

MENTORING IN PRESERVICE MATHEMATICS TEACHER EDUCATION

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Mentoring is often assumed to be done by experienced teachers with new teachers in one-on-one settings and designed to help the mentee be successful with the tasks of teaching. In the context of preservice teacher education, mentoring usually takes place during field experiences, particularly student teaching when the mentor is the host classroom teacher. However, there is evidence to suggest that many preservice teachers are completing field experiences in classrooms that do not reflect a reform-oriented view of mathematics teaching. Thus, the mentoring they are receiving is not likely to help them craft reform-oriented teaching practices (Walkington, 2003). In addition, in many places, there is a shortage of field placements, period—whether of high quality or not (Walkington, 2003).

Further, and particularly in the case of preservice *elementary* teachers, the mentoring they receive may not be specific to mathematics at all. Mentoring is likely to occur around classroom management or pacing of the lesson. Even at the secondary level, there is evidence that conversations between mentors and mentees often do not revolve around issues that are specific to teaching mathematics (Wilson & Drumm, 2000). These situations suggest that mentoring of preservice teachers needs to be more broadly conceived so as to extend to the preservice teacher education classroom.

In this article, I present some examples of what mentoring might mean and look like in the context of preservice mathematics teacher education. In particular, I describe ways in which mentoring might be used in preservice teacher education to foster a sense of collegiality and inquiry into teaching and learning that are critical to successful mentoring relationship. To set up the discussion of mentoring in preservice teacher education, I first describe a fundamental shift in the focus of teacher education—from

apprenticeship to assisted performance—in order to re-envision mentoring in a preservice context.

Feiman-Nemser (2001) questioned the long-standing apprenticeship model of teacher education, in general, and field experiences, in particular, in which future teachers are expected to practice the things that they will be expected to do as teachers. In this model, preservice teachers are often expected to do tasks, such as taking attendance, collecting morning seatwork, preparing bulletin boards, and conducting calendar time, all of which involve mimicking the behavior of the classroom teacher. This apprenticeship model of teacher education often leaves preservice teachers with a feeling that the only way to learn to teach is to wait until they have their own classrooms and are able to devise their own methods of teaching. Lanier and Little (1986) cautioned that this "wait and see" approach makes it difficult for preservice teachers to see the range of possible decisions and actions available in teaching and results in a continuation of the teaching practices by which they were taught and a tendency to see these patterns of teaching as the only options.

Feiman-Nemser (2001) proposed an assisted performance approach to teacher education as an alternative to the apprenticeship model. She suggested that teacher education programs should provide an opportunity for future teachers to engage in tasks and activities that enable them to "learn with help what they are not ready to do on their own" (p. 1016). Viewing teacher education as assisted performance invites us to reconsider the tasks of teacher education, both in the university classroom and in the field experience classroom. This view of preservice teacher learning also opens the door to conceptualize mentoring as something that is done by teacher educators and by peers. To illuminate what it might mean to think of mentoring in preservice teacher education that is recast as assisted performance, I describe three tasks from my mathematics methods course that provided preservice elementary teachers with an opportunity to engage in assisted performance and in which they were mentored by peers, a teaching assistant, and the instructor. I describe each one in turn and provide data to indicate the ways in which mentoring helped them develop their thinking about mathematics teaching and learning.

Methods

The data reported in this article come from a five-year span of two cohorts of novice teachers. Data collection spanned the participants' professional education program (last two years of college) and first two years of teaching practice. The professional education program was a 60-hour, four-semester program leading to certification in grades PreK-5 and included two mathematics methods courses (3 semester hours each), which were taken during the first two semesters of the program. I was the mathematics methods instructor for all of the students in the study. The courses focused on understanding children's mathematical thinking and crafting teaching practices.

Data collected for the project include a mathematics beliefs survey, field notes for all class sessions, and all written work produced by the students during both mathematics methods courses. In addition, 15 target students were observed four times teaching a mathematics lesson and individually interviewed on four occasions as preservice teachers. They were also observed and interviewed regularly during their first two years of teaching.

For purposes of this article, I have focused on one of the target students, which I will refer to as "Karina", and data from the methods course and interviews during her preservice years. Karina was a Caucasian female in her early 20s. She was an excellent student, graduating with a perfect grade point average. In her initial autobiography she wrote; "I don't like math! I guess I am one of those strange students who do well at math but don't care too much for it. I believe math is highly important, and I do see the point of *someone* doing it; I just don't like to be that someone!"

Karina elaborated that she had test anxiety in mathematics, her parents also did not like mathematics, and that she would prefer to use a calculator to do practical things, such as balance a checkbook. I selected Karina as the focus of this article because she exhibited considerable change in her views about mathematics. I believe these changes were due to the mentoring she received from her peers and instructor while learning to teach via assisted performance tasks.

Mentoring Via Assisted Performance

In this section I describe three tasks from the first mathematics methods course that engaged the preservice

teachers in assisted performance. I describe each task, provide data from Karina to show how the component affected her learning, and elaborate on the ways in which this is a form of mentoring. The first task involved critiquing an essay written by a teacher as she reflected on her teaching practice, the second task involved working one-on-one with a child for an extended period of time, and the third task involved observing an experienced teacher.

Critiquing an essay by Vivian Paley

Early in the semester of the first mathematics methods course, the preservice teachers were asked to read a book chapter titled "On Listening to What the Children Say" by Vivian Paley (Paley, 1987) in which Paley explains how she became aware of the importance of listening to the children in her kindergarten classroom in order to uncover the meaning behind their words. The chapter does not address mathematics teaching; rather it describes classroom activities such as show-and-tell and the housekeeping center in the classroom. Throughout the chapter, Paley provides examples of things she heard children say, how she initially interpreted their words, and what she learned about the children's meaning when she continued to listen to and probe them for further explanation.

One particularly vivid scene resulted from a child's assertion that his mother no longer had birthdays. Rather than dismissing the child's comment, Paley asked the child to explain his statement. The child associated birthdays with cakes, which are baked by your mother. Since his mother's mother was no longer alive to bake a cake, he deduced that his mother could no longer have birthdays. By probing the child's statement, Paley uncovered a very logical, but incorrect, conception the child had about birthdays.

The preservice teachers had a vigorous discussion about the chapter with some suggesting that Paley had gone to extremes to make her point. In particular, they noted that it is simply not possible or desirable to probe every single utterance from every child. However, many of the preservice teachers found the chapter illuminating because it provided specific examples of situations in which Paley had the potential to underestimate, misinterpret, or dismiss a child's reasoning.

Following the discussion in class, students wrote reflective commentaries on the chapter. I made a deliberate pedagogical decision to have the students write their commentaries *after* the class discussion rather than before it because I wanted the students to hear their peers' reactions to the chapter and to have an opportunity to articulate their own views before writing the commentary. Karina's commentary provides evidence of how the reading and discussion helped her become more aware of her own beliefs and behaviors.

Karina related the Paley article to her prior experiences as an assistant in a pre-kindergarten classroom. She used it to self-critique her teaching of an individual child in mathematics. Karina struggled to teach the child because she wanted to jump in and "give" the child the solution. In her final portfolio recounting her field experience Karina wrote; "I have a bad habit of leading children to the answer instead of letting them discover their own way. I also want to jump right in with my own suggestions during the problem solving process."

Thus, Karina analyzed explicitly her teaching practices in light of Paley's descriptions of children's thinking and its impact on her instruction. I argue that this task represents an example of assisted performance because Karina was not yet ready to conduct this level of analysis on her own. Rather, she was assisted in analyzing teaching both by her peers and by me, the facilitator of the discussion.

This constitutes an example of "group mentoring" in which the preservice teachers were exposed to "broad themes of reform through discussions of highly contextualized problems of practice" (Feiman-Nemser, 1996, p. 2). The specific examples described in Paley's chapter provided the preservice teachers with "compelling alternatives" and "powerful images of good teaching" (Feiman-Nemser, 2001, p. 1017), both of which are functions of a mentor.

The experience of reading the chapter and discussing it with peers provided the preservice teachers with an opportunity to engage in what Feiman-Nemser (1996) called one of "the core activities of mentoring—observing and discussing teaching with colleagues" (p. 2). The chapter gave the preservice teachers an example of how one studies one's own teaching and that of others. Although some preservice teachers initially dismissed what they had

read, discussing the chapter with peers with support from the instructor helped them take a more open-minded approach to the text of the essay, to find something of value in the chapter, and to relate it to their own experiences. Left on their own to read the chapter and write a reflection, many preservice teachers were not yet ready to take Paley's ideas seriously. However, assisted by their peers and the instructor, the preservice teachers were able to engage in a meaningful discussion of what Paley meant, how it worked in her classroom, and the implications for mathematics teaching and learning. The fact that the preservice teachers continued to refer to the Paley chapter in their assignments for class and their interviews suggests that this was a powerful learning experience for them.

Field experience

Approximately four weeks into the mathematics methods course, each preservice teacher began to work one-on-one with a third-grader focusing on mathematics once a week for eight weeks (see Mewborn, 2000 for details of this field experience). The goal of the field experience was for the preservice teachers to learn to listen to and assess children's mathematical thinking and to plan subsequent instruction based on this assessment. Thus, the preservice teachers were encouraged to engage the children in problem solving rather than in computational work.

Throughout the field experience, two teaching/research assistants and I moved from pair to pair using a coaching model to provide input. For example, if a child solved a problem correctly and the preservice teacher was ready to move on to the next problem, I would interject and ask the child to explain her/his solution method. In this manner, I was able to model for the preservice teachers what I was teaching in the university classroom: the importance of uncovering children's mathematical thinking in order to inform subsequent instruction.

The field experience caused Karina to reexamine her focus as a teacher from a focus on *her* thinking to her child's thinking. After reading the Paley chapter, Karina said that figuring out student's mathematical thinking was difficult "because I have a hard time seeing things except in the way that I would have done it." She acknowledged that it was important to be able to approach a problem "from another

angle" if children did not understand the first approach. However, Karina concerned: "I could only think of my way, one way. I don't know how to do math from any other angle."

Karina's initial focus on her way of thinking resulted in problematic interactions with her student, Tonya. She was not very patient and tended to interject suggestions at the first sign that the child did not know exactly how to proceed with a problem. The assistants and I gave Karina a great deal of feedback, both in the form of written feedback on her plans and in the form of coaching during her lessons to alert her to these tendencies. Karina was very receptive to this feedback and was already somewhat aware of these tendencies. However, Karina found this extremely difficult, the child resisted Karina's attempts to "back off." Because of her earlier habit of providing directive feedback every time, Tonya was stuck. Karina created the expectation that she would give Tonya the answer and thus, Tonya became upset, frustrated, and even withdrawn when Karina tried to change tactics and withhold her input in favor of allowing the child to explore solutions on her own. In some sense, Karina went from one extreme—telling the child what to do at every turn—to another—providing no assistance.

Karina's peers and I responded to her by encouraging her to talk explicitly with Tonya about different kinds of mathematical problems, such as basic facts that have a single correct answer and a direct path to a solution or problem solving tasks that may have multiple correct answers and multiple solution paths. We encouraged her to tell Tonya that because there can be multiple solution paths to some problems, in order for Karina to help her, Tonya would need to ask for help when she was stuck and describe her thought processes up to the point.

Through this feedback, Karina came to understand that her goal was to find a middle ground in which she could provide encouragement, hints, and scaffolding without forcing the child into her way of thinking. In Karina's final reflection on her field experience she wrote, "It took a while, and it was difficult, but I think I'm better about not giving so many suggestions. I think I am realizing when Tonya needs help and when she really just needs me to let her think."

The field experience provided a forum for mentoring by the instructor in the areas of linking theory and practice, developing teaching skills and pedagogical strategies, and

analyzing and reflecting upon student learning. Because the preservice teachers worked weekly with the same child for a period of two months with on-campus class sessions interspersed with the fieldwork, they had an opportunity to engage in a protracted and deliberate study of the mathematical thinking and learning of a single child with ongoing mentoring from me. I was able to craft on-campus sessions to respond to things I saw at the school and to draw explicit connections between class work and fieldwork. Writing weekly plans, enacting them, and writing a reflection on the session gave the future teachers experience with designing appropriate instructional tasks, justifying pedagogical actions, assessing student learning, and communicating with other educators. I was able to provide individual mentoring by previewing their plans and making suggestions for modifications prior to the lesson. I also read their reflections after the lesson, making extensive comments, and often offering them articles, activities, and web sites to be investigated before the next teaching session.

Directing new teachers to appropriate resources that meet their immediate needs is a common function of a mentor. The teaching sessions themselves, coupled with support and challenge from the teaching assistants and me, enabled the preservice teachers to experiment with various methods of teaching, questioning, and assessing student learning in order to develop a preliminary understanding of what works best under which conditions. On-the-spot mentoring occurred when we modeled questioning techniques, helped to interpret students' thinking, or posed extensions of tasks.

Observing an experienced teacher

Toward the end of the first mathematics methods course, the preservice teachers were given an opportunity to observe and discuss a mathematics lesson taught by a mathematics specialist in a local school. The purpose of this task was to offer the preservice teachers an example of how the things they were learning in their methods class might be implemented with a full classroom of diverse learners (see Mewborn, 1998, Mewborn & Huberty, 1999 for a description of this teacher's practice).

The specific assignment given to the preservice teachers was to observe a lesson, discuss it afterward, and write a 500-word paper about the teacher's actions, the students' learning, and the connections between the two. Typically, several preservice teachers observed the lesson at the same time and thus had a peer group with whom to discuss the observation. Further, because different groups saw different lessons, there was an opportunity for rich discussion among the groups as well.

Observing the lesson showed Karina how the teacher can use the thinking and actions of the children to develop the mathematics lesson. She commented how shocked she was by how little the teacher said while the children were trying to decide what to do. She was sure that she would have jumped in there and tried to give them a hint and ruined the whole process!

Because Karina was struggling with her role as a teacher with Tonya, the observation seemed to reinforce her self-awareness. Further, Karina had an opportunity to see the rich thinking of which children are capable—something that she did not experience much with Tonya because she fluctuated between telling her what to do and telling her nothing.

This task is as an example of assisted performance because the preservice teachers were assisted in forming and articulating new visions of teaching. They were not yet capable of doing this on their own based on their limited teaching experiences and observations. The assistance in this case came from the experienced teacher, but note that this was not the result of an extended relationship with a teacher as is typically the case in a field experience. Rather, it was a single observation of a carefully selected teacher.

This task provides an example of mentoring that is similar to that of the Paley article task. In this situation, however, both the teaching and the mathematics specialist's reflections were live rather than textual. Feiman-Nemser (2001) suggested that studying the ways in which different teachers work toward the same goal could help preservice teachers develop the tools to study teaching. In this case, Karina was able to compare and contrast her own teaching of one child with the mathematics specialist's teaching in a classroom setting. Karina's comments suggest that she was beginning to appreciate the synergistic relationship between student learning and teaching.

Conclusion

Mentoring in preservice teacher education certainly has a different flavor than mentoring during the induction years, but it shares many of the same characteristics. A notable difference is that mentoring during the induction years is often done in response to issues raised by the novice that arise directly out of practice. For example, a new teacher may be having difficulty teaching a particular topic or may be apprehensive about upcoming parent-teacher conferences. With the exception of field experiences, the stimulus of one's own practice is generally missing from the mentoring that occurs in preservice programs. While preservice teachers have concerns of their own that could serve as fodder for mentoring, their concerns are often different from the concerns teacher educators want to address. For example, preservice teachers may be preoccupied with classroom management or may want a prescriptive solution to teaching students to memorize basic multiplication facts when teacher educators wish they were seeking advice on how to make textbook exercises more open-ended.

The purpose of mentoring, according to Hudson and Skamp (2002) is to guide "improvement and change in [mathematics] education by constructing knowledge about the curriculum, teaching, and learning. Tasks such as the ones described here, along with deliberate mentoring activities by teacher educators, can help preservice teachers become agents of reform one day. As much of the mentoring they will receive during their induction years will be generic, it is particularly important that preservice teachers receive subject-specific mentoring in mathematics methods classes.

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