Reflections and Deflections of Policy: The Case of Carol Turner

Deborah Loewenberg Ball

Educational Evaluation and Policy Analysis, Vol. 12, No. 3 (Autumn, 1990), 247-259.

Stable URL:
http://links.jstor.org/sici?sici=0162-3737%28199023%2912%3A3%3C247%3ARADOPT%3E2.0.CO%3B2-L

Educational Evaluation and Policy Analysis is currently published by American Educational Research Association.

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at http://www.jstor.org/about/terms.html. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at http://www.jstor.org/journals/aera.html.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is an independent not-for-profit organization dedicated to creating and preserving a digital archive of scholarly journals. For more information regarding JSTOR, please contact support@jstor.org.

http://www.jstor.org/
Wed Feb 23 11:24:07 2005

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

Educational Evaluation and Policy Analysis
Fall 1990, Vol. 12, No. 3, pp. 247–259

Reflections and Deflections of Policy: The Case of Carol Turner

Deborah Loewenberg Ball
Michigan State University

This article presents a case of Carol, an accomplished second grade teacher who was disposed to teach in ways that seem consistent with the California Mathematics Curriculum Framework. *Her approach–grounded in her conceptions of mathematics and her notions about how children learn mathematics—seemed, however, to have been virtually untouched by the policy initiative. Her practice, reflecting glimmers of the new ways, somehow also deflected them. Because the visions of mathematics and mathematical pedagogy represented in the Framework are multiple, Carol could be seen at once as complying with the Framework, or as subtly contradicting it. This raises questions both about the intentions of the Framework and about the nature of this reform. Would a state like California be happy if it could move all teachers to where Carol is? Alternatively, do the state policymakers want to change all teachers–those in the mainstream and on the fringe? The case highlights the complexity of the changes implied by California's curriculum Framework and the difficulties inherent in communicating those changes in ways that can influence both pedestrian and accomplished practice.*

Mrs. Turner points at the problem on the chalkboard.

$$\begin{array}{r} 30 \\ -16 \\ \hline \end{array}$$

Thirty-five pairs of eyes are fixed on her, awaiting the cue.

"Tell me what to do *here,* class!" she demands.

"Borrow!" choruses the class.

"I don't say 6 take away 0, *do* I? You're so smart!" she exclaims, obviously pleased.

"What *do* I say?"

"Borrow a ten from three tens," comes the quick response.

A dedicated teacher who deeply wants her students to succeed, Carol Turner[1] is lively and enthusiastic in the classroom. She delivers lessons with a brisk flair and virtually insists that students learn. Being at center stage, she keeps all eyes on herself and all minds on the curricular track.

Carol wants her children to master the mathematical content of the second grade curriculum—telling time to the hour and half hour, counting by fives and tens, reading a calendar, adding and subtracting two-digit numbers—and she pushes them to participate in the classroom activity and discourse. Sometimes the math period lasts over 75 minutes, so bent is she on accomplishing her goals. With a plethora of little stories, mnemonics, play-acting, and concrete materials, she marches her charges through the domain of second-grade mathematics. Having been a special education teacher for a number of years, Carol believes that her strengths—patience, the ability to "break down" the content, the use of a wide variety of imaginative teaching devices to suit different "learning modalities"[2]—grow out of this background.

Carol is highly regarded by both parents and administrators. Her classroom, one of about a dozen portables clustered on the school grounds, is crowded like most of the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

other rooms in this large suburban California district. Her 35 pupils, who attend school year-round, include Black, Asian, and Hispanic children from middle- and lower middle-class backgrounds. Children sit at desks grouped in fives, reflecting the current vogue for "cooperative learning." The children in each group share a small plastic basket with paper, pencils, glue, and bags of popsicle sticks. The classroom's walls and bulletin boards are cheerfully decorated with holiday and seasonal motifs—Santa Claus with toys, promises, and cotton snow in December, the Easter Bunny and springtime blossoms in March.

Carol believes that she teaches mathematics for understanding. She sees mathematics as a set of sensible tools and her version of teaching for understanding puts her at the helm, in charge of equipping pupils with these tools. "Teaching without understanding is not teaching," she asserts (interview, 12/88). She says that emphasizing the underlying meanings of the mathematical procedures is essential in teaching and learning mathematics. She contrasts this with "teaching rote," something she openly disdains. Understanding—knowing the reasons and the purposes and being able to "apply math skills to everyday living"—are her fundamental goals.

Perhaps more than any other teacher we visited, Carol Turner was disposed to teach in ways that seemed consistent with the Mathematics Curriculum Framework for California Public Schools (California State Department of Education, 1985). This case explores her approach to teaching mathematics and the deeply-held convictions that underlie it. Interestingly, Carol's approach—grounded in her conceptions of mathematics and her notions about how children learn mathematics—seems to have been virtually untouched by the policy initiative. Her practice, reflecting glimmers of the new ways, somehow also deflected them. We use this case as an opportunity to explore why a teacher like Carol, so apparently disposed toward some aspects of the *Framework*'s vision of mathematics teaching and learning, could remain so apparently unaffected by it.

Carol's Practice: "Teaching Without Understanding Is Not Teaching"

Carol demands that her students understand. She makes sure they attend and she believes that the mark of a successful teaching moment is that "every eye was on [me]." Syllogistically, she reasons: When the children are looking at her, they are probably engaged. If they are engaged, then they will understand. They will understand because she carefully structures their activities so that they will develop the *correct* understandings: giving them templates for explaining procedures, guiding their work with manipulatives, leading them with questions.

> With popsicle sticks bundled in groups of ten, the children are trying to solve 53 − 28.
>
> They record their work on small scratch pads. After a couple of minutes, Mrs. Turner asks one boy to explain what he did.
>
> S: 13 minus 8.
>
> T: What did you do when you subtracted the 8?
>
> S: Wrote a 5.
>
> T: Yes, but what did you have to do to take the 8 away? You must have had to do something before you could take those 8 sticks away from 3 sticks.
>
> S: Unbundle.
>
> T: Yes. We haven't had to do that much yet because we've just been getting ready to do the subtracting, just setting things up. (She looks at the rest of the children.) How many of you had to take the rubberband off to take the 8 away? (About half the children raise their hands. She directs the others to remove the rubberbands from their bundle of sticks; she waits before continuing.)
>
> T: Now, boys and girls, tell me what to do.
>
> Ss: Cross out the 5 and put a 4.
>
> T: (crosses out the 5 in 53 and writes a 4 above it) Yes, we have *unbundled* one of our tens and so we have 4 left.
>
> T: What's 13 take away 8?
>
> Ss: 5.
>
> T: (turns back to the boy whom she had originally called on): Carl, what did you do next?
>
> S: 4 minus 2.
>
> T: (looks expectantly at the class)
>
> Ss: 2.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

T: (writing the 2) *Okay!*
(observation, 12/88)

In this segment, Carol leads her students through the explanation that underlies the subtraction. She focuses on the link between the bundled popsicle sticks and the conventional algorithm—"What do you have to do to 3 to take 8 away?" This is one of a series of carefully planned steps through which she marches her students, shepherding them carefully toward the destination of mastering subtraction with regrouping, or "borrowing."

Carol sees herself as different from her colleagues. Many teachers believe, she remarked, that "it's okay if [the children] don't know *why* to borrow—let them learn rote and then later the concept will come." She says she has never agreed with this stance: "If they really haven't pictured that and done it with a base ten [material], you are making [the students'] job harder. I can't buy it when [teachers] say rote is okay. Somewhere along the line they are going to get it. When? When they are 35 years old?" Saying that she hopes she is not "hurting anybody's feelings," Carol says that teachers who aim merely for rote learning are lazy. Explaining that "useless information is skills you give kids and they don't know what you do with them," she describes her goal as follows:

> I want to empower them with a sense of survival skills so that they will be an educated adult who can function with math and use that math and not be afraid to use it when they come to a problem—they need to build a door, or they need to figure out how much they need carpeting, or go purchase something. That they can approach that. They can't approach it if they don't have the *concept* of area. They can't approach it if they don't have a *concept* of measurement using the length of feet or yards or whatever you're using. (interview, 12/88)

For Carol, mastering mathematics involves understanding the "whys," and she is convinced that manipulatives are essential in helping children develop these kinds of mathematical understanding. She explained that she has "*always* used a lot of manipulatives," and her storehouse of devices includes not only manipulatives, but also stories, metaphors, and gimmicks.

Carol's beliefs about learning mathematics, as well as her convictions about teaching mathematics, contribute to her commitment to using such models. First, she believes that students must be "actively engaged." Active engagement entails moving objects—or one's body—around, following a lead, and, above all, watching and listening. Experience has convinced her that "children learn through doing. They don't learn through sitting and doing workbook pages." She draws an analogy to underscore her point: "Lincoln didn't really learn law through reading. He really learned it by practicing it and doing it and actually manipulating things and getting into a courtroom. That's where you learn. So with math it's the same thing." She explained that "research supports the fact" that children learn when they are actively involved, when they're moving things around, when they can *see* what is going on. Carol's strong beliefs about how and what children need to learn lead her to choose teaching strategies that afford her students opportunities to manipulate objects, watch eye-grabbing demonstrations, and act out stories.

Carol also believes that helping children to develop mathematical understandings depends on "breaking down the content": analyzing and identifying the concepts, steps, and processes, taking them apart, and working on them sequentially. "You really analyze every step you do. When they have grasped that, you go on to the next and you build." So, in teaching "borrowing," Carol focuses initially on place value in two-digit numbers. Next, students regroup two-digit numbers: 57 = 4 tens + 17 ones. Then she has them examine subtraction exercises to decide whether regrouping is necessary or not. After this step, students begin performing the calculations, often in application contexts. In this way, Carol helps her students master one bit of the overall topic at a time.

Carol makes a clear distinction between two qualitatively different ways of "breaking up the content." The point of "breaking down a topic" into its components—a strategy she embraces—is to help children "get to that global understanding." What Carol disapproves of is what she calls "segmenting" content. When mathematics is segmented,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

topics that are fundamentally connected are taught separately with little reference to one another—for example, when money is separated from place value. Making connections among mathematical ideas is something she sees as central.

Carol's beliefs about teaching mathematics by breaking down the content reinforce her commitment to using a wide variety of manipulatives and other devices. Such representations, she believes, help students focus on the underlying concepts and meanings. Across her development of subtraction with regrouping, for example, Carol uses many concrete and other models. Her view is based on "a concrete philosophy," developed while she was working with special education children.

Carol uses many different representations to teach a topic because she thinks that helps to "send home the messages." Students are there to receive ideas and skills; she aims to get those into their minds. Carol also believes that children learn best in different ways, in different "modalities." Thus, the more representations, the better, because one device will work best for one child, while another will click for a second.

Carol has a storehouse of models for the content she teaches and she uses these different representations deliberately. When her new text suggests that she use "base-ten materials" for teaching multi-digit subtraction, for instance, Carol has a repertoire of alternatives on which to draw and which she is disposed to use: money, "Mr. and Mrs. Tens and Ones" (a dramatization of place value and regrouping), popsicle sticks and rubberbands, base-ten blocks, a tens and ones pocket chart, and Unifix cubes (plastic interlocking blocks). Not only does she have this extended repertoire, but she differentiates among the models for place value and regrouping. She explains that some are better for some purposes than others. For example, popsicle sticks have a practical advantage over Unifix cubes: they don't fall apart. Popsicle sticks also model grouping by tens especially well, since the children have to put a rubberband around a bundle each time it adds up to a group of ten sticks.

Carol is deliberate about using the different models. When she uses popsicle sticks to represent two-digit subtraction, for example, she has the students leave the rubberband on the bundle at first so that they can "see that it is a group of ten and when they put the little 1 on their paper, that still is a group of ten." Later she has them unbundle the sticks so that they can see how you go from 5 to 15 in the ones' column. Money, she explains, makes a good model because it is so familiar; students' everyday experience with and knowledge about money equip them to use it effectively to look closely at the number system. "Mr. and Mrs. Tens and Ones," a dramatic play, is good because "children love play acting and role playing." She makes hats for the children and they pretend to live in either the tens or the ones "house." They make up stories together about children playing in the ones house; when there are ten children in the house, Mrs. Ones must tell them that they can no longer play there—they must go to Mrs. Tens' house. The children must figure out how to do this: "They *physically* move their bodies." Carol emphasizes that "the kinesthetic is probably the strongest modality in children, and if you use that, you're going to get a lot further."

In addition to possessing a well-established and articulated repertoire of representations, Carol also invents models on the spot. During one lesson I observed, she was trying to help her students understand "Mrs. Turner's law of math": "Never subtract the top number from the bottom." To illustrate that doing this was "a magic trick"—a move that didn't make sense—she spontaneously pulled out a plastic baggie and held it up in front of the class. Dramatically, she challenged the children, "Can you take 4 candies out of this bag?" (observation, 12/88). Later she explained that she had come up with this idea in order to get them to "*look* at the total situation" and analyze it. She was pleased with how this worked, for "every eye" was on her while she was showing the baggie. "You know, if you keep bringing it back to something concrete," she explained, "they understand. If I had said it or put it on the chalkboard, I wouldn't have had their attention" (interview, 12/88). Here, Carol's belief in the value of looking, of seeing, comes through.

Carol thinks it critical that children make links between the various models and the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

conventional numbers and symbols. In fact, one key criterion for "understanding" is that students should be able to carry out procedures on paper and also model those procedures:

> I usually use the manipulatives right up front until I feel they have mastered the manipulatives and then I tie the manipulatives into the written. We'll do a manipulative simultaneously with the board. And then from that I want them to show me the manipulative and simultaneously be able to do it on paper. And then take away the manipulative and see if they can do it on paper. Now doing both together is the hard part. They could do it on the paper, and they could do it to show, but if they really can do both at the same time, then I really know they are understanding. And it's not just rote. And for me, that's important. (interview, 12/88)

In helping her students make those links, Carol leads the students smoothly between the objects and the symbols, using conceptually-focused language, the referential vocabulary of the concrete models, and stories:

T: Okay, let's do 60 − 37, 6 tens and 0 ones minus 3 tens and 7 ones. Rachel, help me out here. What should I do?

$$\begin{array}{r} 60 \\ -37 \\ \hline \end{array}$$

S: Borrow.
T: You mean I don't go 7 take away 0? . . . You're right! Tell me what to do.
S: Cross out the 6 and write 5 and put a 1 next to the 0.
T: (tries to focus the children on the meaning of these symbols) And that 1 represents what? A group of −?
Ss: Ten!
T: (nods) Okay, so 10 take away 7.
S: 3.
T: (writing this down, moves to the next column. Again she carefully uses the language of place value.) 5 tens take away 3 tens?
S: 2.
T: (looking out at the class) What does 2 tens and 3 ones equal?
Ss: 23!
Later, Carol discovers a child working alone who is automatically regrouping on every example. She finds him on 74 − 43.
T (stooping over): Can I take 3 away from 4?
The child, silent, stares at her.
T: (linking it to a real-world context): You have 4 cookies? Can you eat 3 cookies?
S: Yes.
T: How many will be left over?
S: One.
T: So there's no reason to borrow there. Be careful. (observation, 12/88)

Carol aims to *give* her students mathematical understanding. She provides them with representations and guides their use of them. She connects the models to the symbols and oversees the children's linking of these. She directs and shapes the classroom discourse. The children, actively talking, moving objects, and writing, participate in highly structured and controlled ways.

> Carol has the children get out scratch paper and number it from 1 to 5. She writes a two-digit subtraction exercise,
>
> $$\begin{array}{r} 65 \\ -29 \\ \hline \end{array}$$
>
> on the board and tells them to write Y if they would need to borrow and N if they wouldn't. She reminds them that they worked on this yesterday with sticks. She asks the class for the answer and then asks one boy why. He gives the correct reason ("you can't subtract 9 from 5") and the teacher continues with four more examples. For each one, she asks for the answers and the reason for the answer. Each reason given is short and standardized.
>
> When this is finished, Carol has the students solve the exercises they have been discussing. She goes over each problem with the entire class, focusing both on whether or not borrowing is required and why, and what to do to get the answer:
>
> $$\begin{array}{r} 81 \\ -56 \\ \hline \end{array}$$

T: Do you need to borrow here?
Ss: (chorus) Yes.
T: Why? Jared?
S: Because you can't take 6 away from 1, And you can't put the 6 on top.
T: Did everyone hear that? Beautifully said! You can't do that magic trick. Now, class, tell me what to do and why.
Ss: (chorus): Cross out the 8, put a 7. Put a 1 next to the 1.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

T: (writing this on the board) 11 take away 6 is—?
Ss: 5!!
T: 7 take away 5 is—?
Ss: 2!! (observation, 12/88)

Carol knows where she wants her students to be, both conceptually and procedurally, and she shapes their activity and discourse to make sure they get there. Carol wants her students to master the mathematics of second grade. But to her this means not only mastering, for instance, the algorithm for subtraction. It also means that understanding how and why the algorithm works. In Carol's mind, however, there is *an* explanation, or "why," of borrowing and she wants to make sure her students get it. With a template for the correct reasoning, then, she leads the children to provide the explanations and justifications for their work. The template provides the form and the content of the explanation; students fill in the blanks. Just as there is a right answer, there is also a right explanation.

Carol asks one small group of boys to explain to the rest of the class how they solved 43 − 28. She calls on Phillip, one of the group's members.
S: I crossed out the 4 and put a 3.
T: No, what did you say in the ones place?
S: (puzzled): Unbundle a ten?
T: No. First, what did you say in the ones?
S: (pause) I don't know.
T: Yes, you know. You did the problem. What did you do?
T: (pointing at the problem on the board and prompting) Tell me, can you take 8 away from 3?
S: (lights up) No.
T: So what did you do?
S: I borrowed!
T: (smiles at him) See? You *can* tell me. Now, where did you borrow from? (in a teasing tone) From Santa Claus?
Ss (giggling)
S: From the tens.
T: You borrowed this from the tens, leaving how many? (She crosses out the 4 on the 43.)
S (pauses).
T (persisting): Did you throw it up in the air or did you do something with that group of tens? Where did you put it?
She writes a 3 above the 4 and a 1 next to the 3. Then she explains, gently: You borrowed from the 4, leaving that a 3 and putting your group of ten here (with the ones).
(observation, 12/88)

This routine of explanation was repeated throughout the lesson, including the steps and their reasons. Carol pushed and pulled, firmly and insistently, directing the children toward her goal for them: that they be able to perform the procedure of two-digit subtraction, knowing when and how to borrow and why. When Phillip, above, could not fill in the template correctly, Carol completed it for him: *"You borrowed from the 4, leaving that a 3 and putting your group of ten here."*

In Carol's classroom, children's opportunities to talk are structured and shaped to help them converge on the correct understandings. They are helped to know the right reasons as well as the right answers. Mathematical speculation, conjecture, and invention are not a part of the discourse. One day I observed Carol using a "storybook" from grade 2 of the *Real Math* program (Willoughby, Bereiter, Hilton, & Rubenstein, 1981). She read the children a story about a girl who had a job walking dogs. The problem was: Is 15 minutes enough time to walk ten dogs one at a time if it takes 10 minutes to walk one dog? Carol told the class that "there is no right answer—it's just what you think." Then she led the children step by step to a precisely calculated answer to the unasked question, exactly how long does it take to walk the ten dogs?

T: How many dogs does she have to walk?
S: Ten.
T: Ten. And how many minutes does it take to walk one dog? Douglas?
S: Ten.
T: Ten. So, ten groups of ten. Let's count by tens. (The class counts together: 10, 20, 30, . . . , 100).
T: So that's a hundred minutes altogether.
Gasps and oohs are heard around the class.
T: How many minutes in an hour?
S: 60.
T: 60. Is 100 larger or smaller than 60?
Ss: Larger.
T: Larger. So does she need more time or less time than an hour?
S: More.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

T: More. You are right. She couldn't possibly do that in 15 minutes. *Good* listening!!
(observation, 12/88)

Carol's introductory comment ("there's no right answer–it's just what you think") may have been intended to encourage students to volunteer ideas and to not fear being wrong. But there was a right answer. And although Carol wanted students to participate in solving the problem, their participation was structured and limited. This was consistent across observations of Carol's teaching, for although students' talk is a regular part of the classroom discourse in Carol's class, their comments rarely consist of more than one or two words and the substance of their talk is highly controlled. They fill in blanks in the templates Carol provides: 5 *what?* Is 60 more or less than 100? 7 take away 4 is ____? 50 has how many tens? and so on. These templates model and direct the kind of thinking and the ways of knowing that she is trying to foster. The dog story held opportunities not pursued by Carol: to formulate problems and questions, to experiment with alternative approaches to answering them, to compare estimated with precise answers and to consider the need for either in this context, and so on. Mathematical understanding has for Carol a convergent quality that seems to foreclose a more open-ended search for meaning. With her energies focused on mastery, Carol loves the storybooks because "they tie in very closely with the lessons and [they] really make the kids think and reason," using what they have learned "and not just rote." According to Carol, they offer opportunities to apply mathematical skills to real-life contexts. But note that the contexts are highly constrained. Instead of allowing students the opportunity to create and solve problems in diverse ways, Carol carefully walks her students down the "right" solution path.

Although she does not want to be seen as "bragging," Carol is comfortable with and proud of her approach to teaching mathematics. Unlike many of her colleagues, she believes, she works hard, stresses meaning and understanding, and her students learn. If Carol worries, it is about assessment. It concerns her on two levels: (1) deciding for herself if her students are "mastering" what she is teaching and (2) having her students do well on standardized tests. Behind her classroom door, Carol feels quite able to determine what students are learning—for most of her goals. "Monitoring" their written work, she can see if they are making any errors. She can ask them to "show me with blocks and verbally explain" (interview, 4/89). If children can do at least two of these three "ingredients" (do, model, explain), then Carol feels confident that they understand. She is less sure about how to tell if children are mastering reasoning with the new text's storybook problems:

> There isn't really a guideline to tell you how to build proof that these children are getting some kind of an idea about these problems, because the problems are all done orally. Always ask why when they come up with an answer . . . 'How did you get that?' But I always feel like there is one or two kids maybe I'm missing.

Two concerns surface in Carol's comments. What counts as evidence that students are developing good reasoning skills? And how can one "monitor" students' understanding with a class size of 35?

Still, Carol worries more about whether the annually administered standardized test will produce evidence that she has taught. She knows that her district places a high premium on good test scores and that her class's results and her school's will be scrutinized by administrators. "In this district it's a big deal. It hits the papers—it's big stuff. Even [administrators'] jobs come and go." She worries that her students will not understand the test's format because they have never had to "bubble in" answers before. She is anxious about making sure that she has covered the necessary content before the test is administered—multiplication, for instance. Consequently, Carol prepares her students to take the standardized test, using a test skills booklet entitled *Scoring High.* She uses its contents to review the mathematics she has taught, to give them test-taking "survival skills" (such as eliminating unreasonable answers), to prepare them for the format, and to cue them that the test writers may try to

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

"fool you." Carol does not seem confident that her new approach alone can empower students to succeed on the standardized tests, so she supplements her teaching with specific preparation for such assessments.

Carol and the Framework: Take #1

Carol's approach to teaching mathematics reflects a number of specific features central to the *Framework's* vision of practice. She uses manipulatives and other representations thoughtfully and deliberately. She emphasizes meanings, aiming to help her students know not just how to perform procedures, but why. Her goals focus on the meaningful application of mathematical skills in everyday life, and she stresses the need to analyze situations carefully and to monitor the reasonableness of answers. Carol is concerned with connections: the relationships among alternative representations as well as among mathematical ideas and skills.

Her role in all this is decidedly directive: orchestrating students' use of a variety of representations, teaching them the explanations for what they are doing, modeling problem solving, and guiding students' practice with all of these. Carol takes pride in her ability to reach for understanding with her large and diverse class. Steeped in techniques of "effective instruction," she is conscious of providing her students with "anticipatory sets," of using both guided and independent practice, and of "checking for understanding." She sees these strengths as consistent with her focus on understanding.

Carol has not actually spent any time studying the *Framework* or thinking about its implications for her practice. Because she is doing her job, she says, her principal would not care that she does not refer to the document. Carol thinks of the *Framework* as a manual for *what to teach* in mathematics, and she has been wholly unconcerned with its contents: She stores it in a box in her room. In her mind, it seems undifferentiated from the school district's curriculum guidelines and, although she feels accountable to those guidelines, she believes that she knows what her students need to learn. "I know what my goals and objectives are, what my job is. This [the *Framework*] is a piece of paper. It's not my Bible. . . . Even if they burned it tomorrow, I could still teach" (interview, 12/88). Carol, assuming that mathematics "hasn't changed over the years," knows that her second graders are not supposed to learn multiplication and division, but that they do need to learn to tell time, to read a calendar, to add and subtract. Additionally, Carol believes that no document can tell her what to teach her particular students because the "basic truth about teaching is that you look at where your children are and you take them where they are and move them on up."

When shown an excerpt from the *Framework* on "teaching for understanding," Carol read it over carefully and then exclaimed, "Really this says what I've been saying." She noted the excerpt's emphasis on meaningful application, on fundamental concepts, on making sense of answers. "It really says beautifully what I was aiming for. 'Mathematical rules, procedures, and formulas are not powerful tools in isolation.' They're *not.* They're meaningless. 'Students who are taught them out of context are buried by a growing list of separate items that have narrow application.' That's why I am saying that that categorization and building of skills [is so important]." Carol was not surprised to find, on reading some of the document, that her approach to teaching fit with the *Framework*; she had, of course, always assumed that it did.

Carol: Is There A Message of Change for Her?

From Carol's point of view, she perceives no real mandate to change what she does to teach mathematics. She is aware that there is a new state framework for mathematics but assumes that it has little, if anything, new to say to her. In fact, when asked to examine it, she says that "it says the things I've been saying." She also knows that her district has just adopted a new textbook series that she is expected to follow closely. Although she believes that this text is "aligned" with the *Framework*, she sees this as an issue for district administrators, not teachers like herself. "[The program] is following the *Framework* and I guess if we don't follow the *Framework*, we lose funding." Still, she does not perceive

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

the textbook adoption as linked to the implementation of the new framework. When asked why her district chose a new series this year, Carol said she did not know: "I really couldn't tell you the whole reason. I think it was time, you know. I think every few years they evaluate the books and decide what's working and not working. Some surveys were done and they probably looked through thousands of programs and decided on this one" (interview, 4/89).

Despite her detachment from the policy and implementation issues, Carol is delighted with *Real Math.* "It's a wonderful program," she says with enthusiasm, for she sees it as fitting with her approach and beliefs much better than texts she has used in the past. What she likes especially about it is that it "builds concepts" at the same time that it develops skills and procedures: "I think when you do that, they're going to retain it more. What they're doing has *meaning.*" She also likes how well the book breaks down the skills and processes, reminding her of the kind of "task analysis" and teaching that they do in special education: "In special ed, you don't take anything for granted with the children and you really analyze every step. This program does the step-by-step no matter what and insures that each child is building those skills. In special ed, they also do a "lot of manipulative work, a lot of multi-sensory things." She is impressed with the spiral organization of the content because if a child is having trouble with a concept or a skill, it keeps coming up, in different ways and using different models. "The program doesn't just go money, money, money, time, time, time. It kind of interweaves all those concepts," she observes. And, she adds, "Someone has really thought about the process by which children learn."

Carol is following the textbook closely this year because, she said, "We're supposed to adhere strictly to it. They said for it to really work for you, we want you to use it just as it says." Carol teaches all the lessons, including the games and the storybook discussions which many of her colleagues perceive as "extras." To Carol, these are not dispensable; they are key components of the program. When she alters the text, the changes seem subtle. For example, she chose to have her students keep their popsicle sticks bundled when they first started regrouping for subtraction. Although the book directed her to have them unbundle the sticks, Carol wanted her children to focus on the fact that they were borrowing a *ten* and so she modified the book's plan. Other modifications seem more dramatic: her reshaping of the dog story into a specific question with a specific right answer, for instance.

Although she says that many of the other teachers do not like *Real Math* because it has changed their teaching strategy, Carol has not yet found anything she does not like about the program; she believes that it fits her beliefs about learning and teaching mathematics—or at least she sees it that way. Although she does not consider herself a textbook-driven teacher, she likes this book so much that she finds herself sticking to it: "It works beautifully." She points to a few new ideas she has picked up from it. One is teaching children strategies for the basic addition and subtraction facts to decrease the memory load entailed. Some of these included skip counting, using doubles, and groups of tens. "Ten and six are sixteen, and all of a sudden the light bulbs are going on, where before ten plus six, they'd go, eleven, twelve, thirteen, fourteen, fifteen, sixteen. It's so simple. It's a group of ten and six ones, sixteen. That was fantastic. I've seen a lot of speeding up the action there." The book has also given her a better gauge of where she should be at a given point in the year. In general, though, the book does not seem different or new; it is "pretty much doing the same things" that she has always done—using manipulatives and breaking down the content.

Carol and the Framework Revisited: Take #2

Although Carol does not see the textbook adoption as connected to the *Framework*, it is nonetheless her district's vehicle for initiating and implementing change. Yet Carol perceives *Real Math* as congruent with her current approach. Nothing in the new text seems to have, as yet, led her to a sense that she is being asked to rethink and reshape her practice.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

From an outside perspective, Carol Turner's practice reflects—and thereby also perhaps *de*flects—the *Framework*. One reading of the *Framework* would suggest that this is a teacher who is doing it all. Following the textbook closely and quite happily, Carol probably includes the seven strands of mathematical content highlighted in the *Framework*. She teaches for understanding, emphasizing underlying concepts and stressing applications. She reinforces and connects concepts and skills, provides opportunities for problem solving, and uses concrete materials. She attends to a variety of learning styles, provides remedial help when needed, has students work in groups, and leads classroom discourse with carefully planned questions. And she believes that students learn best when they are "actively involved." Examining the ideas embedded in this last phrase reveals how Carol's approach, although it resembles the *Framework's* vision, also differs from it in some fundamental ways.

What students actively engage in. Carol conceives of mathematics as a body of concepts, topics, and reasonable procedures that are useful in everyday life. This knowledge is "out there" to be learned; mathematics is not something that human beings have created and continue to construct. If students engage in a variety of activities that involve them in manipulating objects, acting out and telling representational stories, giving reasons, responding to questions, and, above all, watching closely, they are more likely to master and retain the mathematical concepts and procedures they need. Carol does not think of mathematics as inherently beautiful and fascinating, as a domain of inquiry with intrinsic intellectual value—a view suggested by some of the *Framework's* text (California State Department of Education, 1985, p. 1). She does not think of mathematical activity in terms of formulating problems, making and pursuing conjectures, or evaluating alternative mathematical claims (California State Department of Education, 1985, p. 3). Instead, Carol's conception is of mathematics as a set of tools, and she engages her students in activities designed to help them learn to use those tools.

What it means to be actively engaged. Carol believes that children learn best when they *do*–when they can manipulate objects, act out situations, talk. When they do these things, they are more likely to be paying attention, which is key. She contrasts these sorts of activities with doing workbook pages and dittos, which do not actively involve learners. Carol carefully structures her students' activities so that they will develop the *correct* understandings: giving them templates for explaining, guiding their work with manipulatives, leading them with questions. She also manages time efficiently, moving along briskly and keeping children focused. That the teacher should "serve as a facilitator rather than a directive group leader" (California State Department of Education, 1985, p. 13) does not fit her assumptions about the teacher's role in promoting active engagement. She is not inclined to let students be stuck and take time to puzzle and be confused (California State Department of Education, 1985, p. 14). Her role is to make sure they "get" the content they are supposed to be learning. The *Framework* urges teachers to encourage alternative approaches and divergent ideas rather than pressing for single right answers:

> [Good questions] encourage students to explain, experiment, explore, and suggest strategies. The way in which a teacher responds to students' answers can influence the answers as much as the questions do. If a teacher reacts to an answer in a way that signals conformity (through praise, criticism, or other value judgment) students will perceive that their thinking process is not valued as much as the answers the teacher has in mind. (California State Department of Education, 1985, p. 17)

Carol, however, decidedly lets children know if their answers are correct, prodding and praising along the way. She also actively presses for convergence and conformity with standard mathematical procedures, solutions, and explanations, considering that a key aspect of her responsibility.

Carol's approach to teaching mathematics includes innovative practices and materials. She uses manipulatives, emphasizes meaning, and wants students to be able to apply mathematics to real-world situations. Consequently, her classroom appears to reflect key

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

dimensions of the *Framework's* vision of practice. Still, her conception of mathematics and her beliefs about knowing and learning mathematics are rooted in the traditional epistemology of school mathematics: Mathematics is a body of knowledge, consisting of concepts and procedures. Skill with these mathematical procedures is the central goal. The teacher dispenses the essential knowledge; the children receive it. There is a right way to use and to do mathematics. Because this traditional orientation to knowledge lies under the veneer of Carol's use of manipulatives and focus on the "whys," the nature of her children's encounters with mathematics may differ from the sort implied by a deeper reading of the *Framework's* vision.

Dilemmas in Communicating About Change

Carol does not realize that the mathematics *Framework* outlines a vision of practice that might suggest a fundamentally different classroom epistemology than the one she enacts. Although she has received a new textbook and has been told to adhere to it closely, she perceives the text as fitting with what she already does well. Thus, she does not think that her district is expecting her to change the way in which she teaches mathematics to her second graders—and, in fact, they may not be: District personnel may believe that Carol is enacting the vision of the *Framework*. Moreover, the district's press for high standardized test scores only reinforces her sense that nothing is changing. She is still accountable for what seems like the same content, measured in the same ways.

In Carol's district, the new text series has been designated as the primary messenger of change. How well it serves the role of communicating and fostering change is an open question. It clearly *can* provide guidance to teachers in using manipulatives, in selecting better mathematical tasks, and in creating different kinds of activities. What is less clear is whether or not a text, as the primary vehicle of change, can provide guidance for teachers on basic questions of knowledge and learning. In Carol's case it seems to fail. Can *Real Math*—or any of the "approved" texts—do the job of helping teachers come to understand and begin to implement a different classroom epistemology? Can a textbook provide sufficient vision and guidance for teachers to take on new roles in helping children to construct knowledge? Can a textbook challenge teachers' assumptions about knowledge and begin to help them develop different understandings of mathematics as a domain of inquiry and of knowing?

The promise and pitfalls of textbooks as messengers of change. Those who would try to change what goes on in schools must figure out how to communicate about change in a way that makes sense and respects where teachers are and yet makes them realize that they are being asked to rethink what they do, and in a way that provides guidance for that change. Because many teachers rely on textbooks as a core for their teaching, a textbook is a reasonable candidate for communicating and providing guidance for change. Yet teachers never literally "follow" textbooks. Rather, they necessarily interpret and depart from them. Deliberately and unintentionally, teachers adapt and modify the suggestions in the text to suit their own orientations and the needs of their particular students. However, a textbook is still more steadily and consistently available than a resource teacher and more concrete and specific than a set of curriculum statements. From a pragmatic standpoint, teachers are far more likely to read a textbook and consider its contents than they are to seriously engage a policy document. Textbooks can also be significant resources for teachers whose subject matter or pedagogical understandings are thin. Still, in the case of the kinds of changes suggested by the *Framework,* textbooks present problems of two kinds—problems in the message and problems with the messenger.

Problems in the textbook's message. Mathematics textbooks, however radically revised (and the California ones are not), tend to comprise a mélange of old and new, of the traditional and the novel. Patched together through market-spurred revisions, mathematics textbooks include pages with unstructured and nonroutine problems interwoven with pages with algorithmic presentations of procedures (e.g., multiplication of decimals). The message is thereby easily gar-

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

bled. What exactly *is* this new approach to teaching mathematics for understanding? Is it adding manipulatives and calculators? Is it sprinkling "problem solving" into the curricular stew? The classrooms envisioned by the *Framework's* writers are coherent. Textbooks, given the politics of their revision and change, are not.

Problems with the textbook as messenger. Texts, by their very nature, focus on the substantive—on the topics and procedures of the subject: fractions and decimals, measurement and geometry, functions and multiplication. A mathematics text containing both familiar and not-so-familiar topics can help teachers reconsider *what* to teach. The pedagogical suggestions lining the margins or buried in the recesses of the teacher's guide can influence *what* teachers use to represent those topics. Far less probable, however, is it that a marketable textbook can package a different orientation to knowing or encourage a different role for the teacher. These are deep-seated dispositions, simmered over the years of a teacher's experience and seasoned by cultural assumptions about and images of teaching and learning (Cohen, 1989). Changing the role the teacher plays—how the teacher helps students learn—is not merely a matter of changing these suggestions in the teacher's guide, for shifting the balance of authority for answers from the teacher and the text to the students cannot be directed from the margins. Changing ways in which children encounter mathematics in school so that they might develop understanding through mathematical conjecture and argument, for example, requires something that likely goes beyond written texts. It requires changed views of what mathematics is and what it means to know and do mathematics as well as changed assumptions about students and how they learn. These are complicated changes, often underestimated by reformers.

Carol and the Winds of Change

In order to help a successful teacher like Carol Turner consider changing what she does in her classroom, the messages she encounters must engage her where she is—they must both make sense and be compelling. They must give her an alternative vision and give her considerable guidance about what that alternative practice would look like and entail. This does not seem to have happened in Carol's case. Two reasons seem to account for this.

First, what she does reflects enough of some features of the *Framework* that any new ideas she has encountered—using manipulatives, for example—seem familiar and comfortable. The ideas purveyed by the new textbook and the district's messages to teachers do not challenge her accustomed ways of helping students learn mathematics. She hears that she should stress concepts, meanings, and applications. She should use cooperative grouping and manipulatives. All this, Carol thinks to herself, she has always done.

A second and related reason is that Carol perceives no mandate to change or rethink her practice. A question we must ask the *Framework* is whether or not a teacher like Carol *is* being asked to change. *Is* she teaching in the spirit of the *Framework*? How would the *Framework's* authors and advocates assess her approach to teaching mathematics? Like any text, the *Framework* is open to multiple interpretations. In this case, Carol's teaching looks different in light of different readings of the policy statement. Which one is right? Is there a "right" interpretation, from anyone's perspective in California?

Carol's case highlights the conceptual difficulty of communicating an alternative vision of teaching to those who would enact it. For teachers, as the implementors of policy, the message must be sufficiently clear. They must be able to understand the direction and substance of the policy. This means that the policy must make sense from the teachers' current frames of reference. From this standpoint, textbooks make good policy messengers because they can represent ideas in a forum that is familiar and concrete. Carol was enjoying and paying careful attention to her new textbook. Still, for change to occur, the message must seem to be outlining a direction and a practice that seems different from the status quo. The policy must be seen to be advocating something that would require some

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission

change. Here textbooks may fall short, for creating texts that can represent a significantly different sort of classroom practice is difficult. Carol's interpretation of the policy's thrust was that it was asking for what she already did. Carol's case helps to illustrate a central problem of change: how to communicate and provide guidance for change in a way that is comprehensible and yet challenges current practice.

Carol's case also highlights questions concerning the targets of reforms like the California *Framework*. Carol is a thoughtful teacher whose practice, while traditional in many ways, goes far beyond typical mathematics instruction. Her students do learn that there are reasons for the mathematical moves they learn to make, and that they can represent their written work with models. But Carol's students have not been given the opportunity to frame their own problems, or explore multiple, and valid, solution paths. They have not learned to take charge of their own learning, or to participate as full members in classroom discourse. The visions of mathematics in the *Framework* are multiple and Carol could be seen at once as complying with the *Framework*, or as subtly contradicting it. This raises questions both about the intentions of the *Framework* and about the nature of this reform. Would a state like California be happy if they could move all teachers to where Carol is? Alternatively, do policymakers want to change *all* teachers—those in the mainstream and on the fringe? Cases like Carol's suggest that policy instruments must pack a more powerful punch if they want to challenge both pedestrian and accomplished practice.

Notes

This work was supported in part by the Center for the Teaching and Learning of Elementary Subjects and the National Center for Research on Teacher Education, both of which are funded by the Office for Educational Research Improvement, U.S. Department of Education. The opinions herein are those of the author and do not reflect the position, policy, or endorsement of Department. (Grant No. R117P80004) The author gratefully acknowledges the other members of the research team: David Cohen, Ruth Heaton, Penelope Peterson, Richard Prawat, Ralph Putnam, Janine Remillard, Nancy Wiemers, and Suzanne Wilson. This article profited from the close reading and suggestions of David Cohen and Suzanne Wilson.

[1]Carol Turner is a pseudonym.

[2]Words in quotation marks are the teacher's terms.

References

California State Department of Education. (1985). *Mathematics curriculum framework for California public schools.* Sacramento, CA: Author.

Cohen, D.K. (1989). Teaching practice: Plus ça change . . . In P.W. Jackson (Ed.), *Contributing to educational change: Perspectives on research and practice,* (pp. 27–84). Berkeley CA: McCutchan.

Willoughby, S., Bereiter, C., Hilton, P., & Rubenstein, J. (1981). *Real Math.* La Salle, IL: Open Court.

Author

DEBORAH LOEWENBERG BALL is an Assistant Professor at Michigan State University, 116K Erickson Hall, East Lansing, MI 48823. *Specializations:* research on teacher education and teaching, and mathematics education.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission