, which included both authors and additional mathematics education graduate students from the university. The difference between the two settings, however, was in whether

Table 1: Participant Background Information

Pseudonym	Gender	Race	Grade Taught	Teaching Experience in Years	Highest Degree
Gloria	F	B	4th	20	Bachelors
Kallie	F	W	4th	10	Masters
Tori	F	W	4th	5	Bachelors
Lola	F	W	4th	3	Bachelors
Anna	F	W	4th	18	Masters

the class was an established or non-established class, as previously described.

In June 2010, year one teachers participated in their first summer institute. On the last day of the institute, the teachers participated in a pre-lesson discussion and observation of a single lesson with students from the local youth organization. The students in this non-established class completed the Mystery Op 1 task (Erikson, 1996) and the Counting Cubes problem (Olson, 1999) under the direction of the first author. During the lesson, year one teachers observed with the goal of identifying students engaged in each of the Process Standards (NCTM, 2000). After the lesson, teachers participated in a lesson debriefing led by project staff that provided them with the opportunity to ask questions and share their thoughts regarding the lesson.

During the 2010 – 2011 academic year, project teachers attended up to three academic follow-ups. At each follow-up, teachers observed reform-oriented demonstration lessons conducted by project staff in established classrooms. Lessons in round one follow-ups (follow-ups one, two, and three) occurred during September/October and engaged students in creating and generalizing growing patterns. Lessons in round two follow-ups (follow-ups four, five, and six) occurred in November/December and engaged students in investigations of area and perimeter. Lessons in round three follow-ups (follow-ups seven, eight, and nine) occurred in February and engaged students in explorations of polyhedra that led the students to discover Euler's formula. Just as with the non-established class, teachers observing the established classes participated in lesson briefings and debriefings led by project staff.

Following the last academic follow-up, we identified our participants as previously described. In March, the second author interviewed participants individually using the interview protocol (see Appendix A). Each interview was conducted at the convenience of the participant and occurred at the participant's school. Interviews lasted approximately fifteen minutes, on average. Each interview was audio recorded and later transcribed.

DATA ANALYSIS

In analyzing the interview data, we used an open-coding process (Charmaz, 2002; Strauss & Corbin, 1990). To begin, we individually analyzed the interview transcripts, coding the recurring ideas. Next, we met to discuss the codes, creating an agreed upon list of codes. We then separately analyzed the transcripts again, using the list of agreed upon codes. Afterwards, we met for a second time to review and refine the codes. In some instances, we eliminated codes, as they were not prevalent across the interviews. In other instances, we expanded existing codes as we realized new ideas that were embedded within the codes. As part of this refining process, we were able to develop a descriptor for each code (see Appendix B). Next, we individually coded the transcripts one last time utilizing the revised list of codes with descriptors. Upon meeting together, we compared our codes to check for agreement. The interrater reliability was computed to be 91%. For those instances where there was not agreement, we discussed the data and its coding until an agreement was reached.

To facilitate the identification of trends emerging from the data, we created a chart of the participants and codes. For each participant, we went through the interview transcript and recorded the frequency of statements or collections of statements that corresponded with each code. Appendix C contains this table.

LIMITATIONS

Prior to reading and interpreting the findings, limitations of this study should be taken into consideration. The first limitation is the use of purposeful sampling. We elected to purposefully select our participants to insure that they had experienced the same phenomenon and to reduce the impact of unaccounted for influences. In doing so, however, we introduced the potential for researcher bias, the second limitation of this study. To eliminate the potential for bias, we established clear selection criteria and conducted analyses independently followed by collaborative discussions. Through thick descriptions of our procedures, our intent was to offset the potential for bias. In addition, although the purpose of qualitative research is not to produce generalizable results, through these thick descriptions we have strengthened the transferability of the results. Finally, we were not able to observe participants' classrooms and instead based our conclusions on their views of their own instructional practices. We felt this was appropriate, however, as we were interested in the participants' perceptions.

Results

The results of the data analysis will be organized according to the research questions. Participants' statements taken from the interviews will be shared as a means for supporting the reported results. In these statements, pseudonyms will be used to protect the participants' identities. Also, participants did not utilize the terms established classes or non-established classes in their interviews, instead using project-specific terms. As a result, the project-specific terms have been replaced with the terms established classes or non-established classes as appropriate.

How does viewing reform-oriented demonstration lessons impact teacher practice as reported by teachers?

To answer this research question, participants were questioned regarding how they utilized information gained through observing reform-oriented demonstration lessons in the established classes. Three trends were consistently noted within their responses. Each of these will be described in the following paragraphs.

Utilizing the lessons. All five participants indicated that they utilized the demonstration lessons from the observations with their classes. In some cases, the participant stated that she utilized the lesson as it was implemented in the established class. This was Tori's practice, as evidenced by the following:

> I take tons of notes and when I come, afterwards, after I observe a lesson I usually come back the next day and I . . . teach the lesson or eventually when I get to that subject, I teach the same lesson.

Other participants, like Kallie, indicated that they utilized the lessons but adapted them as needed for their students.

> I bring the lessons back . . . and that's what I do with everything PrIME gives me is just to bring it back and adapt it to the way I need it, so I really like getting the lessons and every lesson that we've seen, I've actually done in the classroom.

Participants clearly saw the lessons as a resource, providing them with tasks and problems that they could use with their own students. This was the view expressed by Anna.

> I'm able to bring a lot of that back and use it 'cause you know, you're just always searching for things and ideas and materials and um, anyway, the follow-ups have been great for giving me problem-solving type things to bring back to my classroom.

Supporting students in thinking about the mathematics. In analyzing the interview data, all five participants spoke to implementing strategies taken from the observations that supported students' engagement in thinking deeply about mathematics. Participants mentioned strategies such as: utilizing a timer as a means of pacing the lesson and providing adequate "think time;" using think-pair-share to support "think time" and increase communication among the students; and providing tasks/questions that focused students' thoughts on the mathematics. While not all participants mentioned all of these strategies, Lola noted all three and tied them to meeting her mathematics objective.

> There, the teacher is just . . . setting the pace sort of about the time how much time the kids have to think about a question and kind of just guiding them and prompting them but letting the kids take hold of the discussions and where the discussion leads. I really started utilizing the think-pair-share. I really like that. Um, I've also as a teacher I thought when I go and prepare my lessons, I think of better questions that I can ask my kids to get them engaged with the lesson instead of just saying here's what we're going to do today, this is how it's done. . . . Am I giving them what they need to really think about it? Am I really getting to the, I guess like really the main idea that I want them to know not just not getting the surface, but getting deep down inside to the concept. . . . I really take the objective, whatever I'm teaching, and I really try to think about what it is I want them to know or about, how I want them to learn it, and just try to get some good tasks like the ones that I've learned from PrIME to really engage their thinking that will kind of, I don't know what the word is, try to get them thinking along those lines instead of me just teaching it to them, saying this is how you do this, kind of letting them, a good task is going to let them problem solve to figure it out.

Improving questioning techniques. Finally, four of the five participants provided evidence of a third trend: improving their questioning techniques. Participants indicated that observations of reform-oriented lessons in the established classrooms reminded them of the need to ask better questions. In some cases, asking better questions involved simply asking students to justify their reasoning. According to Gloria, "I also like how, um, the students, they just don't give the answer, they have to explain why they think they're correct. I like that." In other instances, the participants spoke of creating better questions. Tori

said, "Just rewording questions, learning how to ask better questions, I'm getting a lot of that, too, just observing that. . . . I mean just looking at different lessons, too, how we look at different questions." Furthermore, Kallie noted how the lesson observations allowed her to focus on the classroom discourse facilitated through the questions asked.

> So I love getting the lessons and the ideas. Um, I like just seeing the, the interaction between you guys as the teachers and the students and the kind of questions that y'all ask that I might not think of.

What are teachers' perceptions of the benefits of demonstration lessons in established classes?

When questioned about the benefits of the lesson observations in established classes, three themes emerged from the data. Each of these will be described below.

Providing a vision. In their interviews, three participants noted that the demonstration lessons provided a vision of what reform-oriented instruction would look like in their own classrooms. According to Anna,

> The instruction going on [in the established classes], it just really kind of um, gives you an idea of how it's going to work out for you to some extent when you bring, you know, it's just more to me realistic for how it's really gonna go in the classroom.

Like Anna, Lola recognized the support that the demonstration lessons in the established classes provided her in envisioning reform-based instruction in her own classroom. More specifically, student-oriented instruction and questioning caught Lola's attention.

> I got to see how they would do a lesson in [the established classes] and how they conducted it and it was really good because I saw how it was student-oriented and not teacher-oriented and so that was really beneficial, and just kind of questioning that they asked. It kind of gave me a good feel about how I could do that in my own classroom.

As seen here, participants reported that demonstration lessons in the established classes led them to believe that they could carry out similar instruction in their own classrooms.

Rejuvenating the participants. In addition to providing a vision, all five participants stated that the demonstration lessons served to rejuvenate them, reminding them of the reform-oriented practices about which they were learning and "jumpstarting" their implementation of these practices in their classrooms. Tori stated, "Those help a lot, too, cause it reminds, it kind of is a reminder cause I do really good and then I'm glad we [observe in an established classroom] because it kind of gets me back into the routine of things." Similarly, Gloria said, "Of course, I forgot about some of the things that I had been taught this summer so the [established classroom lessons] helped to refresh my mind or my memory about some of the things." Both Tori and Gloria indicated that the reform-oriented demonstration lessons in the established classes served as a reminder of the previously learned instructional ideas. Adding to this, Kallie explained the role of the school environment as it relates to this need for rejuvenation.

> At school we get to where we're in time limitations and so we get in this habit of speedy, speedy, speedy, speedy, you know? And our mind's just thinking about that . . . and so then . . . [the lesson in the established class] just reminds me what I wanna be like. And then I come back here [to my school] and you know, I really do that and they start you know, time time time, get this done and then I'll start going back and then I get to go back to [observe in an established class] and come back, you know. . . . It gets me motivated again. It gets my mind thinking like a PrIME teacher and not like a [state-testing] teacher, you know? It gets my mind back into thinking like a PrIME teacher.

Analyzing instruction. Finally, four of the five participants spoke of the opportunity to analyze instruction via the lesson debriefs. Following demonstration lessons in established classes, project teachers participated in a discussion of the lesson(s) led by project staff members. For Anna, these debriefs provided the opportunity to analyze the lessons and identify instructional strategies to utilize in her classroom.

> The things that we, you know, get to see in the [established classes], we're able to kind of break them down and talk about them when we meet together and then, uh, so many, it gives you so many ideas to bring back to your own classroom and implement immediately while they're fresh on your mind.

Similarly, Lola spoke of how important this opportunity to analyze the lesson was to her.

> I really like the debriefs where we get to go back and talk about it. I really like that. To get everybody's input about what they've learned and what they saw and what they think. You can go back and just ask the questions like what did you see from the lesson, what would you have done, what could you have done differently, you just don't go see the lesson and leave. You actually get to go back and talk about what worked, what didn't work, what would you try different next time.

Based on their responses, participants valued the opportunity to discuss the observed reform-oriented instruction. While this is not necessarily a benefit of demonstration lessons in the established classrooms, participants recognized the opportunity that the demonstration lessons provided for them to engage in this practice.

What are advantages of demonstration lessons in established classes versus non-established classes as perceived by teachers?

In considering the two different classroom environments, participants noted three differences between the established and non-established classes, citing these differences as advantages for the established classes. These advantages are described in the paragraphs that follow.

Engaged students. When reflecting on the two different classroom environments, four of the participants indicated that the students from established classes were more willing to engage in the lesson. Kallie saw the students in the non-established class as the type of students who needed to be held accountable for the work in order for them to engage in the lesson.

> Because [the non-established classroom] was just, you have so many of um, the type of kid that is not on task, the type, and I guess those kids don't care cause it's summer and they're not focused and it's not school and it's not for a grade so they don't care.

Tori also spoke of the students' engagement in the lesson. Unlike Kallie, however, she stated that some of the students in the non-established class engaged in the lesson.

> The [established classes] had more advantages just because the kids . . . know they're supposed to be in school and learning. But, as a new PrIME teacher, I liked seeing [the non-established class] because I had no idea of really what [the project instructors are] wanting. . . . The kids in the summer really, they knew they weren't in school. But some of 'em still did try. I mean, I'm not gonna sit there and say that they weren't engaged because they were. But the, you know the other kids in the [established classes], you could definitely tell they were more excited and . . . they knew they had to do it rather than the other ones didn't, but I still think that they both walked out of there with something.

Established classroom community. In addition to student engagement, all five participants noted that established classes had an advantage in that a classroom community was in place. Anna described this feature in terms of how the classes had "meshed."

> Because, I mean, that was good at the [non-established class], um, even though of course that was summer time and the kids you could tell it, you know. But, . . . you go into an [established class] and you, and you're seeing actual classes that have meshed and have been together.

Similarly, Gloria referred to the relationships of the students.

> Another thing I think that the kids have a better relationship with each other, you know during the school year [in established classes]. They're in the same class whereas these kids [in the non-established classes] are pulled from all different age levels or, well not necessarily age levels but different classes. . . . I think that may have made a difference.

Diverse students. Finally, two of the participants noted that the non-established classes lacked diversity. In reflecting over the two different classroom environments, Lola noted this lack of diversity, yet failed to indicate how she was thinking about diversity. She said, "The makeup was different from I guess when you're in [an established class] environment. You have more diversity. And, in the summer there wasn't a lot of diversity with the [students]." Based on her response, it is not clear whether Lola was considering diversity in terms of race, academics, gender, etc.

Alternatively, Kallie addressed the need for academic diversity within a classroom, something she did not see in the non-established class. In this quote, she is describing the importance of this diversity.

> And then, you have a mixture of kids, you know, like sometimes those good kids keep those other kids focused and on track, and then sometimes those good kids think too, uh, much out there and then those other lower kids bring 'em back in.

Discussion and Implications

Improving student achievement in mathematics requires that teachers re-conceptualize their roles as mathematics teachers (Sowder, 2007). Towards this goal, Santagata (2011) indicated that a deficit of many professional development programs results from a failure to include observation of reform-oriented instruction in classrooms similar to those of the participating teachers. With this in mind, we designed our professional development program to include reform-oriented demonstration lessons in both established and non-established classes.

Results indicated that observing established classes provided participants with a vision of reform-oriented instruction that could be transferred into their own classrooms. As a result of these observations, participants reported that they returned to their classrooms with a goal of improving their questioning techniques and supporting their students in thinking deeply about mathematics. Meeting this goal was supported by their use of the demonstration lessons.

These results support the claim that professional development should include observations of reform-oriented instructions in classrooms similar to those of participating teachers (Santagata, 2011). The results enhance this claim, however, by offering a description of the classroom characteristics valued by teachers in defining similar classrooms. In addition, the results offer insight into features of demonstration lessons that facilitate the transference of instructional practices to individual classrooms. These points along with implications are discussed below.

SIMILAR CLASSROOMS

Through comparisons of the established and non-established classes, we gain insight into the classroom attributes that teachers consider important for establishing the similarity of classrooms. The first of these attributes is the diversity of the students. All of the students in the non-established class were African-American. In addition, teachers in the project perceived the students as being average to below average in terms of academic preparation as a result of their affiliation with the local youth organization. This was compared to the students in the established classes that had a full range of students with regard to race (Caucasian, African American, Hispanic, and Asian) and academics (from well above average to well below average). By noting the lack of diversity in the non-established class, the participants communicated diversity as an important feature of classrooms being observed. It was not always clear, however, whether the participants were referring to academic diversity, racial diversity, or some other student characteristic.

The second attribute of similar classrooms is evidence of an existing classroom community whose norms and practices align with the vision of reform-based instruction. In the established classes, students knew each other and were accustomed to listening to one another, talking about mathematics with each other, and discussing one another's ideas. This was not true in the non-established class. Although students in this class were willing to talk, students were not accustomed to participating in classroom discourse, a key feature of reform-oriented instruction (Chapin, O'Connor, & Anderson, 2003). Students' struggles to engage in classroom discourse made it difficult for participants to benefit from the observation.

Finally, the third aspect of similar classrooms is student accountability. In the non-established class, students had no reason other than self-motivation for participating in the learning activities. While many students in the non-established class possessed this self-motivation, others did not and served as a distraction to the participants. This was in contrast to the established classes where the accountability was in place. While we would argue that over time all students in the non-established classes would develop the self-motivation through the selection of engaging tasks, participants did not have the opportunity to observe this phenomenon evolve with only one lesson to observe. As a result, participants identified accountability as an important aspect for supporting student engagement and as a key attribute of similar classrooms.

In light of these results, we have examined our use of non-established classrooms in our summer institute with an eye on attempting to redesign them so that they appear more similar to teachers' established classes. To this end, our intent is as follows:

1. to identify a more diverse group of students with which to work;

2. to establish classroom norms by working with the students in classroom settings prior to the demonstration lesson; and

3. to work with the organization from which the students are recruited to support student accountability.

FEATURES OF DEMONSTRATION LESSONS

With the key attributes of similar classrooms identified, it makes sense to consider the features of the demonstration lessons that facilitated the transference of instructional practices to individual classrooms. In reviewing our demonstration lessons, we identified four key features. First, the established classes represented classes that were similar to those of the participants, with similar defined in response to the previous question. As a result of the similarity, the participants could imagine the lesson being carried out successfully with their own students. And because the observations of established classes occurred during the school year, the ideas learned could be immediately applied in the classrooms. Thus, the second key feature of this professional development was its occurrence during the school year. Third, each observation of the established classes was followed by lesson debriefings. Santagata (2011) stated that teachers need the opportunity to discuss their observations. When asked about the benefits of lesson observations, participants described the importance of these debriefings, supporting Santagata's claim. Finally, the opportunities to observe multiple established classes over time allowed for the observations to serve as a source of rejuvenation. This aligns with the work of Loucks-Horsley et al. (2010) who reported that professional development needs to be on-going, allowing ideas to be revisited and developed over time.

With these features in place, it was possible for instructional practices observed in the demonstration lessons to be transferred into teachers' classrooms. Our results indicated that these instructional practices included teacher moves that support students' thinking about the mathematics and improved questioning techniques. In light of this finding, in the future we aim to make additional aspects of reform-oriented instruction more explicit through lesson briefings and debriefings with a goal of supporting the transference of these ideas as well.

Conclusion

In reviewing these results, creators of professional development should heed the perceptions of these teachers who speak to the importance of viewing reform-oriented instruction in classrooms similar to their own. While observing instruction within one's own classroom can have profound effects (Barlow, 2012), this is not always a possibility. In the event that observations are to occur in similar classrooms, these classrooms should be similar in terms of student make-up, student accountability, and classroom community. When these conditions are met, the lesson observations support teachers in envisioning reform-oriented instruction in their own classrooms with emphasis given to supporting students in thinking deeply about the mathematics and improving their own questioning techniques. These results are based, however, on a small number of teachers' self reports. Further inquiry is required to verify these results as well as to investigate teachers' ability to notice other dimensions of reform-oriented teaching.

References

Balfanz, R., MacIver, D. J., & Byrnes, V. (2006). The implementation and impact of evidence-based mathematics reforms in high-poverty middle schools: A multi-site, multi-year study. *Journal for Research in Mathematics Education, 37,* 33- 64.

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

Barlow, A. T. (2012). Transitioning to standards-based instruction: Beliefs and view of an elementary mathematics teacher. *Teaching and Learning: The Journal of National Inquiry and Reflective Practice, 26*, 3–19.

Borasi, R., & Fonzi, J. (2002). *Professional development that supports school mathematics reform.* Foundations series of monographs for professionals in science, mathematics, and technology education. Arlington, VA: National Science Foundation.

Casey, K. (2011). Modeling lessons. *Educational Leadership, 69,* 24-29.

Chapin, S. H., O'Connor, C., & Anderson, N. C. (2003). *Classroom discussions: Using math talk to help students learn – grades 1 – 6.* Sausalito, CA: Math Solutions Publications.

Charmaz, K. (2002). Qualitative interviewing and grounded theory analysis. In J. F. Gubrium & J.A. Holstein (Eds.), *Handbook of interview research: Context and method* (pp. 675-693). Thousand Oaks: Sage.

Erikson, T. (1996). *United we solve: 116 math problems for groups, grades 5-10.* Oakland, CA: Eeps Media.

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction* (8th ed.). Boston, MA: Pearson Education.

Gersten, R., & Kelly, B. (1992). Coaching secondary special education teachers in implementation of an innovative videodisc mathematics curriculum. *Remedial and Special Education, 13*(4), 40-51.

Gigante, N. A., Firestone, W. A. (2007). Administrative support and teacher leadership in schools implementing reform. *Journal of Educational Administration, 46*, 302- 325.

Loucks-Horsley, S., Stiles, K. E., Mundry, S., Love, N., & Hewson, P. W. (2010). *Designing professional development for teachers of science and mathematics,* (3rd ed.). Thousand Oaks, CA: Corwin Press.

Mathematics and Science Partnership Knowledge Management and Dissemination. (n.d.a) *Teacher leaders providing classroom support to teachers through demonstration lessons/modeling.* Retrieved on December 9, 2011, from www.mspkmd.net/index.php?page=03_2a.

Mathematics and Science Partnership Knowledge Management and Dissemination. (n.d.b) *Teacher leaders providing classroom support to teachers through demonstration lessons/modeling.* Retrieved on December 9, 2011, from www.mspkmd.net/index.php?page=03_2c.

Miller, K. F. (2011). Situation awareness in teaching: What educators can learn from video-based research in other fields. In M. G. Sherin, V. R. Jacobs, & R. A. Philipp (Eds.), Mathematics teacher noticing: *Seeing through teachers' eyes* (pp. 51–65). New York: Routledge.

National Council of Teachers of Mathematics (NCTM). (2000). Principles and standards for school mathematics. Reston, VA: Author.

Olson, M. (1999). Problem solvers: Counting cubes. *Teaching Children Mathematics, 5,* 406.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*, 307-332.

Ross, J. A., McDougall, D., & Hogaboam-Gray, A. (2002). Research on reform in mathematics education, 1993-2000. *The Alberta Journal of Educational Research, 48*, 122–138.

Santagata, R. (2011). From teacher noticing to a framework for analyzing and improving classroom lessons. In M. G. Sherin, V. R. Jacobs, & R. A. Philipp (Eds.), *Mathematics teacher noticing: Seeing through teachers' eyes* (pp. 152–168). New York: Routledge.

Strauss, A. & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* Newbury Park, CA: Sage.

Sowder, J. T. (2007). The mathematical education and development of teachers. In F. K. Lester, Jr. (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 157-224). Charlotte, NC: Information Age Publishing.

Vesilind, E. M., & Jones, M. G. (1998). Gardens or graveyards: Science education reform and school culture. *Journal of Research in Science Teaching, 35*, 757-775.

Wallace, J. D., Nesbit, C. R., & Miller, A. S. (1999). Six leadership models for professional development in science and mathematics. *Journal of Science Teacher Education, 10*, 247-268.

APPENDIX A

Interview Questions

1. Thinking about the lessons observed during follow-ups… Do you feel the observations are beneficial to you as a practicing teacher? Please explain.

Follow-up Question: After the lesson observations, how do you take information from that day and utilize it in your classroom?

2. So, you know during the summer institute you had the opportunity to watch PrIME instructors teach the [local] kids. Do you feel there are advantages to watching PrIME instructors teach kids during the follow-ups as opposed to during the summer institute? Please explain.

3. What can be done to improve the classroom observations?

   *Explain what you mean by…

   *Can you give an example of…

   *Can you describe in more detail…

   *How do you apply that to your classroom?

APPENDIX B

Code	Brief Description	Full Description
Q	Questioning	The teacher mentions questioning in general. Examples include a reference to questioning, types of questions, better questions, probing questions, more than yes or no questions, etc. but with no specific information included.
Q2	Asking for students to justify their ideas	The teacher indicates the expectation that students are to explain how they got their answer and how they know their answer is correct.
Q3	Answering students questions with questions	The intent of these types of questions is to keep the student thinking. They may be in the form of, "I don't know. What do you think?" or "Could there be another solution?"
T	Facilitating students critically thinking about the mathematics	The teacher describes efforts to get students thinking about the mathematics. These may include think-pair-share, slowing down the pace of the lesson, the timer, randomly calling on students, class discussions, etc. Questioning focuses on appropriately supporting students in understanding and/or reflecting problems as well as summarizing their thoughts about the mathematics at hand.
G	Students sitting in groups	The teacher indicates that students are seated in groups. She does not necessarily indicate that the students are working collaboratively in their groups. This is different from "centers."
LI	Implementing the lessons (and sometimes with adaptations)	The teacher indicates that she has implemented the lesson that was observed in the academic follow-up. There may or may not have been adaptations made to the lesson.
LV	Lesson provides a vision of what "this" looks like in their classrooms	The teacher indicates that seeing the lessons enacted during the follow-up helps them to "see" this type of instruction occurring in her own classroom.
D1	Students were more focused.	Teacher indicated that the students in the established class when compared to those in the non-established classes were more focused. They were engaged or in learning mode.
D2	Classroom norms were in place.	Teacher speaks to the classroom norms being set in the established classes as opposed to those in the non-established classes. The students know each other. Behavior expectations are already set. Things of that nature . . .
D3	Students accountable for the work.	Teacher indicated that the students in the established classes are to be held accountable for the work as opposed to the students in the non-established classes who are not held accountable for the material. The material in the lesson is information that the student will need to know. They are willing to learn it. There will be repercussions if they do not learn it. They are taking it seriously.
D4	AF students are more diverse.	The students in the established classes are more diverse. They look like a regular class of students. As opposed to the non-established class of students who all have similar appearances.
D	Lesson debriefs are beneficial.	The teacher indicated that the lesson debriefs were beneficial.
R	Academic follow-ups serve to rejuvenate the teachers	The teacher indicated that going to a follow-up served as a refresher, reminding them of what it looks like to be a project teacher.
E	Students are allowed/encouraged to explore the mathematics.	The teacher aims to have students explore the mathematics on their own. This can be evidenced by statements about stop-and-go, not answering their questions, using manipulatives, selecting good problems, etc. The focus of the teacher is on appropriately supporting students as they are solving tasks or problems.

APPENDIX C

Interview Coding Results

Code	Gloria	Kallie	Tori	Lola	Anna
Q		3	4	2	
Q2	1			1	
Q3		1			
T	3		3	7	2
G	1		1		
LI	2	4	3	1	3
LV		2		1	1
D1	1	2	1	1	
D2	1	1	1	2	1
D3		2	2	2	
D4		1		1	
D	2	1		1	2
R	1	1	1	1	1
E	1	2	2	4	4