Meet Katy

Katy is a typical mathematics methods student in her last year of teacher preparation. She has high hopes of becoming an elementary teacher, like her father. Katy is representative of “typical” students entering a mathematics methods course in terms of her content knowledge and tentative feelings about mathematical learning. In her autobiography, she states, “Math for me in elementary school was never much of a problem... I always received good grades.” She confides that she learned mathematics alone through “memorizing rules and doing worksheets,” and because of this is “not a confident mathematician, [and I] need the practice and experience [of teaching] to help me grow.” Katy feels that she has a minimal understanding of many important concepts that elementary teachers need to understand. She agrees that she is constantly “relearning math to understand and remember concepts that I learned before.”

For the most part, preservice teachers like Katy have a limited understanding of mathematical concepts (Ball, 1988, 1990, 1991; Brown, Cooney, & Jones, 1990; Flodin, McDiarmid, & Weimers, 1990; National Research Council, 2001; Steele & Widman, 1997; Stevens & Wenner, 1996). Although many preservice teachers know mathematical facts and procedures, learning opportunities (P-16) often fail to help preservice teachers gain a full understanding of the very concepts they will be required to teach (National Research Council, 2001). Perceived knowledge deficits in
mathematical content and teaching skills often erode preservice and new teachers’ confidence in their ability to teach a subject they do not fully understand (Karp, 1991; Levine, 1993) and they approach the teaching of mathematics with less than ideal attitudes (Frank, 1990; Sloan, Vinson, Haynes, & Gresham, 1997).

We, members of the teaching profession, have an obligation to support preservice and new teachers in their math teaching. As Katy’s story unfolds over a semester, consider the following questions and possible interventions.

Do we help preservice and new teachers understand the value of rehearsal?

Katy’s first lesson on exploring volume tells of her remarkable start in the class. She concocted a first grade lesson based on two exploratory activities that asked students to estimate and compare the volume of containers of various sizes and shapes. After ordering them by size, students were required to find a way to determine the accuracy of their answers by using only one of the containers and some rice. Katy enacted the lesson very well, as she states, “I felt like I was prepared so I came in confident I guess, even though I was scared and nervous. I knew exactly how I wanted the lesson to go.” Usually first lessons are not as successful as Katy’s, so I asked her how she prepared for her lesson. Katy identified three problems she needed to solve in order for her lesson to go smoothly. First, she questioned how she could teach the lesson “so I don’t have too many instructions and don’t do too much telling.” Second, she wanted her students to discover the concepts. Third, she was concerned about the sequence of activities. She attacked these problems in a number of ways. She relates, “I thought about this lesson for a week… I tried to think of every way to do it.” Then Katy took planning one step further; she rehearsed her lesson. She states, “I used rice, beans… and I filled quite a number of containers until I found the best ones. My whole kitchen table was covered with containers and beans.” In addition to her rehearsal, Katy also consulted with her lesson partner, her father, a kindergarten teacher and me. Katy’s only regret about her lesson was that she should have done a more thorough job of reviewing the concepts her students discovered.

Katy’s use of rehearsal ensured a successful lesson. She realized that just reading through the activity and planning without physical and mental rehearsal would lead to a poorly constructed and executed lesson. As mentors of preservice and inservice teachers, we need to help them understand the advantages of rehearsal through demonstration and sharing our self-talk as we plan and prepare for our lessons. We often take for granted that they understand the benefits of something as simple as rehearsal.

Do we adequately help preservice and new teachers think through lessons in detail?
Do we help preservice and new teachers learn how to collaborate?

Katy did not experience the same success with her second lesson on finding the average student using mean and mode. Katy and another peer teacher teamed to teach this lesson because of time constraints and the complexity of the lesson. Katy remarked, “… we didn’t mull it over like the first one… a lot of stuff we just hadn’t thought about… I didn’t know what my partner was planning on doing.” When asked what indicators made her question the lesson’s success, Katy remarked, “I got a lot more questions in the second lesson. ‘How should we do this?’ We hadn’t thought about how we would do some parts of the
lesson… that is why it didn’t feel like it went so well.” In her reflective lesson response, Katy adds:

I will think my instruction through more next time. I will try not to be overwhelmed when I get questions. I feel as if I didn’t explain good enough. I need to evaluate the kinds of questions… Questions aren’t necessarily negative.

Communication is essential to clarify roles and responsibilities when team teaching. The team did not determine what sections of the lesson they would teach and stumbled through the lesson, repeatedly interrupting each other. To compound a difficult situation, neither team member adequately examined or rehearsed the lesson, so students’ misinterpretations and questions caught them off guard.

Cooperating teachers, mentor teachers, and methods teachers should share their perspectives and methods of analyzing a lesson for student misconceptions. They should share the questions that must be answered when planning a lesson: What concept needs to be addressed? What activity will best help all students understand this concept? Are these examples appropriate for the students being taught? What part of the lesson will some students misinterpret? How can I keep this lesson challenging from start to finish for all students? Is this lesson better taught in a whole group or should I break into small groups for some of the time? What questions can I ask to make sure students understand the concepts? Preservice teachers need to realize that all teachers struggle with questions like these continually.

Do we adequately prepare preservice and new teachers to match the curriculum with where children are?

To enhance the learning in their block of methods classes, preservice teachers were asked to perform course assignments in local school district classrooms. Katy was assigned to a fourth grade field placement classroom one morning a week throughout the semester with a full week scheduled near the middle of the semester and another full week at the end.

Katy’s field experiences were less than ideal. She was asked to perform the usual tasks like designing bulletin boards or running off worksheets, but was seldom given the opportunity to work with children. During her intensive teaching week, she repeated her second peer teaching lesson in her field experience classroom and experienced many problems, “I was being bombarded with questions… so I felt like I was explaining things that I have already gone over.” When asked what factors contributed to her problems, she replied,

… they are not used to doing activities… they do worksheets and… never use manipulatives… they [students] are either in a large group or doing individual seat work. When I come in and do activities or group work, there is chaos.

Katy also identified two additional elements that contributed to problems with the lesson. First, her lesson was taught out of context. The class was not studying measurement or data concepts and the lesson relied on understanding both. Second, she had little opportunity to accurately assess what her students would be able to do since she rarely worked with the students in her class. Katy’s cooperating teacher tried to allay her feelings of failure, confirming that her students were not used to cooperative learning activities and being able to move
about the class to do projects, but Katy was not comforted by her words.

Preservice teachers need to learn about children’s mathematical thinking through interaction with students on conceptual tasks. Katy was busy running copies, cutting out bulletin board designs, and grading papers, while other preservice teachers were working with small groups of students on assessment tasks, helping individual students with difficult assignments, and even teaching whole class lessons. Communication between Katy’s university supervisor and cooperating teacher could have prevented this problem. Clear expectations for participation need to be agreed upon by the university supervisor, methods teachers, and the classroom teacher, so the preservice teachers’ roles and responsibilities are defined. Once this is done, they need to be monitored and maintained.

Katy and her cooperating teacher also needed to improve their communication. She needed to share her teaching plans with her cooperating teacher, and together, they should have scrutinized their feasibility. Honesty can also be an issue. Many mentor teachers are worried that criticism of preservice or new teachers’ work will lower self-esteem, but a failed lesson can be much more devastating, as in Katy’s case. Joint preparation and a candid debriefing of each lesson are suggested ways to avoid this situation.

Sometimes there is a disconnect between teaching practices used in the field and those advocated in methods courses. Preservice teachers are instructed to think about and teach according to the *NCTM Principles and Standards for School Mathematics* (2000) in their methods classes. The process strands of problem solving, reasoning and proof, communication, connections, and representation are stressed. Cooperating teachers and mentor teachers need to ask themselves: Do I structure investigations that will help students understand mathematical concepts? Do I ask student to discuss and justify their answers? Do I ask students to work cooperatively to solve problems? Do I help students make connections between related concepts? Do I use models and manipulatives to help students make sense of mathematical concepts? If these practices are not used in the field experiences classrooms, preservice teachers with limited teaching experience will not be able to successfully impose new practices. Cooperating teachers need to honestly assess their methods of teaching and align their practices with the process strands.

Do we help preservice and new teachers understand and value content knowledge?

Katy’s last lesson involved the probability concept of drawing with and without replacement. Since this was our last day of class, Katy approached me to ask if we would get to her lesson. When she realized we would, she was visibly upset because she had not planned for it. As usual Katy came to class early, so I handed her resource books with possible lessons she could use for reference and she quickly planned her lesson. Katy reflected in her journal, “My lesson went okay but not great. It proved to me how important planning and [having] time to think about a lesson is to teaching. I didn’t feel confident going in or coming out of the lesson.”

Fortunately for Katy, she knew enough mathematical content to understand the lessons and had some time to prepare. Many preservice and new teachers would have struggled with the teaching of less familiar concepts without support. Through rehearsal strategies, Katy was able to remember the concepts she was taught in
previous years, but other cases in the study were not as successful and their teaching often confused students. Before teaching, all teachers need to fully understand their topic, be able to analyze how children will best learn this mathematical concept, anticipate children’s reactions (understanding as well as misconceptions), and create appropriate interventions. Methods teachers and cooperating teachers need to provide resources and build in measures to check for concept understanding. Questioning, requiring knowledge packages, concept webs, and/or detailed meta-cognitive journals about concepts are a few ways to determine content knowledge so resources can be provided.

Conclusions

How could a strong starter like Katy change so drastically over a semester’s time? What caused her to change from a well planned, confident teacher, using successful rehearsal strategies, to a mediocre teacher gradually losing faith in her abilities? A reoccurring theme is that Katy lost sight of the value of rehearsal. Although she was successful using it in her first lesson, she didn’t connect her success to her preparation process. Mentor teachers can help by emphasizing that rehearsal is a tool that even veteran teachers use.

Second, Katy could not relate her teaching to the needs and prior knowledge of her students. Through no fault of her own, she did not have experiences that would lead her to understanding how children think and reason mathematically. Successful teaching depends on constructing tasks that help children make sense of concepts.

Communication is another pervading issue. Conversations about planning and effective teaching practices needed to occur continually. Katy needed her cooperating teacher’s insights into students’ background knowledge and long-term goals. Katy was also a victim of a communication lapse between cooperating teacher and university supervisor. Her roles and responsibilities in her field experience classroom should have been defined and discussed.

Katy also confessed that she had a minimal understanding of what she was teaching. Through rehearsal, learning about children’s mathematical thinking, conversations, and other professional development activities, preservice and new teachers can make connections to their prior knowledge and bring forgotten or misunderstood concepts into focus.

I ask you to consider what Katy’s story has to tell us and reflect on your role in the math education community. What can you do to prevent Katy’s story from happening to another new teacher?

References


