DOCUMENT RESUME

ED 355 093 SE 053 183

AUTHOR McDiarmid, G. Williamson; Kleinfeld, Judith, Ed.
TITLE Kathy: A Case of Innovative Mathematics Teaching in a Multicultural Classroom. Teaching Cases in Cross-Cultural Education Series, No. 9.
INSTITUTION Alaska Univ., Fairbanks. Center for Cross-Cultural Studies.
REPORT NO ISBN-1-877962-24-4
PUB DATE 92
NOTE 43p.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Case Studies; Constructivism (Learning); Culture Conflict; *Discovery Learning; Discovery Processes; Discussion (Teaching Technique); Elementary Education; Higher Education; *Instructional Innovation; Mathematics Education; *Mathematics Instruction; Models; *Multicultural Education; Parent Teacher Cooperation; *Preservice Teacher Education; Problem Solving; Teacher Effectiveness; Teaching Methods
IDENTIFIERS *Educational Issues

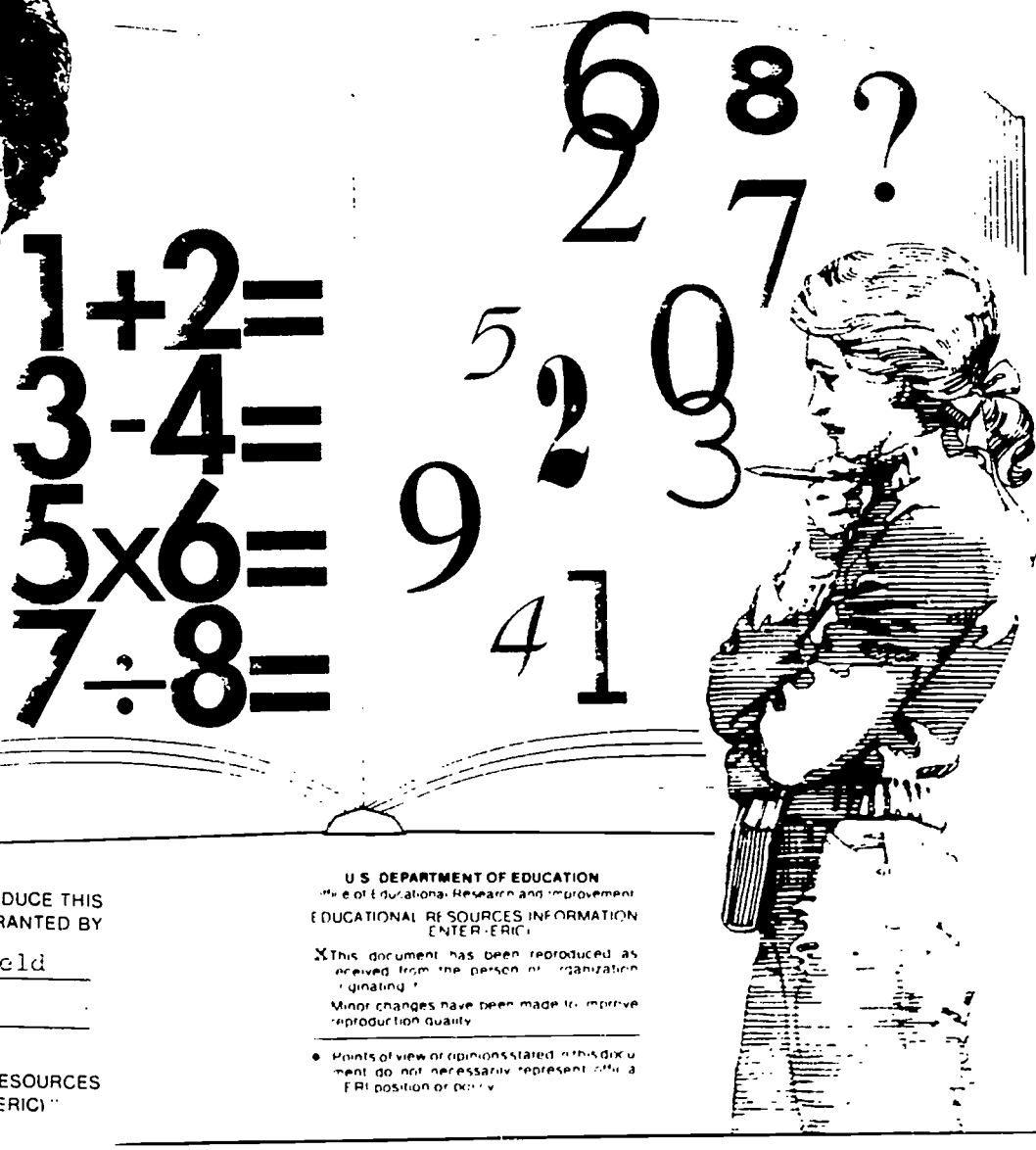
ABSTRACT

Teaching cases have been utilized in professional training and can offer dramatic accounts of problems teachers may confront in the classroom. This case study examines a fact-based story of a third-grade teacher's confrontation with the mother of an African-American child who disagrees with the innovative approach utilized in her child's mathematics classroom. The booklet is designed for use in the preparation of elementary school teachers and presented in seven sections. The bulk of the document is the presentation of the case: a description of the conflict between the teacher and the mother, a description of the teaching methods utilized in the student's third-grade classroom, and an account of the parent conference in which the confrontation arose. The sixth section provides background and context information on Kathy, the teacher; the multicultural makeup of the classroom; Kathy's preservice preparation for teaching mathematics; a description of the school and school community; Kathy's efforts to find an effective mathematics teaching model; and Kathy's decision to adapt a teaching method based on research and writings that envision mathematics as a sense-making process. The last part of the document raises questions that form a framework from which to discuss the issues involved in the case study. Additional reading suggestions are included. (Contains six references.) (MDH)

Kathy

A Case of Innovative Mathematics Teaching in a Multicultural Classroom

by G. Williamson McDiarmid
edited by Judith Kleinfeld



Center for Cross-Cultural Studies

Fairbanks Alaska
99775-3992

Kathy

A Case of Innovative Mathematics Teaching in a Multicultural Classroom

G. Williamson McDiarmid
Associate Director
National Center for Research on
Teacher Education
Michigan State University
East Lansing, Michigan

Edited by Judith Kleinfeld
Teaching Cases in Cross-Cultural Education
College of Rural Alaska
University of Alaska Fairbanks

1992

Center for Cross-Cultural Studies
The University of Alaska Fairbanks, Fairbanks 99775-0420

Published 1992.
Printed in the United States of America

Elmer E. Rasmuson Library Cataloging-in-Publication Data

McDiarmid, G. Williamson.
Kathy: a case of innovative mathematics teaching in a multicultural classroom / G. Williamson McDiarmid, edited by Judith Kleinfeld. Fairbanks: Center for Cross-Cultural Studies, University of Alaska Fairbanks. 1992.
p. cm.
ISBN 1-877962-24-4

1. Education, Cross-cultural studies. 2. Intercultural education. 3. Mathematics—Study and teaching. I. Kleinfeld, Judith. II. Title. III. Series: Teaching cases in cross-cultural education; no.9.
LC1099.M33 1992

Table of Contents

Introduction

Kathy tells the story of a talented teacher who introduces a new way of teaching mathematics that is based on achieving mathematical understanding rather than learning mathematical rules. Kathy Hamilton is convinced that this innovation, consistent with the most recent research in mathematical education, will benefit all students but especially children of color.

An African-American parent, Denise Carter, challenges her innovation. How can a teacher justify spending an entire classroom period discussing one problem? How can she let children waste time arguing about the answer to a problem and hearing misinformation when the teacher knows the right answer? Ms. Carter wants her daughter Yolanda to learn mathematics well and to do well on standardized tests, not to serve as a guinea pig for yet another white liberal reformer. African-American children, Ms. Carter believes, learn best under the firm but caring authority of an adult who presents in a clear and structured way the material that the children should learn. Ms. Carter intends to take up Kathy's mathematics class with the principal and demand an individualized study program in mathematics for Yolanda.

This case raises central questions in the teaching of mathematics and in the teaching of children from different cultural backgrounds. Why have standard ways of teaching mathematics been a failure for so many children, especially children of color and young women? Is this new reform going to end up as discredited as the "new math" of the 1960s? How is mathematics best taught, and how should innovations be introduced? Does one approach to the teaching of mathematics work best for all children, or are different approaches needed for children of different cultural backgrounds?

The case of *Kathy* provides an opportunity for teachers to reflect on such critical issues. While Kathy Hamilton is a composite character, the story is based on a teacher's actual experience in introducing this innovation in mathematics teaching. The dialogue in the case is taken from a transcription of a third-grade classroom in which this mathematical innovation is used.

While this case is based on a real-world situation, we are not suggesting that Kathy's case is representative in any statistical sense. But such situations arise and do raise issues of importance in teaching.

Purposes of Teaching Cases

Teaching cases have long been a cornerstone of professional preparation in schools of law, business, and medicine. Teacher educators have begun to explore their value in the preparation of teachers (Merseth, 1991; Shulman, 1992; Doyle, 1990).

Cases offer rich, dramatic accounts of the problems teachers actually confront in the classroom. As McRobbie and Shulman (1991) point out:

> Cognitive psychologists like Rand Spiro and his colleagues at the University of Illinois point out that principles alone tend to confirm the novice's already oversimplified notion of what teaching is all about. Cases, by contrast, illustrate how complex teaching really is, thereby better preparing newcomers for an "ill-structured domain" where there are few clear right or wrong courses of action. Advocates of case methods hope that with practice in analyzing a variety of cases, individually and in groups, students will learn to think like professionals. (p. 1)

Cases increase teachers' abilities to:

- identify the issues in a troubling situation and frame these problems in productive ways,
- understand the complexity of professional problems and how ethical, interpersonal, and policy issues may be implicit in classroom decisions,
- apply theoretical concepts and research findings to concrete situations, and

- identify a number of possible strategies for handling situations.

A good case, like a good story, also gives pleasure. Students typically enjoy reading cases and thinking about these human dramas.

Studying and Teaching a Case

To encourage students to think about the issues and come to class with a position on them and a strategy for dealing with the problems, we often ask students to read the case before class and write a one to two page paper analyzing the case and recommending a course of action. In the case of Kathy, for example, the case leader might ask students to come to class with a paper describing how Kathy Hamilton should handle a meeting with the principal and Yolanda's mother and justifying the course of action they have selected from the perspective of both mathematics education and intercultural relationships.

The recommended readings that follow the case will give students greater understanding of the views of African-American parents and educators as well as an introduction to competing approaches to the teaching of mathematics. Role playing the meeting between Kathy Hamilton, Ms. Carter, and the principal can make these issues concrete and dramatic and provide concrete examples for discussion.

To help students consolidate what they have learned from the class discussion of the case, we often ask them to write a reflective paper on the case afterwards. We hope to find a more complex analysis of the issues and an increased repertoire of potential strategies for dealing with them.

In reading and teaching a case, the following types of questions are often helpful. Most have been culled from the instructor's guide to *Teaching and the Case Method* (Christensen, Hansen, & Moore, 1987) and from discussions about case method teaching (Christensen, 1987). These questions are:

1. What are the central issues in this situation? Which are the most urgent?
2. What, if anything, should anyone do? Why do you think so?

3. How would you evaluate what the teacher did up to this point? What other options does the teacher have?
4. How do you think this situation appears to others in the case: the students, parents, or principal?
5. How did this situation develop? What, if anything, might alter the basic conditions that created the present difficulties?
6. What, if anything, have you learned from the case?

A case discussion usually benefits from students talking and arguing with each other, rather than directing comments to the teacher alone. Arranging student chairs in a semi-circle or using a classroom with swivel seats encourages such student-to-student dialogue. The case leader can also suggest that students direct their comments to the last speaker, raise questions with each other, comment on each other's responses, and take responsibility as a group for analyzing the case.

While student dialogue is desirable, the case leader should also take an active role in presenting helpful information. At strategic points, the case leader can bring up research findings or theoretical perspectives that illuminate the case. Many students appreciate a structured closure to a case discussion. Some case leaders summarize the issues of the case and the insights that have come up. Others ask students what they have learned from the case. Still other case leaders use the closure to present a conceptual framework, prepared in advance, that organizes the various issues of the case.

References

Christensen, C. R., & Hansen, A. J. (1987). *Teaching and the case method*. Boston: Harvard Business School.

Christensen, C. R., Hansen, A. J., & Moore, J. F. (1987). *Teaching and the case method: Instructor's guide*. Boston: Harvard Business School.

Doyle, W. (1990). Case methods for teacher education. *Teacher Education Quarterly*, winter, 7–15.

McRobbie, J. & Schulman, J. (1991). *Case methods: A knowledge brief on effective teaching*. San Francisco: Far West Laboratory.

Merseth, K. (1991). *The case for cases in teacher education*. Washington, DC: American Association for Higher Education.

Shulman, J. H. (Ed.). (1992). *Case methods in teacher education*. New York: Teachers College Press.

List of Characters

Kathy Hamilton	A veteran elementary school teacher
Denise Carter	African-American mother of Yolanda
Yolanda Carter	African-American third-grade student of Kathy's
Dr. Peters	Principal of Avendon Elementary School
Professor Toussaint	Dr. Peters' former doctoral advisor

Conflict

It was parents' night at Avendon Elementary School. Denise Carter, the mother of third-grader Yolanda, was working to keep her agitation under control. She didn't want her tone to betray the anger she felt as she talked to her daughter's teacher. She thought the young white woman across the desk from her, Kathy Hamilton, meant well. But she was deeply concerned about what her daughter was learning, especially in math. She wasn't sure how to proceed. Should she suggest tactfully that the teacher take a different approach to teaching math? Should she ask that Yolanda be put into her own math program? As she sat by the teacher's desk, her handbag gripped tightly in her lap, Ms. Carter tried to concentrate on what Kathy was saying to her.

From the way Ms. Carter clutched her handbag and avoided Kathy's eyes, Kathy knew the woman, sitting erect on the edge of her chair, was upset. Kathy wasn't sure why. The week before this meeting, Ms. Carter had taken Kathy up on her invitation to come in and observe the class. Now, Ms. Carter was questioning Kathy about her approach to teaching mathematics—a new approach Kathy had adopted this year.

"You see," Ms. Carter was saying, "I have worked as a special education and Chapter I aide, and I'm taking courses to become certified. That experience plus my experience as a parent makes me wonder about what the kids are doing in math. I'm worried, frankly, that Yolanda won't learn much math this year and will get further behind."

"I understand your concern," answered Kathy, speaking deliberately. "I know that in my classroom it appears as if the kids are just talking. It also takes us a long time to arrive at the correct answer. But I run things this way for a reason. Just because students are sitting at their desks with their heads down doing row after row of calculations doesn't mean they are learning math. The way I'm doing things now, my students have to understand why they get the results they get. They have to be able to explain their answers to me and everyone else. I also know that it takes different kids varying lengths of time to understand. In our discussions, different students use different explanations and examples to explain things. I think this approach increases the opportunities students have to connect with an example or explanation that makes sense to them."

Kathy, who is white, had taken an entirely new approach to teaching math this year. After several years of teaching, she had grown to believe that conventional approaches to math weren't serving many, perhaps most, of the children in her class, particularly children of color. She was stunned and hurt by Ms. Carter's criticisms of her teaching.

After observing her daughter's third-grade math period, Ms. Carter was upset. She had seen her daughter and the other students discussing one simple arithmetic problem for most of the period without resolving all the differences in their solutions before the end of the period. She could tell from Yolanda's homework that Ms. Hamilton was trying to involve the students in thinking about the math they were learning. Yet Ms. Carter was worried that Yolanda, who has had problems with math in the past, would fall even further behind. She wanted Yolanda learning her times tables and doing lots of practice problems at home as well as at school. Ms. Carter had no intention of allowing her daughter to become another African-American victim of what she viewed as white liberal educators.

Kathy Hamilton had changed her teaching of mathematics to deal with the kinds of problems she had noticed children have in remembering the math they learn. Working with a faculty member from a nearby university, she developed a different approach to math in which students articulate their understandings and must rationalize these to their classmates. In the process of trying to explain why they think what they think, the students must

reflect on the soundness of their own ideas and arguments. As students work together to figure out various problems and what makes sense, they become a community focused on mathematics.

Kathy didn't know what to do. She realized that Ms. Carter knew much more about African-American children than she did. Yet she didn't believe that conventional approaches, including individualized programs, help most children develop the kinds of understandings that will enable them to succeed now, much less later in school when they will encounter more complicated mathematics. Should she insist that Yolanda continue with the rest of the class and risk Ms. Carter's wrath or concede that she may be right about African-American children and put Yolanda on an individualized program? More fundamentally, is Ms. Carter correct in believing that the kind of teaching Kathy practices victimizes African-American and other children of color?

Teaching Mathematics: A Third-Grade Class

Singly and in small groups, the third-graders came in from recess, got out their mathematics notebooks, and wrote down the problem their teacher, Ms. Hamilton, had written on the chalkboard.* The problem for the day was: "Write down at least ten numbers. Add 20 to each of these numbers. Circle all answers that are even."

As usual, Kathy gave the students a few minutes to work on the problem. As her students worked, Kathy, a small, energetic young woman in her early 30s, circulated around the room, looking over their shoulders at what they were writing. A few students talked quietly to their neighbors about the problem. Several also asked Kathy about the meaning of the problem. A few minutes into the class, she interrupted the students' writing time.

"People seem to have a lot of questions about what I've written on the board. What do you think the first part of what I've written means?"

Several students put their hands up. Kathy waited, as she had learned to do, to give everyone a chance to think about the

* The classroom dialogue is based on an actual transcription of a third-grade class. The dialogue between Ms. Carter and Kathy Hamilton is based on discussions with the actual people whose beliefs and actions form the basis for these two characters. While the case and the pedagogical dilemma are shaped by the experiences of Deborah Ball, Kathy Hamilton is a composite character. Professor Ball's writing about mathematics and her teaching have significantly influenced my own understanding of teaching mathematics.

question. Soon, half of the 24 pupils had their hands up. "O.K., Cindy, what do you think it means?"

"It means ten numbers or more." As Cindy finishes her sentence, a couple of hands go up.

"What makes you think that is what it means?" Kathy asked.

Cindy hesitated, looked at her notebook. "Because 'at least' means that many: 10, or more than ten."

"And what do others think?" Kathy again waited, even though several students had their hands up. "Heather."

"I think it means ten but not more than ten. Because if it was more than ten then it would say that."

"So you disagree with Cindy? O.K., anyone else want to challenge Cindy's interpretation? Ahmed?"

"I want to challenge Heather. How can she say . . ."

Kathy interrupted the student, saying, "Ahmed, would you please talk to Heather? It's her idea that you are challenging."

Ahmed turned in his chair so that he was looking at Heather. "If it was like you said, then it would say 'equal to 10,' not 'at least' ten. 'At least' means that it can't be any less than 10."

"Bill, you wanted to say something?" asked Kathy.

"I agree with Ahmed. It can't be less than 10."

"And what do you think now, Cindy?"

Cindy stared at her notebook for a few seconds and then answered, "I want to revise what I said before. I think it means 10 or more than 10, like Ahmed was saying."

"Sarah, do you want to say something?"

"I want to challenge Cindy and Ahmed."

"Why?"

"Well, I think it means it could be more than 10 or less than 10. That's what 'at least' means."

A half-a-dozen hands went up before Sarah had even finished her sentence.

"Why does that make sense to you? " Kathy asked.

"It says 'at least' so it's not exactly 10. It could be more or it could be less."

"What makes you think it could be less?"

"It says 'at least' so that could mean 'less.'"

"Is 'less' the same as 'at least'?"

Sarah studied her notebook. Kathy waited, ignoring the hands raised all around her. After about ten seconds, she said, "Why don't you continue to think about it? When you've figured out how to say why you think what you think, you can tell us."

The discussion had taken about ten minutes. Kathy hadn't been at all uncomfortable spending that much time talking about what the question asked. She had discovered that students frequently misinterpreted problems in mathematics. At first, she thought discussing the meaning of the question was important primarily for the many students in her class whose proficiency in standard English was quite limited. Through discussions like these, however, she had discovered that students fluent in English were as likely to misinterpret problems as were their less proficient classmates.

Kathy then suggested that they begin discussing the students' solutions for the problem of the day: "Write down at least ten numbers. Add 20 to each of these numbers."

As usual, Kathy waited while hands were raised and then said, "Safussah?"

"220 and 240."

"Why does that make sense . . . Kevin?"

"He did 20 + 20 equals 40," he answered.

"Any comments about that?" Kathy asked.

After several other students offered their explanations, Kathy asked for another response.

"75 and 95."

"Why do you think this, Paula?"

"Because you add a 2 to a 7 to get the 9."

Wondering whether Paula understood that the 2 and the 7 were tens, Kathy probed, "And why did you add 2 to the 7?"

"If you have 1 batch of 10 for 1, you need 2 batches of 10 for 20." Inwardly, Kathy smiled at Paula's response.

She surveyed the class and realized that Janie had been quiet so far today. Kathy asked, "Janie, what did you come up with for this problem?" Janie paused, looking over her work in her notebook, and then, slowly, she explained, "I noticed a pattern. Whenever we started with an even number and added 20, the answer was even. Whenever we started with an odd number and added 20, we ended up with an odd number."

Kathy looked at her. "Why do you think that is?"

"I'm not sure," responded Janie. "I just noticed it. That's what I'm trying to figure out."

Several hands were up. Kathy called on Robert. "I said $1\frac{1}{2}$ plus 20 equals $21\frac{1}{2}$—and it starts out even and ends up odd. So I don't think Janie's idea works all the time."

Kathy looked at the problem she had written on the board and realized that she had not specified that the problem should deal only with whole numbers. Rational numbers, like $1\frac{1}{2}$, are not classified as either odd or even; that classification scheme applies only to the natural numbers. Kathy wondered what the students would make of Robert's "counterexample."

Janie looked down at her notebook for a moment and then, raising her eyes to look solemnly at Robert, said, "I don't think $21\frac{1}{2}$ is odd. 21 is odd, but $\frac{1}{2}$ is not even or odd. So $21\frac{1}{2}$ isn't either."

Several other students nodded in apparent agreement.

But Ahmed objected strongly, noting that the problem didn't say you could use fractions. Larry responded, "That doesn't matter. I agree with Janie that they are not even or odd. So if you work with fractions, you just have to say that the answer is not even or odd."

Kathy commented that she was glad to see them being so careful about whether the question made sense for a particular situation—like fractions or whole numbers.

The conversation had continued for another 15 minutes, moving from a discussion of what made a number even to Janie's idea that numbers remained odd or even when 20 was added. Kathy, as she typically did, asked students to explain how they reached the conclusions they reached. When students disagreed, she encouraged them to explain to one another why they disagreed. Whether the students' conclusions were right or wrong, she asked for them for their reasons.

Her entry in her notebook for the day included the following:

The discussion in math today makes me think that the kids are beginning to see the pattern of even and odd numbers as well as the effects of adding multiples of 10 to a number. Again, language came up as a primary source of confusion. Adult native speakers take for granted that kids understand phrases like "at least." Our discussion today revealed that children may interpret such phrases in ways that adults cannot imagine. Negative numbers came up again. Njama offered as an example -20 + 20 = 0. This rekindled the debate about the nature of zero. Is it a number? Is it nothing or something? Is it odd or even? Fascinating stuff. Jeannie seemed alone in insisting that zero was even: She used the number line to argue that it had to be even because +1 and -1 were both odd and the pattern of numbers was odd, even, odd, even. . .. And Janie's conjecture—that a number would remain either even or odd when 20 was added to it—was GREAT. I think they are pretty close to being able to actually prove why this happens, although Robert's counterexample of 21½ worried them. They think that maybe there would be still other exceptions.

Heather thought maybe it wouldn't work with really BIG numbers like 2,000,000,987,000,114. I like how they are beginning to be able to sniff around the critical boundaries—like 0 or large numbers or negatives—to decide how likely it is that the conjecture is true. They are making really good progress on figuring out if ideas make sense—without me telling them every last thing.

Yolanda's mother, Ms. Carter, visited during math class today. She is a tall woman who exudes confidence. I see where Yolanda gets her height and grace. I had hoped she would stay around after the math—I was eager to hear what she had to say. But she left immediately after the discussion.

Confrontation

During the parent conference from which the quotation at the beginning is taken, Ms. Carter tried to express her concerns about Kathy's teaching in a way that impressed on Kathy how strongly she felt and, at the same time, helped the white teacher understand that African-American children must perform especially well in conventional terms. That is, they must score well on standardized tests. Kathy, for her part, tried to explain why she taught mathematics as she did and why she believed this was in the best interest of all children, especially poor children and those of color. In response to Kathy's defense of why she has her students explain their solutions to the whole class, Ms. Carter replied:

"And what if they are wrong? What good is it for the children to sit there and hear a classmate give an off-the-wall explanation of a wrong answer? Doesn't that just imprint the wrong information in their minds or at least confuse them?" retorted Ms. Carter.

"But I think," Kathy responded, "that the students can figure out what does and doesn't make sense for themselves. That's the whole point: For us, as a class, to decide what does and doesn't make mathematical sense. I want them to develop a view of themselves as people who are capable of deciding whether or not something makes sense in mathematics. That's the only way they will become independent learners. But it takes time: We have to take the time to talk about why the different solutions and ideas they come up with do or do not make sense."

"But they're only children. How are they supposed to know what does or doesn't make sense in mathematics? I'm an adult and I don't always know what does and doesn't make sense in mathematics. But I could add and subtract and do a little algebra—enough to get me into college and through my courses."

Ms. Carter leaned forward in her chair, resting her elbows on her knees and looking directly at Kathy. "Look," she continued, "the only way you get along in school is by doing well on the tests. Yolanda doesn't do well on the tests—I never did. I know that African-American kids in general don't do well on standardized tests. I'm worried that the way you are teaching is not going to help her. The way you are teaching may be just fine for kids from white middle-class homes. But African-American kids need more structure. And if kids like Yolanda need more structure, then it's doubly true for poor and lower-middle class kids. A lot of them come from home situations where there isn't much structure. They need to have high expectations set for them and then the structure and emotional support to meet those standards. They need textbooks, workbooks, and worksheets. They need homework, rows of problems to do. They need loving, caring discipline. They don't need to be running all over the classroom visiting with their friends."

Kathy twisted the pen she held in her hand. From this last remark, Kathy could sense for the first time the full depth of this parent's anger. Evidently unable to convince Ms. Carter of the pedagogical soundness of her math teaching, Kathy's own frustration was mounting. At the same time, her sense of uncertainty about what she was doing was exacerbated by Ms. Carter's argument about African-American children. Maybe she was right. Maybe what Kathy was doing was actually more harmful than helpful.

Taking a deep breath, Kathy answered, "Ms. Carter, I'm sorry if that's what you think my students were doing on the day you came to visit. Every day, they spend part of math working in groups. I do this because I want them to have the opportunity to learn from and with others. People who use mathematics in the world of work don't work in isolation. Why should my students have to?"

"Yes, but they take all their tests in isolation. Who will Yolanda work with on her SATs?"

"I think you'll see on the Metropolitan tests this spring that my kids will do fine. I plan to review test-taking skills with them before the tests."

"But if Yolanda and the other children of color in your classroom don't do fine? In April, it's too late to go back and help them learn what they didn't learn earlier. The students spent the entire period that I observed discussing one simple problem. How can you possibly cover the entire curriculum at that rate?" Ms. Carter recognized that her anger had gotten the best of her composure. She could sit no longer. She stood, and stepped away from the desk, conscious, despite her anger, that she didn't want to intimidate the young woman sitting behind the desk. The small and thin teacher's size made Ms. Carter conscious of her height.

"No, Ms. Hamilton, I can't sit by and let Yolanda lose a whole year of mathematics because of your philosophy about learning." She paused. "I'm going to speak to Dr. Peters. Since this is the only third grade in the school, I'm going to ask if Yolanda can't be put in an individualized mathematics skills program. I had experience of those when I worked in Chapter I." Softening her tone, she added, "Look, I'm sure you mean well. But I can't sit by and see my daughter victimized by liberal notions about teaching."

After Ms. Carter left, Kathy went out into the hall and asked the next parent to excuse her for a moment. In the restroom, she splashed cold water on her face and took several deep breaths. As she looked at her flushed face in the mirror, she wondered if Ms. Carter were right. Would her students be at a disadvantage on standardized tests because they spent most of their time reasoning through, writing about, and discussing problems rather than doing computations? Was her approach particularly harmful for children of color? This charge had stung her. A major reason she had changed the way she taught mathematics was because she felt that conventional approaches perpetuated the disenfranchisement in mathematics of females and children of color.

How many other parents, particularly those of color, felt as Ms. Carter did but were too polite or unsure of themselves to speak to Kathy? Was Ms. Carter right that these children, in particular, needed to have work and knowledge structured for them? While she knew that Ms. Carter had far more experience with children of color than she had, all of the children in her class had, after an

initial period of hesitancy and uncertainty, responded with diligence and enthusiasm to her new approach. From what they said during discussions, she knew they were learning, knew they were developing precisely the understandings she had hoped for. At the same time, she didn't know if these understandings would translate into higher scores on standardized tests. In her experience, these tests weren't designed to measure the understanding she hoped her students would develop.

Walking back towards her classroom from the rest room, Kathy couldn't stop her hands from shaking. She knew that her principal, Dr. Peters, would have to look into the matter. She knew this would put Dr. Peters in a familiar but nonetheless difficult place, caught between a teacher and a parent. Kathy wasn't sure she wanted to put Dr. Peters in such a place. She had always supported Kathy, but Kathy also knew her principal felt strongly about the right of parents to have a say in their children's education. Dr. Peters was herself an African-American parent. Should she abandon her new way of teaching? Could she do it? Could she go back to teaching in a way that seemed to fly in the face of what she knew about how children learn mathematics? Should she abandon having her kids work together to solve problems and key her teaching to the kinds of multiple-choice questions they would encounter on standardized tests?

Background and Context

Kathy

A seasoned veteran of early elementary teaching, Kathy was teaching third graders this year. Dissatisfied with the way she taught mathematics, she had changed her approach. Kathy had found herself increasingly frustrated with what she perceived as her students' inability to remember, sometimes from one class to the next, much of the mathematics they did. She remembered, for instance, showing kids how to add fractions, emphasizing that the denominators of like fractions weren't added together, only the numerators. She used various manipulatives to help her students get the idea—fraction bars, Cuisenaire rods, and measuring cups, among others. Her students, after she demonstrated how to do the problems on the board, would then do a lot of examples she had prepared for them on a hand-out. She made sure the children had the fraction bars available so they could use these to aid their calculations.

Yet, if Kathy asked students to add a few like fractions, most would add the denominators as well as the numerator. Often she would stop what they were doing and reteach the operation, again using fractions bars and other manipulatives. She found herself repeatedly reminding students of various rules: "Remember, when we add like fractions, we add only the numerators, not the denominators." "Remember, when we subtract a bigger number from a smaller number, we have to borrow 1 from the next number. That means the next number will be smaller by one if you then subtract a number from it." "Remember, we can't subtract from 0. We have to borrow from the number next to it."

Rules like this last one bothered her the most, because she knew that mathematically it wasn't true. But she wasn't ready to discuss negative numbers yet.

Another aspect of the problem was that she spent nearly half of each year reviewing the mathematics she knew her students had been taught the year before. As a result, she felt rushed trying to cover the curriculum. Because she was constantly reteaching things she thought her students should know, she felt they just didn't make much progress. Even though her students had been scoring near the mean on standardized tests, Kathy worried that whoever taught her students the following year would, in turn, spend half the year reviewing what the students were supposed to have learned in Kathy's class.

Finally, Kathy suspected that her students' inability to remember the mathematics she and other teachers tried to teach them signaled something even more fundamental: most of her students didn't really understand the mathematics they did. The kinds of mistakes students made in subtracting double-digit numbers, for instance, indicated they just didn't have a very good sense of place value. Their failure to "take away" 10 from the digit in the ten's place wasn't just because they forgot; they didn't understand the idea of place value, they didn't understand the difference between numbers in the unit place and those in the tens or hundreds or thousands place.

The Students

Figuring out a better way to help her students learn mathematics was complicated by the diverse backgrounds of her students. Some came from homes of Moslem immigrants. Others were from various U.S. minority groups: six of the 24 students were African-American. Yolanda and one of her classmates were clearly middle class. The other African-American students came from working-class backgrounds. Only about a quarter of the students were white. Many of the students, both white and those of color, had only recently moved to the community. Consequently, the range of knowledge of mathematics and of spoken and written English that students brought to Kathy's classroom each September was extraordinarily broad. Some students brought with them a good knowledge of written as well as

spoken English but little acquaintance with mathematics. Others, although they were often well drilled in "number facts," were unable to speak a complete sentence in English.

Students from families who had recently immigrated had trouble with the language in their mathematics workbook and frequently seemed puzzled by Kathy's explanations. Increasingly, Kathy had also come to notice that these students were not the only ones at a disadvantage during mathematics period: Boys more often than girls volunteered to do problems on the board and to answer Kathy's questions.

So, in addition to her concern about her students' ability to remember math, Kathy worried that her way of teaching mathematics put some of her students, particularly girls and those of color, at a disadvantage. Creating opportunities for ***all*** students in her class to learn was a top priority for Kathy; that children of color frequently scored lower than white students on the end-of-the-year standardized test of mathematics distressed her at least as much as the fact that her students seemed to forget quickly what she worked so hard to teach them.

Kathy's Preservice Preparation for Teaching Mathematics

Kathy, who had always been a very successful student, decided to get her teaching certificate during her freshman year in college. She loved kids and learning and had always enjoyed school. Because she had always done well in mathematics in high school, she took a couple of courses beyond those required of elementary education majors. She found doing mathematics easy and couldn't understand the anxiety it generated among her elementary education classmates.

Her math methods course was taught by a former sixth-grade teacher who went out of his way to assure his students that their program would prepare them so that they could "hit the ground running" in their classrooms. He emphasized the use of manipulatives in teaching. This, he told his students, would make the mathematics much more concrete. The problem with the way mathematics is taught, he told his students, is that it's too abstract, and elementary children were not developmentally ready for mathematical abstractions. The math methods professor required students to prepare four lesson plans on which he

provided feedback. One of these plans they subsequently used to teach the lesson to classmates in the methods class—what the professor called "microteaching." Students used one of the other plans to teach two 20-minute lessons in a nearby elementary school while the professor observed. Students also had to create a mathematics center around a particular topic.

Kathy developed lessons on fractions and on time. The first involved using Cuisenaire rods and the second a clock that could be taken apart in one-hour wedges. Her center required kids to weigh different objects, record the weight, hypothesize about the comparative weight of different objects, then use a balance scale to prove their hypotheses. For all of her lesson plans, her teaching, and her center, Kathy received the highest possible evaluation. The professor praised her for her inventiveness and the concrete character of her activities.

During student teaching, her cooperating teacher didn't use any of the approaches Kathy had learned in her methods course. This teacher, who early in the term told Kathy that the most important thing for students to work on in second grade was to decode correctly and express themselves in both speech and writing, wasn't very interested in math. She used the mathematics workbooks required by the district and did little beyond having students do the problems in the workbook. When Kathy offered to set up a center for the children to work on weighing like that she had designed for her methods class, the teacher agreed. After the center was set up, Kathy explained to the students what they were to do. Although the students appeared initially quite excited, she noticed that after the first week, they rarely chose to work at her center during free time.

Kathy was anxious to try out the ideas she had learned in her methods courses. The faculty member from the university who supervised Kathy during student teaching cautioned her not to change everything the students were used to. The supervisor told Kathy that she worried that introducing too many changes could upset both the students and the cooperating teacher. Kathy consequently limited herself to giving the students counters to help them do addition and subtraction calculations in their workbooks.

Good recommendations from the faculty member who supervised her student teaching and from her cooperating teacher, an

A-average, and her appealing personality helped Kathy get a job right away as a third-grade teacher in the same town in which she had attended college. Well-organized and thoughtful, she impressed her principal and colleagues with her teaching ability. Kathy, however, was not one to rest on her laurels. She faithfully attended whatever staff development activities the district sponsored. She also began to pursue her masters at the university. Because of her broad interests, she took courses not only in education but the arts and sciences as well. She worked hard to balance her teaching and coursework with being a wife and, subsequently, a mother.

Early in her career, Kathy began to individualize her mathematics instruction. She had encountered individualized programs initially in her methods course. Subsequently, a district sponsored an in-service workshop on an individualized approach to elementary math. Kathy saw such an approach as an answer to the wide range of math knowledge and ability she found among her students. Working at their own pace, students could progress through the math according to their ability and initiative.

She decided to adopt the program promoted in the in-service workshop she had attended. This allowed her to test students to identify their skill deficiencies and to design an instructional program tailored to their individual needs. Her principal, Dr. Peters, a supportive woman who encouraged her staff to be creative, agreed to buy the program for Kathy out of a discretionary instructional materials fund. Kathy prepared packages for each of her students that included commercially produced materials as well as worksheets she developed. Together, she and each student kept track of the student's progress. This required frequent short tests and remedial materials keyed to the student's skill weaknesses. She also developed various grade-specific mathematics learning centers intended to help students with topics, such as place value, long division, and fractions, that they found particularly difficult.

Most of her students scored at or above the national average on standardized tests of mathematics, although students who were recent immigrants or children of color did less well. Despite these results, Kathy noticed that, as the year went on, she frequently had to remind students of things they had learned earlier in the year. Despite practicing subtraction with regrouping a lot, for example, her students often forgot that when they borrowed

from a number, they had to reduce that number by the amount they had borrowed. In a problem such as 52 – 48 = ?, they would get an answer of 14. She was baffled and frustrated by her inability to help her students remember to take 10 away from the number in the tens place. While using manipulatives, e.g., counters, seemed to help in the short run, it didn't seem to help students remember.

Avendon School and the Community

Avendon Elementary is located on the border of three communities. About 15 percent of the students come from Moslem families, some of whom only recently immigrated to the U.S. and had settled in a neighborhood of relatives and compatriots. Roughly another quarter of the students come from middle and lower-middle class African-American families. The remaining children come from lower middle class and working class white and Latino families. The student population is also highly transient; on the first day of the school year, between a third and a half of the students are new to the school.

Several of the recently arrived Moslem children come from homes in which the parents were accustomed to separate schooling for boys and girls. If these students attended school in their home countries before entering Avendon, they were not used to going to school with children of the opposite sex. Some of the Moslem parents have expectations for the behavior and performance of male children that differ from those they hold for female children. After all, most women in Moslem societies work exclusively in the home; few are encouraged to take jobs outside the home. Then again, some of the Moslem parents adapt their expectations to the circumstances in U.S. schools and society.

Similarly, some of the students come from families whose cultural values are not the same as those that were promoted in the hidden curriculum that characterizes the Avendon School or Kathy's classroom.* Like all teachers, Kathy had to deal with such

---

* The "hidden curriculum" is a phrase associated with Philip Jackson (1968) who, in his *Life in Classrooms*, described what children learn from the rules, procedures, expectations, and values that tend to predominate in most U.S. classrooms. Because children from middle-class homes come to school already knowing much of what the hidden curriculum teaches, they begin with an advantage over lower-class children and those from homes in which they have learned other rules, procedures, values, and expectations.

aspects of the classroom as the fact that 25 people are crowded into about 400 square feet and not everyone can talk at once, go to the bathroom at once, get a drink of water at once, and so on. Other features include how to handle public evaluations of students and Kathy's authority as teacher. For instance, Kathy, who respected her students' capacity to think for themselves, frequently involved students in making decisions about how to proceed. If they were absorbed in a task, Kathy willingly changed her plans to allow students time to finish. During parent conferences, Kathy frequently had to justify to parents, whose experience of school usually differed dramatically from what their children were experiencing in Kathy's class, her decision not to use competition or punishment to motivate students. This was particularly difficult with parents who used punishment to try to shape their children's behavior.

Kathy's principal, Dr. Peters, was considered by her staff to be a "teachers' principal." She believed her primary responsibilities were to support her teachers and ensure that all children at the school had an equal opportunity to learn. Once a teacher convinced her of the soundness of an innovation, Dr. Peters would do all she could to help the teacher implement her plan. Partly as a result of Dr. Peter's reputation in the district, the staff she attracted to Avendon had a reputation for innovation and open-mindedness. To ensure that all students had equal access to learning, she hired an English as a second language teacher and supported her in establishing an innovative ESL program. The ESL teacher tried to avoid scheduling students in the resource room during the times academic subjects were being taught. Dr. Peters also tried to hire as aides people who lived in the communities Avendon served and who knew, from the inside, the difficulties their children faced.

Dr. Peters was also very well liked and respected in the community. Parents reported that she was approachable and welcomed visits to the school. She struck parents as sympathetic and attuned to their concerns. Within the district, she was regarded as among the three or four best building administrators in town.

The Search for an Effective Teaching Model

In an effort to figure out what to do with her third graders, Kathy looked around for a course she could take that would help her. She had found that typical university courses were not very helpful in teaching. Not only did such courses fail to deal with the topics, such as number theory, that she taught in elementary school, but in more advanced courses she found that the professors weren't particularly good teachers themselves, dealing almost exclusively with the subject matter and not helping floundering students. She recognized that the mathematics she did know she had taught herself.

In retrospect, her mathematics methods course, while full of what she now thought of as useful tricks like using manipulatives, had not dealt at all with the kinds of problems learners are likely to have with different topics and procedures. The focus of the course had been on ways of teaching almost in the absence of the learner and, curiously, the subject matter itself. An advanced mathematics methods course, if such a course existed, seemed unlikely to provide Kathy the knowledge she felt she needed.

One day, she mentioned to Dr. Peters her frustration in searching for a course that would answer her needs. Dr. Peters suggested she visit the professor who had been her doctoral advisor. According to Dr. Peters, the professor, Dr. Toussaint, conducted research on the teaching and learning of mathematics and might be able to advise Kathy on what to do.

During Kathy's visit, Professor Toussaint agreed that what she was looking for was probably not available at the university or anywhere else for that matter. She offered to serve as the supervising professor for an independent study in which Kathy investigated different models for teaching mathematics to elementary students.

During the summer, Kathy read and summarized several books and articles on teaching mathematics, some of them research studies and some promotions for particular teaching models. In addition, she viewed videotapes of teachers that Professor Toussaint had collected, showing different approaches to teaching mathematics. Some of these were commercial tapes made to demonstrate a particular method and others were tapes the professor had made in the course of her research.

In the final paper Kathy wrote for Dr. Toussaint, she noted that different models of teaching mathematics were distinguished by

the view they took of mathematics: What is mathematics all about and what does it mean to know it? Having been disappointed with individualized programs, Kathy spent little time investigating this approach. She noted in her paper that these programs were based on a "skills" view of mathematical knowledge: mathematics consists of discrete processes that increase in difficulty as one advances in the subject. As in karate, you can't advance to a higher level until you've mastered the level just below it. Such a view, she argued, encouraged children to think of mathematics as a hierarchy of rules and procedures. This was precisely the view of mathematics that had long informed her teaching, a view she had found wanting.

Like nearly all the teachers in her district, Kathy had attended the district-sponsored "Instructional Theory into Practice" series of in-services. Because of the popularity of the "effective teaching" approach, Kathy investigated an application of this to mathematics. She read a book by Good, Grouws, and Ebmeier (1983) entitled *Active Mathematics Teaching*. As a basis for their model, the authors had sifted through the findings on effective teaching. Good and his colleagues identified the teaching behaviors associated with increased achievement test scores and organized those behaviors into a model. They then trained teachers to use the model. When they compared the test scores of students taught by these teachers with those of students taught by teachers who had not been trained in using the *Active Mathematics Teaching* model, they found that the former were higher then the latter. They used the results of this experiment to refine the model. The model calls for the teacher to spend 8 minutes in review, 20 minutes developing skills and concepts, and 15 minutes supervising seat work. The model further prescribes 15 minutes of homework each night except Friday, weekly reviews to be conducted for 20 minutes each Monday, and monthly reviews to be conducted every fourth Monday.

In her analysis of the training manual, Kathy noted that the authors emphasize the importance of the teacher helping students to understand what they are doing. She quoted Good, Grouws, and Ebmeier (1983) at length in her paper:

> Many problems arise in math classes in which teachers give too little attention to development. Students exposed to such teaching frequently attempt to memorize rules for doing things and concentrate on mechanical skills. These rules have

> no meaning for the student (because development work was not done) and, thus, they are easily forgotten, especially when new sets of rules are "learned." When students do not understand what they are doing, each new problem causes them great difficulty. (p. 33)

In discussing what teachers ought to do, the authors, Kathy noted, dwelt on student comprehension rather than either speed or accuracy. This all made sense to Kathy and accorded with her own experience. However, one sentence in the book by Good, Grouws, and Ebmeier (1983) surprised her and she quoted this too in her paper for Professor Toussaint:

> Teachers can maintain an emphasis upon meaning by frequently providing process explanations themselves after students respond ("Yes, Tina, that's right because . . .").
> (p. 34)

If, Kathy asked, the emphasis is on student comprehension, why is the teacher the one who is supposed to explain? Why not have students attempt to explain? If the teacher gives the explanation, how does she know that the student really understands? Moreover, the authors recommended that if students don't seem to understand, then the teacher "should repeat the meaning portion of the lesson" using, "if possible, . . . different examples." Wasn't this, Kathy asked in her paper, another version of the old chestnut that teachers should repeat everything three times? If students didn't get it the first time, what, other than the passage of time, would be different about the second time?

Kathy concluded that what made this model different from the kind of mathematics teaching most people were used to was that it was systematic and it encouraged teachers to explain to students why mathematical procedures worked. She wondered, what if the teacher herself doesn't understand why the procedure works? Why does invert and multiply work when dividing by fractions? How many teachers understood this? Finally, Kathy raised questions in her paper about the effects of using such a model on children who historically haven't done well in school mathematics—females, poor children, and those of color. She knew that those who survived mathematics courses and pursued careers that involved using mathematics were overwhelmingly white, male, and middle-class. How did the model address issues of equal access to understanding mathematics in ways that en-

able the learner to take the necessary college-prep mathematics and science in high school and to continue studying math and science in college?

Another View of Teaching Mathematics

Kathy's reading had led her to both research and theoretical work on how children learn mathematics. She noted in her final paper for Professor Toussaint that this work, which struck her as very pertinent to her questions, hadn't generated any models of mathematics teaching that she could find. Rather, the focus was on how students made sense out of mathematics. In the work of Duckworth (1987), a teacher who had worked with Piaget, she came across a sentence that she included in her paper because for her it was the germ of a different way of thinking about learning mathematics: "Knowledge is always based on other knowledge—a refinement and a reintegration of the knowledge one already has" (p. 42). She wrote that such a view of learning placed the primary emphasis on *what children already knew* when they came to her. Teaching wasn't filling in empty places in the children's minds but rather getting them to reorganize their ways of thinking to accommodate new ideas, frameworks, or information. From her experience, Kathy knew her students came to her with ideas about numbers and operations with numbers already well formed.

She thought about her students' struggles with fractions. To them, the idea that $\frac{4}{4}$ is greater than $\frac{4}{8}$ is counter-intuitive. Isn't 8 greater than 4? Aren't 8 things more than 4 things? Similarly, when adding $\frac{4}{4}$ and $\frac{4}{8}$, why can't you just add numerator with numerator, denominator with denominator? Why is the answer $1\frac{1}{2}$ and not $\frac{8}{12}$? Kathy could demonstrate over and over, using a variety of manipulatives and examples, why the answer is $1\frac{1}{2}$ and still not dent her students' initial conviction that the answer should be $\frac{8}{12}$.

She found the writings of Lauren Resnick (1983), a cognitive psychologist, to be helpful in thinking about the learning process:

> [Learners] do not simply acquire information passively until there is enough of it for "correct" rules and explanations to emerge. This tendency to construct ordered explanations and

> routines in the absence of adequate information can account at least partly for another phenomenon . . . : robust beliefs that are resistant to change even when instruction (and thus better information) *does* come along. (p. 26)

From her own experience with mathematics, she knew that children could remember enough mathematics to do well on a test without developing any genuine understanding. Hadn't she received an *A* in college calculus without understanding anything beyond the manipulation of numbers and symbols? She included in her paper a reference to a mathematician. Peter Hilton (1986), a rare mathematician who had written about what teachers need to know about math to help their pupils learn, argued that mathematics

> is not a set of skills, though its practice requires, and inculcates, skill. It is not a set of separate disciplines [i.e., Algebra, geometry, trigonometry, etc.]. Thus what matters is that a student and the student's teacher learn to think mathematically; any significant part of mathematics can be used to convey the necessary understanding and thinking ability (p. 73).

She also noted in her paper that making sense out of things is both a personal and a social process. First people's families and communities are both the context and the medium for making sense, and later school and workplace are added. The people around one enable some understandings and discourage others. In learning mathematics, as in learning anything, the individual's community or society is critical.

She read of but didn't comment on the ideas of math educators who argue that children should be required to learn mathematics by rote and that the teacher's role is to keep learners' noses to the wheel. This view of teaching and learning mathematics was very familiar. This was what she had experienced in school, what she had seen as a student teacher, and what many of her colleagues continued to believe.

Kathy concluded her paper with a set of inferences for teaching that she drew from the research and writings on learning in mathematics:

1. If learners' prior knowledge determines the sense they make out of new knowledge and information, the teacher needs to

know what that prior knowledge is. Pre-tests may capture what learners know but miss how learners think.

2. If the teacher is to know what students are thinking, she has to create occasions for them to tell her what they are thinking.
3. Teachers should capitalize on the social nature of sense making rather than constrain it through individualized instruction.
4. If teachers are to know how to help students develop understandings of mathematics that are meaningful to them and true to the best thinking in the field, then the teachers must understand the mathematics they teach—they must be able to think mathematically, not merely know how to do mechanical operations.

When she started teaching her third grade class in the fall, Kathy Hamilton based her teaching of mathematics on these principles. Her third graders would not merely do pages and pages of rote mechanical problems. They would learn to think mathematically. Kathy intended to create a classroom where students would reveal their mathematical thinking, argue about the solutions to mathematical problems, and gain genuine understanding. Her classroom would be a busy, social place.

But Yolanda's mother was equally convinced that this method of teaching math was not right for her daughter. She didn't want any teacher experimenting with her child. She wanted Yolanda to do well on standardized tests.

Kathy Hamilton thought about the meeting with Dr. Peters, the principal, that she knew would be coming soon. Should she hold firm to her stand on the right way to teach mathematics? Should she set up an individualized program just for Yolanda? What if other parents wanted individualized programs as well? Could she convince Yolanda's mother that she was right? Was she sure she was right?

Discussion Issues

Kathy has taken a considerable risk in adopting a new approach to teaching mathematics. In the first place, while powerful and persuasive logical arguments can be made for teaching mathematics the way she does, her approach does constitute a major departure from what students, parents, and even colleagues and administrators are accustomed to. In most matters but particularly in education, many people seem most comfortable with what they themselves experienced as students—whether what they experienced was effective or not. Consequently, when parents learn that teachers plan to adopt new practices, they are suspicious. In part, their suspicions arise from a sense that schools and teaching have undergone wave after wave of reform and yet measures of school outcomes such as standardized test scores have declined.

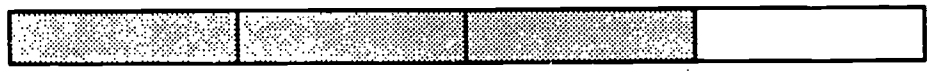
Many parents and teachers hark back to the new math of the 1960s as an example of educators making things worse in the name of making things better. The lesson that many draw from the failure of reforms such as the new math to help students learn math better is that the tried and true methods are best. However, the failure of the new math reforms is useful in thinking about improving teaching. Seymour Sarason (1982) ascribes the failure of the new math reforms to the reformers' failure to change the organization and culture of schools—how teachers, students, and administrators behave and relate to each other in schools and the values, expectations, and roles of these various actors. Studies of other attempts to reform teaching—such as the

introduction of new science textbooks and curriculum materials in the 1960s—also reveal the critical role of teachers' own understanding of the subjects they teach and of their role in their students' learning. Teachers need time and help in figuring out new ideas and new ways of working with kids. In other words, earlier failures may have had less to do with the educational value of particular reforms and more to do with how schools actually work, culturally and politically, and with what resources teachers require in order to change what they are doing.

Parents frequently respond to new teaching ideas by insisting that they do not want their children to be guinea pigs for educational experiments. Yet in a field such as mathematics, the evidence is that the way we have been organizing and teaching math has been a notable failure for many students—particularly women and students of color. On international assessments of scientific and mathematical knowledge, U.S. students score consistently at the bottom of students from the industrialized world. Among U.S. students, women, African-Americans, and Latinos score consistently lower than do white males. As students progress through school, the proportion of women and minority students taking mathematics diminishes much more rapidly than does the proportion of white males. Because mathematics serves to filter students out of scientific fields, few women and students of color find themselves prepared at the end of high school to pursue careers that require mathematical knowledge. If we define an experiment as "any action or process designed to find out whether something is effective, workable, valid, etc.," don't we have to conclude that conventional mathematics instruction is an experiment that has failed for many, if not most, students?

Yet, little data exist to suggest that the kind of pedagogy Kathy practices is better. Part of the reason has to do with the instruments we use to measure effectiveness in education. The most commonly used instrument is the standardized achievement test. Standardized tests lend themselves to measuring a particular kind of knowledge. For instance, there was only *one* item about fractions on the standardized test that Kathy's district used with her third graders:

Which fraction below shows the part of the bar that is shaded?



A. 1/4

B. 1/2

C. 3/4

D. 4/4

While Kathy's students had no problem with the item, she could argue that it dramatically underrepresents her students' genuine understanding of fractions. Consequently, this test is not an adequate measure of her teaching nor their learning. Not only are the existing tests not very sensitive to the kind of understanding such teaching tries to help children develop, but because this kind of teaching is not widespread, little evidence has been gathered about its effects. So the case for such teaching remains unproven: we simply do not know whether or not such teaching better equips students for their subsequent courses, much less for their lives outside of school.

- Given this, what do you think Kathy ought to say to Dr. Peters when they meet to discuss Ms. Carter's concerns?
- Should she try to convince Dr. Peters that she should be allowed to continue teaching mathematics in her new way? What arguments should she use to convince her?
- Should she compromise and spend at least part of each math period having children do workbooks and handouts individually to meet the expectations of Denise Carter and other parents with similar concerns?
- Should she agree to put Yolanda on her own individualized program of workbooks in exchange for Dr. Peters' agreement to allow her to continue her new way of teaching? Would this constitute equal access to equal knowledge? Why or why not?
- How else could Kathy document what students are learning in mathematics besides standardized achievement test scores? How persuasive do you think such alternative measures would be to Ms. Carter?

The issue is, of course, complicated by the fact that Kathy is white and Ms. Carter and Yolanda are African-American. Kathy is aware of the failure of schools throughout U.S. history to offer African-American children the same opportunities to learn that have been offered to middle-class white children. She is also aware that the integration of schools in urban areas and in the

South has not ended discriminatory practices. For instance, she knows that a disproportionate number of African-American children end up in various compensatory and remedial programs and, in high school, in non-academic tracks or programs. She knows the difficulty that many African-American children have with math effectively shuts them off from many careers and disenfranchises them educationally. This is one reason she is so bitterly stung by Ms. Carter's criticism: Her search for a new approach to teaching mathematics was driven, in part, by her concern that what she and other teachers were doing wasn't particularly helpful to children of color.

Denise Carter, on the other hand, has seen the rise and fall of numerous programs intended to help African-American children catch up academically with their white peers. She has been coming around to the point of view that white teachers who teach in ethnically mixed schools or in those attended mostly by students of color might be part of the problem rather than part of the solution. In the name of progressive education, they have been trying to get students of color more "engaged" with the subject matter, to see the relevance of the subject matter to themselves and their lives. While she's not entirely sure about what Kathy is doing, her teaching seems to fit this mold.

Ms. Carter is fed up with the continuing failure of the schools to serve poor children and students of color and is beginning to think that the consequence of a lot of these progressive ideas is to keep African-American children down, to prevent them from catching up with white and Asian-American children. Rather than "trying to understand" African-American children, she feels that teachers need to teach them, directly and rigorously, what they need to know to get ahead in a world dominated by middle-class white males. She wants Yolanda to be taught standard spelling, grammar, and pronunciation, not just how to "express herself" in writing; she wants her to read literary classics, not works deemed "relevant" by patronizing white teachers; and in math, she wants her to learn her times tables and the rules and procedures of math, not some vague and untested notion of "conceptual understanding." The odds, as she sees them, are already stacked against children of color simply because they are not white and because so many are poor. Denying them access to the kinds of knowledge they need to do well by the standards of white middle-class society puts them at an even greater disadvantage.

Ms. Carter also thinks a firm hand in the classroom and the consistent but caring exercise of adult authority is more consistent with the traditional African-American home than is what she regards as the tendency among white teachers such as Kathy to be overly liberal and solicitous of students. They are, after all, children. A major part of our responsibility as adults is to guide them, set boundaries for them, and correct them when their thinking or behavior goes astray. One can love and reassure children and build their self-esteem and pride best by ensuring that they get good grades and achieve well on standardized tests.

Ms. Carter used to believe that her friends who saw the schools as part of a wider effort on the part of white society to perpetuate the political and economic subservience of African-Americans were just paranoid. But her experience as a student, a parent, and an aide in the schools has led her to believe that her friends might be right after all. She knows that African-American kids are just as smart and hard-working as white kids. So how did it happen, year after year, that they remained academically behind white kids? This had been going on too long in too many schools for this to be unintended.

- Do you think Kathy would have reacted differently if Ms. Carter had been white? If so, how?
- Is Ms. Carter right in thinking that Kathy has ignored the home experience of African-American children in her teaching? What role should such experiences play in teaching a subject such a mathematics? Are African-American children likely to bring to math different conceptions of numbers than those of their white classmates? If so, how would their concepts differ?
- In the parents' conference, Ms. Carter argued that African-American children need "structure." What did you understand her to mean by this term? Do you think lower-class African-American children and other children of color need more structure than do middle-class white children? Why or why not? Is structure lacking in Kathy's classroom? What makes you think so?
- What do you think about Ms. Carter's sense that progressive educational practices serve to further disadvantage children of color?

References

Duckworth, E. (1987). Either we're too early & they can't learn it, or we're too late & they know it already: The dilemma of "applying Piaget." In E. Duckworth, *"The having of wonderful ideas" and other essays on teaching and learning* (pp. 31–49). New York: Teachers College.

Good, T., Grouws, D., & Ebmeier, H. (1983). *Active mathematics teaching*. New York: Longman.

Hilton, P. (1986). A mathematics curriculum for future secondary school mathematics teachers. In D. D. Dill (Ed.), *The knowledge most worth having in teacher education: An exploration of the knowledge, values, and skills essential to teaching in the middle and secondary schools*. Chapel Hill, NC: University of North Carolina.

Jackson, P. (1968). *Life in classrooms*. New York: Holt, Rhinehart & Winston.

Resnick, L. (1983). Toward a cognitive theory of instruction. In S. Paris, G. Olson, & H. Stevenson (Eds.), *Learning and motivation in the classroom* (pp. 5–38). Hillsdale, NJ: Erlbaum.

Sarason, S. (1982). *The culture of the schools and the problem of change*. Boston: Bacon.

Additional Reading

For a discussion of the issues that Denise Carter raises about progressive teaching and children of color, please see the writings of Lisa Delpit, especially:

Delpit, L. D. (1988). The silenced dialogue: Power and pedagogy in the education of other people's children. *Harvard Educational Review, 58,* 280–298.

Delpit, L. D. (1986). Skills and other dilemmas of a progressive Black educator. *Harvard Educational Review, 36,* 379–85.

ISBN 1-877962-24-4