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ABSTRACT

This project investigated the efficacy of classroom coaching in improving instruction in elementary mathematics classrooms. The coaches involved in this study were participants in a professional development program. The program includes three major aspects: (1) an intensive 3-week summer institute focusing on mathematics content, pedagogical content knowledge, and leadership skills; (2) summer lab schools for children organized and run by participants who provide professional development for team teachers who teach the classes; and (3) comprehensive follow-up activities including workshops with leading national and international mathematics educators. This report documents how coaches worked, how they interpreted their roles, and how they affected the teachers with whom they worked. (KHR)

CLASSROOM COACHING: AN EMERGING METHOD OF PROFESSIONAL DEVELOPMENT*

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Purposes

The main purpose of this ongoing project is to investigate the efficacy of classroom coaching in improving instruction in elementary mathematics classrooms. The coaches involved in this study have been participants in a state-funded professional development program for a number of years. That program includes three major aspects:

- an intensive 3-week summer institute focusing on mathematics content, pedagogical content knowledge, and leadership skills;
- summer lab schools for children organized and run by participants, who themselves, with staff support, provide professional development for team teachers who teach the classes;
- comprehensive follow-up activities including workshops with leading national and international mathematics educators.

Part of the leadership development strand has included training in classroom coaching, using a peer coaching model. With private foundation funding, the coaches in this study have been released from classroom duties to be full-time coaches in mathematics in their districts. This ongoing study has been designed to ascertain the impact these coaches are having in the classrooms in which they work, and indirectly, the impact of the professional development in which they have participated. In particular, the study was designed to document how coaches worked, how they interpreted their roles, and how they affected the teachers with whom they worked.

Background

In the last edition of the *Handbook of Research on Teaching*, the chapter on mathematics education (Romberg & Carpenter, 1986) hardly mentions research on in-service teacher education. As Grouws pointed out (1988), and as is still the case, there is little information available about the overall design features of in-service education programs which maximize changes in teacher beliefs and ultimately classroom practices. Grouws called for studies that focus on the impact of various features of in-service education on classroom practice. And the *Handbook of Research on Teacher Education* (Sikula, 1996) does not even include coaching in the index of the volume.

The meager research reported in mathematics about classroom coaching as a means of professional development predicts considerable promise for this technique. Becker and Pence (1999a, b) identified classroom coaching as the most important component of a professional development program for secondary teachers. In these studies, the coaching was done by the authors, who also designed and implemented the whole professional development program. Coaching that was intended as a non-evaluative mechanism for identifying the impact of the professional development itself became the most important aspect of the in-service for participant teachers. Those studies concluded that coaching might itself be a worthy, though time-consuming and expensive, planned component of professional development.

There are a number of models of coaching extant within the educational community. For example, Evered and Selman (1989) define coaching as conveying a person from where he or she is to where he or she wants to be. The metaphor of an old stagecoach communicates this perspective. In this model the teacher is considered a thoughtful decision-maker who, through support and collaboration, can further develop her/his ability to reflect on and improve instruction. A second model is content-focused coaching (Institute for Learning, 1999), which focuses on the content of the lesson in relationship to issues at the core of the teaching-learning process. From my reading and viewing of videotapes in which content-focused coaching is used, it appears to be a bit more directive, in that the coach may use the pre-conference to "teach" content to a teacher who seems to lack content knowledge related to the lesson, may interrupt the lesson and even take it over, and may provide her/his own solutions during pre- or post-conferences. However, both models have the following characteristics in the ideal: a pre-conference to discuss the lesson and its goals and the teacher's focus for the observation; an observation of the lesson in which the coach records as much data as possible; and a post-conference to debrief. Coaching might also include demonstration lessons, co-teaching, or joint lesson planning. In this study I searched for aspects of both models during observations of coaching sessions. In addition, I focused on interactional moves of the coach, such as listening skills, strategic questions, and use of feedback, as well as content specific moves, such as clarifying the goals of the lesson, anticipating and diagnosing difficulties, or reflecting on students' attainment of lesson goals.

Mode of Inquiry

This was a qualitative study using participant observation techniques (Glaser & Strauss, 1967). Observation sessions varied depending upon what the individual coach had planned and how s/he worked with teachers. For example, one coach, Lewis, is working with two fourth grade teachers at the same school. They plan lessons together in a meeting a day or two before the lesson. Then the coach views half of the lesson with one teacher and half with the other, and holds a joint post-conference with both teachers during lunch. Because of scheduling and prohibitive distances involved,

in this case I meet with the coach before the lessons to determine what was discussed in the pre-conference. Then we jointly observe the classes, interacting with the children as they work on activities. I observe the post-conference, providing my input when asked or when it adds to discussion of, for example, student work. In this case I am more on the observer end of the participant-observer continuum. In another case, I spend the whole morning at a school with the coach and the two fifth grade teachers with whom she is working. We have a brief pre-conference with each separately, one before school, the other during a break, identifying areas of focus for the observation. We observe the whole mathematics lesson of each teacher, with the coach making notes that she hands to them during the post-conference. The post-conference usually takes place with both teachers during lunch. There are other variations as other coaches fit in time to meet their coachees in teachers' busy schedules, but space limitations preclude discussing these.

All notes from observations and interviews with teachers and coaches were typed and expanded, with patterns and questions to investigate further identified as work progressed (Glaser & Strauss, 1967). The aim is to identify patterns of coaching work and its impact on teachers, and subsequently, to ascertain how participation in the professional development program has affected the coaches and their work. Data include field notes, interview transcripts, and artifacts from the classrooms such as assessments.

Data Sources

The study is ongoing during the 2000-2001 academic year. Six coaches are being observed, each with at least one teacher, for a total of 12 teachers and 6 coaches. Due to space limitations this paper will discuss the cases of three of the coaches, one male and two female.

Lewis is a former middle school teacher who has been with the professional development project for three years. This is his third year as a coach. Lewis is a European American male who has been teaching 11 years. He works in a small district of eight K-8 schools in northern California. Lewis is working with two fourth grade teachers, Sally and Susan who were using TERC units (Clements, Battista, Akers, Woolley, Sarama, & McMillen, 1998).

Anita is a European American primary school teacher who has extensive professional development, has been teaching 13 years, and has been coaching for three years. However, for the first two years Anita coached only half time, and she described that work as demonstration teaching, not really coaching. She now coaches primary teachers in her K-12 district full time.

Dana is a European American female who taught upper elementary school. She works as a coach in a K-12 district in northern California. Dana has been coaching 3 years, and also has over 20 years of teaching experience. The teachers with whom she works use a variety of materials, with TERC (Clements et al., 1998) forming the core

of the content I observed Dana coaching a fourth grade male teacher, Neil, and a fifth grade female teacher, Melanie, both with less than four years of experience.

Results

The coaches were classified into three types related to patterns of how they interacted with their coachees: coach as collaborator; coach as model; coach as director. These three models range from least to most directive in coaching style. However, I would classify all as falling into the category of the stewardship, internal commitment, and learning model (Hargrove, 1995) which emphasized helping people set goals for self-directed learning and providing feedback as a way to create a shared vision of improvement, in this case, in mathematics instruction.

The Case of Lewis

Lewis is an example of what I am calling a "coach as collaborator." He endeavors to be one of the group of three who are working on a lesson together. Thus the post-conferences tend to be about the structure of the lesson rather than specific as to how each teacher implemented the planned lesson. In fact, by viewing half of each lesson for Sally and Susan, Lewis cannot really ascertain how the second teacher developed the core of the lesson [he does switch order each visit]. Lewis does not keep written notes from the lessons, and does not give the teachers written feedback. However, he works closely with children, frequently asking questions, and seems to have a good sense of what they are understanding. For example, in one lesson the teachers were developing multiplication facts greater than 10; they wanted children to work them out without use of the standard algorithm. In Sally's class, as students shared their methods orally, it was clear that this was difficult for those who knew the algorithm. One girl even verbalized the whole standard algorithm by visualizing it in her head (the problem was 12x6). Both Sally and Susan noted in the post-conference that students seemed wedded to an algorithm. Lewis suggested that they ask children to find more than one way to do 12x6 to get them beyond an algorithm. Sally and Susan liked this suggestion, and in later observations, both were observed asking for more than one way in other contexts.

Although much of his work is collaborative, it is clear that Lewis has a slightly different role from that of the teachers. He provides performance assessment practice items for teachers' use, scores them for the teachers, and does the class presentations of the problems and the rubric scoring to help children get familiar with that type of testing. Although Lewis does not provide feedback specific to how a teacher organized the lesson, he does concentrate on what students seemed to understand. By being active in the classroom, watching and questioning students, he gleans considerable information about student understanding to share with teachers. From Lewis' perspective, perhaps the most important part of his role is encouraging and facilitating the team planning and reflection that are occurring. Without his presence as coach,

this level of collaboration would not be taking place. The planning time forces each teacher to think through the lesson, its goals, and how they plan to implement them beforehand. Because they are working as a team in this way, they have a mutual responsibility for the lesson and its pros and cons. The teaming that Lewis has encouraged has extended to consistent planning throughout the week, even when he is not visiting. Thus Lewis' model encourages the elimination of the isolation many teachers feel by working alone in their own classrooms.

On the other hand, lack of specific feedback to each teacher precludes Lewis from the possibility of influencing each teachers' teaching strategies. The lesson may be the same but may be implemented in quite different ways. Thus Sally seems to have a need for full control at all times in her classroom, so that she leads students to do problems exactly how she wants them done. This style mitigates against students developing multiple methods of solution, such as sought for 12x6. Susan's more open style generates more ways of solving problems. Peer visits or feedback on pedagogy might provide both with more ideas on instructional strategies that would lead to further mutual professional growth.

The Case of Anita

Anita exemplifies "coach as model." Anita has developed a special way of working with teachers new to her as coachees. First she presents several model lessons, leaving the teachers materials and ideas on how to continue that work until her next visit. Then she moves into modeling peer coaching, in which she is the teacher and the classroom teachers act as coach for her. Then she facilitates, by covering their mathematics classes, teachers serving as peer coaches for each other.

For example, I observed two second grade lessons that Anita did several weeks apart. In the first lesson, Anita had students investigate growing patterns. She first modeled finding the first five steps in a geometric pattern on the overhead projector, engaging the children in finding the pattern and describing how it was growing. Next children were given pre-made patterns, first three steps, to copy with cubes, then extend to the fourth and fifth steps. Patterns ranged in difficulty and were exchanged as children completed them. Anita did this lesson in both classes for each teacher, discussing with the teachers the goals for the lesson and what individual children seemed to be understanding. Both teachers were impressed with what their students were able to do in this lesson, although it seemed that they had not done any work with patterning before this. Then Anita left the materials behind asking teachers to give children more practice in finding growing patterns and extending them. At the next lesson, a two-day one several weeks later, children had to complete five steps of a pattern with cubes, then color in the first five steps on inch grid paper, then make a poster of their pattern and a description of how it grew. This lesson ramped up the concept as children also had to fill in a table showing how many cubes were used at each step; this was also modeled with the whole group. Interestingly, Anita adjusted her instruction of the

second lesson in the second class, which immediately followed the first. One aspect of the lesson, looking for patterns in the 100s chart, confused the children. This difficulty and her adjustment provided interesting topics for discussion with the teachers after the lesson. Contrasting the children's interactions in the first set of lessons with those in the last, it was obvious that the classroom teachers had worked with patterns in the interim, as the children seemed much more comfortable copying a pattern concretely and semi-concretely, expressing the patterns they saw in words, and creating the next steps in the patterns.

In another lesson, Anita was acting as the coachee and the two teachers observed her teaching their classes, taking notes on areas of the lesson of interest to Anita: questioning; and checking for understanding via questions, asking for clarification, and asking students to repeat back directions. During the debriefing after both lessons, teachers were able to share concrete data relative to these focus areas of Anita's, which helped generate further discussion about students' understanding. This experience also served to lessen any anxiety the teachers might have had about getting feedback from Anita, as she volunteered to be first to receive feedback.

Thus Anita is acting as a model on several dimensions. She presents exemplary lessons and is always prepared with materials and manipulatives needed for the lesson. Her lessons always begin with a whole-group activity in which she models what she would like the children to do. She clearly does long-range planning as teachers can infer from the work she leaves for them to continue. She wants teachers to do peer visits, so she first models that to help them understand the process and feel comfortable with it. That is, she takes the first risks. Anita has become a model of coaching among peers.

The Case of Dana

Dana is an example of what I am calling "coach as director." She always begins the debriefing session by asking the teacher how s/he thought the lesson went. These two coachees usually give a rather general response to this opening. Then Dana proceeds to guide the teacher to reflect very specifically on the way the content was presented in the lesson and to generate alternate strategies and follow-up activities to enhance student understanding. She takes very detailed notes on the lesson, and, considering she does not have time between the lesson and the debriefing to review her notes, recalls very specific aspects of the lesson on which to focus. She will challenge the teacher mathematically by asking probing questions about the content and is not timid about pointing out errors or omissions related to content.

For example, in one lesson with Neil, the class was discussing a performance assessment item on a practice test:

> "Judy and her two friends buy a bar of candy. The candy bar can be divided into sixteen square pieces. Alice eats four pieces and Kerry eats eight pieces.

Judy eats the other pieces herself. What fraction of the candy bar does each of the three girls eat? Use the diagram to show how you figured it out."

Included was a figure of a square divided into 16 equal squares.

In the discussion of the problem that ensued, some students expressed the answer in sixteenths, while others used fourths. In trying to explain the equivalence, the teacher wrote: 4/4 x 4 = 16/16 In the debriefing, Dana began with the start of the class and discussed various aspects of the lesson before this incident. Then she showed him what he had written and asked for his reaction. Neil began a discussion of why 4/4 and 16/16 were the same because each gave 100% or 1 whole. He commented that he had not explained it well and asked if he were making sense. It seemed that he was trying to clarify that 4/4 of a whole small unit, e.g. a pizza, was not the same as 16/16 of a large pizza because the unit was different. Dana asked if he were trying to build equivalence at that point in the lesson, pointing out that the problem involved the same size model of one candy bar. Neil commented that he had four (pointing) columns to get 16/16. It seemed that Neil was confused between the small squares (1/16 of the whole candy bar) and a column of 4 small squares (4/16 of the candy bar) and thinking that 4 of the 1/4 pieces (or 4/16) should equal the whole candy bar. But he wrote 4/4 x 4 instead of 1/4 x 4 because he wanted the answer in sixteenths. Dana proceeded to help Neil, through a series of questions, to sort out the difficulty. Neil was very open to discussing this and clarifying his thinking.

Dana was quite astute in pinpointing the critical areas of possible misunderstanding in a lesson. For example, in another lesson observed, students were dividing various figures in half. Nearly all the students were striving to find two congruent pieces (not always possible given the irregular shapes). In the debriefing, Dana pointed out that the salient feature to ensure one half was area and that the two halves did not have to be congruent. In the final interview, Neil picked this incident out as an example of how the coaching had helped him. He felt he would not have analyzed that activity in that way without Dana's help in focusing on what was important mathematically. Thus in addition to teaching techniques that helped expand his repertoire of strategies, Neil felt he learned a great deal mathematically as well.

These mathematical issues, I think, would not have arisen in the debriefing if Dana had not raised them. That is, the teacher was not experienced enough to understand the nuances that Dana gleaned from the lesson. Thus her directness in guiding the teacher to new and deeper understandings was a critical component of her success as a coach. However, Dana was not confident that this level of intervention was ideal; she asked me several times for feedback on her coaching and whether she should intervene as she did. Note that, during the year of this study, the coaches in the sample attended a full-day workshop with Lucy West on content-based coaching. Dana and I discussed this model; while she felt that what we had seen on video had been too direct, with the coach interrupting the class at one point, she did feel the obligation to initiate discussion of content issues even if not broached by the teacher.

Discussion

This research identified three unique styles of coaching. These could be considered to range on a continuum from less to more directive. In this paper, three coaches were discussed who each modeled a style of coaching identified from the data: coach as collaborator; coach as model; and coach as director. Lewis, while quite non-directive, does raise questions regarding instruction that he tries to work through with the teachers through collaborative dialogue. However, the model Lewis uses precludes his focusing on individual teachers' instruction specifically. Lewis seems to have had a positive effect on the teachers with whom he works, however, by encouraging their own decision-making and by encouraging the collaboration that they have extended to all mathematics lessons on their own initiative. Anita uses a long-range plan of working with teachers by modeling instruction that actively involves the children in high level tasks as well as modeling the coaching process itself with her as teacher. Dana is much more of a guide to the teachers with whom she works. However, this direct guidance is accepted, at least on content issues, because of the way it is approached. By grounding comments in what the teacher did and what the students did and seemed to understand, Dana and her coachees became collaborative problem solvers in designing next steps in instruction. Of the three coaches discussed in this paper, Dana perhaps best represents the interweaving of content and pedagogy necessary for the improvement of instruction (Ball & Bass, 2000).

Although these three coaches had differing styles of working with teachers, there was one common thread through all of their work. All coaches aimed to develop a shared vision with client teachers of what a mathematics classroom should look like (Hargrove, 1995). Whether it was through cooperative lesson planning, modeling of instruction, or guiding the teacher to deeper reflection, the goal was to improve mathematics instruction by meeting individual needs. Coaches had a coherent, well-articulated conception of mathematics instruction themselves; this vision guided their work.

From the perspective of teachers who were coached, there were some salient characteristics that make coaches effective. These included: openness; fairness; non-judgmental demeanor; helpful; dependable; approachable; and, experience. Although the three coaches discussed here had different styles of coaching, all three exemplified these characteristics albeit in different ways. Coaches all perceived the coaching experience as improving their mathematics instruction. Most felt more comfortable and confident teaching mathematics now, and thought they had a more coherent view of the whole mathematics curriculum at their grade level. Teachers seemed to focus more now on the big ideas of mathematics rather than just following the textbook from page to page. They were more concerned with improving students' understanding of mathematics, and discussed more processes, such as problem solving, than skills when asked about their goals for mathematics instruction. The extra set of eyes and ears in

the classroom helped teachers really focus on what their students were understanding; together with the coaches, they were able to find ways to enhance that understanding.

The cases discussed here are thought-provoking because of their contrasts, and stimulate questions that will be investigated with the rest of the sample of coaches:

Is there a style of coaching that is most efficacious in promoting growth in teachers?

Is there a range of skills, dispositions, and domains of knowledge that are needed by a coach?

What is effective coaching?

How does a coach develop a practice of effective coaching?

Can coaching scaffold a teacher's lack of content knowledge?

Essentially I am looking for evidence that coaching is an effective form of staff development, one that supports effective implementation of reform principles (Saxe, Gearhart, & Nasir, 2001), as well as evidence that helps inform professional development of coaches themselves.

Finally, I would like to comment on my role as the observer. This varied considerably depending on the coach and the teachers with whom they were working. In all classes in which the coach was observing, we both actively participated in the lesson while children were working in groups or individually. During debriefing sessions, I mainly took notes, but occasionally I was asked my opinion of children's understanding by either the classroom teacher or the coach, or to check my notes to compare with the coach's. At their invitation, I would add my opinion. But I did not perceive my role as one of expert and neither did the coaches or teachers. Perhaps the most interesting discussions to me as a teacher educator were those with the coaches after their debriefing with the coachees. These discussions gave me further insight into the coach's intentions and future directions with specific teachers, a valuable window into the coaching process that could not be obtained by observation alone.

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