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Policy and Practice: An Overview

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Policymakers in the U.S. have been trying to change schools and school practices for years. Though studies of such policies raise doubts about their effects, the last decade has seen an unprecedented increase in state policies designed to change instructional practice. One of the boldest and most comprehensive of these has been undertaken in California, where state policymakers have launched an ambitious effort to improve teaching and learning in schools. We offer an early report on California's reforms, focusing on mathematics. State officials have been promoting substantial changes in instruction designed to deepen students' mathematical understanding, to enhance their appreciation of mathematics and to improve their capacity to reason mathematically. If successful, these reforms would be a sharp departure from existing classroom practice, which attends chiefly to computational skills. The research reported here focuses on teachers' early responses to the state's efforts to change mathematics instruction. The case studies of five teachers highlight a key dilemma in such ambitious reforms. On the one hand, teachers are seen as the root of the problem: their instruction is mechanical, often boring, and superficial. On the other hand, teachers are cast as the key agents of improvement because students will not learn the new mathematics that policymakers intend unless teachers learn that math and teach it. But how can teachers teach a mathematics that they never learned, in ways they never experienced? That is the question explored in this special issue.

Policymakers believe that they can steer school practice and change school outcomes. This conviction is manifest in many past and present efforts to improve education, including competency tests, teacher evaluation systems, state teacher certification codes, mandated curricula, and high school graduation requirements. Yet educational researchers report that state and federal policies have affected practice only weakly and inconsistently—Launor, 1984; Cohen, 1989, 1990; Kennedy, Berman, & Demaline, 1986; Rowan & Guthrie, 1989; Sarason, 1971; Stake & Easley, 1978; Welch, 1979.

Policymaking has not, however, been slowed by such reports. The last decade has seen a bumper crop of state policies aimed at instructional improvement. Many states have launched testing programs that seek to drive teaching and learning in new directions. State-mandated reforms of instructional content have also increased. These include the California curriculum frameworks, the revised Michigan reading assessment, efforts to "align" instruction and assessment in Florida and South Carolina, and many new state teacher education requirements.

Despite this rich harvest of new policies, educational researchers continue to argue that the effects of education policies and programs depend chiefly on what teachers make of them (Elmore & McLaughlin, 1988; Firestone, 1989). Are policymakers mistaken to assume that their policies and programs can change teaching and learning? Or do researchers fail to notice ways in which policy does affect instruction?

We know relatively little about the answers to these questions. Many recent state policies have sought to push high school instruction toward an academic core by increasing graduation requirements. And the policies seem to have had some of the desired effects: High school course offerings and students' course taking have changed (Clune, White, & Patterson, 1989). But whether more required courses actually affect what is taught or learned remains an open question. Little is known about how teachers perceive instructional policies, how they interpret them, and how different kinds of policies influence teaching and learning. Many policies and programs have been aimed at classrooms, but what we know about those policies stops at the classroom door, for policy research has seldom investigated the effects of policies on the actual work of teaching and learning. We are only beginning to learn about effects of policy on classrooms, teachers, and students (Cohen, 1990; Porter, Floden, Freeman, Schmidt, & Schwille, 1988; Schwille et al., 1983).

This special issue probes the relations between instructional policy and classroom practice. Behind the classroom door, we explore how elementary teachers have interpreted and responded to a state-level policy designed to radically change mathematics teaching and learning. The policy in question resembles others in the current reform movement: It is an ambitious effort to shift mathematics teaching from mechanical drill and memorization toward mathematical reasoning and understanding. The policy's framers and advocates want students to learn mathematics in more meaningful ways and, toward this end, they are proposing fundamental revision in content and pedagogy. Although the policy has a familiar ring to mathematics educators, it is a far cry from modal practice. Mathematicians and mathematics educators have pressed for similar changes for nearly a century but have persistently failed to make much progress. Policy analysts say that endeavors of this sort are not unusual in the so-called "second wave" of current reform efforts, in which state agencies seek fundamental change in instruction (Firestone, Fuhrman, & Kirst, 1989).

The analysis presented in this issue centers on case studies of five elementary teachers. To set the stage, we offer first a cursory discussion of the nature of the policy, its vision, and the changes it implies. We then sketch a few themes that have been evident in the early stages of the policy's implementation and foreshadow threads that run throughout the five cases themselves.

A New Approach to Elementary School Mathematics

Just what changes in teaching and learning mathematics does the new California state policy envision? And what does the policy entail for practice? A brief look at the current mathematics education reform movement, of which the California initiative is a part, helps to provide a context for the nature of the changes envisioned.

One impetus for the current reform movement (National Council of Teachers of Mathematics, 1989a, b; National Research Council, 1989, 1990) is the widely held belief that American mathematics education is failing (Dossey, Mullis, Lindquist & Chambers, 1988). Mathematics teaching in most elementary classrooms emphasizes rules, procedures, memorization, and right answers (Goodlad, 1984; Stodolsky, 1988). Students seldom confront serious mathematical problems and are rarely expected to reason about mathematical ideas. Teachers stand at the board, show students how to do a particular procedure or type of problem, and assign practice exercises. Students then work quietly on these, asking the teacher for help if they get stuck. When students are done, the teacher checks their answers, marks the ones that are wrong, sometimes goes over the steps once again, and then students fix their incorrect answers.

In these classes, mathematics is represented as calculation, and learning mathematics as rote memorization. Mechanics dominate: Students do not experience mathematics as ways of thinking about quantitative and spatial patterns or as a creative endeavor. Mathematical domains such as probability and geometry are typically sacrificed to traditional arithmetic topics such as subtraction and long division. Students produce answers, not questions; "problem solving" most often means symbolizing and calculating routine word problems. And students seem to learn as they are taught: While many are able to perform basic arithmetic calculations, few are able to reason about mathematical questions or to solve even moderately complex problems (Dossey et al., 1988). Viewed in world perspective, American students' performance is notably weak (Travers & Westbury, 1989). In light of these problems, reformers have argued for major changes in goals, in content, and in pedagogy.

New goals for learning. A consistent theme in current efforts to reform mathematics education is the need for dramatic change in what students learn. One prominent idea is that students should be able to reason mathematically. Another is that they should be able to use such reasoning by applying mathematics to everyday situations. They should be able to understand the conceptual basis of mathematical procedures as well as evaluate mathematical arguments and quantitative data (California State Department of Education, 1985; National Council of Teachers of Mathematics, 1989a; National Research Council, 1989, 1990).

New conceptions of mathematical "content." A second major theme in current reform efforts is that students will not learn such things unless teachers make significant changes in what they teach. Reformers argue that teachers should help students make sense of traditional topics; in addition, they should offer students opportunities to explore novel topics, like probability. And, in addition to teaching mathematical "topics," teachers should focus on helping students learn to reason with, communicate about, and use mathematics. Instead of asking them to memorize algorithms for solving time-speed-distance problems, for example, teachers should help students to figure out how to turn a story about traveling from New York to Chicago into a mathematically soluble problem. Instead of helping students translate "how many more miles" into minus signs or to convert hours methodically into minutes, teachers should help students make and interpret their calculations within the meaningful context of the travelogue. Rather than just trying to get students to give the right answers, teachers should help students to reason mathematically about what might be plausible solutions. Teachers should encourage students to offer alternative solutions to problems and invite them to collaborate in figuring out what makes sense and why.

New pedagogy. If teachers taught these kinds of things, mathematics classes would be very different. Rather than relying exclusively on symbolic representations, teachers and students would use blocks, fraction bars, beans, and pictures and diagrams of many different sorts to represent their mathematical ideas. Students would talk much more in mathematics classes—with their peers in small groups as well as in whole-class discussions. Instead of focusing on the "right answer," students would discuss how to frame problems fruitfully and debate the merits of alternative ways of solving them. In classrooms of this sort, teachers' and students' roles would be dramatically different. Students would do much more of the teaching, for they would be working together, filling the air with ideas about how to solve problems, what made sense, and why it made sense. Teachers would rely less on direct instruction and more on framing lessons, coaching, orchestrating discussion, and the like. Teachers would be no less important, but they would be important in different and unusual ways (National Council of Teachers of Mathematics, 1989b).

Teaching and learning of this sort are quite remote from current practice. In most elementary math classrooms teachers have a virtual monopoly on instruction: They tell and show students how to do particular procedures; they monitor students' performance on written assignments; they act as though students learn mathematics through repetition and drill. Students' contributions are limited to doing as they are told, memorizing procedures, learning "facts," and giving brief, unexplicated answers to highly focused teacher questions.

Great changes therefore would be required to realize the aims of the current movement for reform in mathematics education.

Early Implementation

Policymakers in California have aimed directly at such changes, working to press practice toward these visions. They announced a new policy in 1985, in a new set of state mathematics curriculum guidelines. State officials had consulted widely with mathematicians, mathematics educators, and teachers in the development of the guidelines, referred to as the *Mathematics Curriculum Framework*. Such frameworks have been issued as advisories for local educators since the 1960s, and the 1985 version echoes many of the earlier frameworks' concerns (Wilson, 1989). But the 1985 *Framework* has played a very different role than its predecessors. State officials used it to press publishers to revise both the mathematical content and the pedagogical suggestions in their books, arguing that the texts should conform to the *Framework*. Publishers were exhorted to emphasize understanding rather than rules and to include novel topics such as probability and logic. Publishers were told that if they did not make major changes, their book would be struck from the state's textbook adoption list. This was a bold departure from past uses of state curriculum frameworks. And the State Education Department soon showed that it meant business by rejecting every math textbook that publishers submitted. State officials announced that many revisions were required before the books would be accepted.

Officials in Sacramento then used the new *Framework* to launch a major revision of the state's student achievement testing program. Since 1985, state officials have been developing tests that are intended to assess students' understanding of mathematics rather than just measuring their capacity to remember algorithms and produce correct answers. Policymakers in California believe that these revised tests will be a potent instrument of policy: The redesigned tests are expected to "drive" fundamental changes in teaching and learning mathematics.

This sketch reveals that instructional *alignment* plays a key role in California's efforts to improve mathematics teaching and learning. The idea behind alignment is deceptively simple: Education agencies should recast curriculum guides, textbooks, and assessments, so that all send the same clear messages to teachers and students. The underlying notion is that if instructional guidance is more consistent, teaching and learning will improve (Finn, 1989). But this approach is quite unfamiliar in American education: Most education agencies set only broad goals, or require courses for graduation (Cohen, 1990; Porter, Floden, Freeman, Schmidt, & Schwille, 1988; Schwille, et al., 1983). In contrast, education agencies seeking alignment might define rather specific instructional goals; they might recommend particular teaching methods; and they might specify the topics to be covered, as well as their content. Alternatively, education agencies might seek only to influence all of these things by way of powerful assessments (Finn, 1989; Resnick & Resnick, in press; Shanker, 1989). Whatever the mechanisms, an underlying assumption is that instruction is too important to be left entirely to schools and teachers: It must be closely and carefully managed by higher level agencies.

Effects in Practice

What is happening in California classrooms in response to the new policy? This first analysis focuses on what is happening in the minds and classrooms of elementary teachers. Rarely do policy studies work from the classroom outward. We try to do so here in order to better understand the ways in which policy and practice touch one another—or don't. Hence, we do not report here on our investigations of state policy formation, or on other aspects of this policy's implementation. But as we observed and listened to teachers and learned about their responses to the reform, our conversations with state and local officials provided us with crucial background for probing and interpreting what we saw and heard.

The classroom story is just beginning to unfold. This account is a first report and the cases that follow offer only partial and preliminary answers, partial because the cases focus on only one aspect of the issues sketched here: what teachers have done with the new guidelines and textbooks. The new state tests had not yet been used in the elementary grades, because their revision was incomplete when we visited the classrooms discussed below. And our answers are preliminary because so far we focus on teachers' responses, and these only a few years into the reform. But the issue is compelling, nonetheless: What do practitioners make of such policies?

One thread in the cases is that teachers have responded to the policy in quite varied ways: Some have made what they see as major changes, while others have changed little or not at all. Another thread is that the changes we saw depended partly on what we looked for. Had we attended only to the forms of instructional discourse—asking whether these were traditional lecture, recitation, and seatwork classes—we probably would have concluded that little was new, and that policy had not much affected instruction. Alternatively, we might only have asked if the mathematical content of classrooms measured up to the new Framework's demands. Had we done so, we probably would have concluded that the new practice did not measure up, and that the policy had made little difference.

These inquiries are reasonable, but we did not limit ourselves to them. We also scrutinized the finer texture of the teachers' classroom practices: the particular topics that teachers taught, the content they sought to convey, their pedagogy and classroom organization, and the relations among these things. We also investigated how these compared to teachers' views of their past work. We looked closely in part because our analysis of the policy suggested that it proposed particularly demanding changes—a notion that found support in some other studies of teaching and learning (Cohen, 1988; Lampert, 1988). For one thing, the policy signalled the need for a revolution in most teachers' knowledge of mathematics. For another, the new policy invited basic changes in teachers' beliefs about mathematics and in their beliefs about how students learn mathematics. Additionally, the policy called for change in how teachers thought about their role and how they conducted their classes.

Each of these areas is a crucial dimension of teacher knowledge and practice. Taken together they form an intricate web of ideas and understandings, orientations, habits, and assumptions. None seemed likely candidates for facile change. We suspected that most teachers would have much to learn—and *unlearn*—in order to make such changes. If so, it seemed likely that, like students learning to understand mathematics, California teachers might learn in partial and halting ways.

These considerations seemed sufficient reason to look closely at teachers' work, but there was still another reason. Researchers have relatively little experience in direct study of how innovations affect teaching practice. We had much to learn from the teachers we proposed to observe about how teachers respond to policy.

Our studies are an early step in such learning. We turned up evidence that California's new policy had influenced practice, but we also turned up evidence that practice had influenced policy. That is, this new policy could affect students' mathematics learning only through teachers' extant knowledge and beliefs about mathematics and their practice of mathematics teaching. Policies like this one are made in order to change practice, but they can only work through the practice they seek to change. Teachers are at once the targets and the agents of change.

This point plays itself out in a variety of ways. For example, many teachers see mathematics rather traditionally, as a string of topics to be covered serially: single-digit addition, two-digit addition, single-digit subtraction, and so on. Some of the teachers whom we observed took that view, and it affected their understanding and enactment of the new policy: They tended to interpret the policy as a set of suggestions for topics that they should add to the string. Estimation, manipulatives, and problem solving became new discrete topics, rather than—as the *Framework*'s authors appeared to intend—elements useful in all sorts of mathematical reasoning. These teachers had implemented an element of the *Framework,* in a sense; their lesson had some of the new content. But that new content was organized within the existing structure of traditional school mathematics. To take another example, teachers often search for pedagogical tactics that will engage students and transmit material more effectively: classroom games, film strips, tricks, concrete models, and the like. Some of the teachers whom we observed seemed to apprehend the policy as a new source for such tactics. For example, the *Framework* had recommended the use of concrete materials so that students would have access to varied representations of mathematical ideas. Several teachers were delighted with the idea; they avidly embraced concrete materials, and used them extensively. In a sense they had implemented the policy. But these teachers' use of the new materials was filtered through their established practice: Some of these teachers offered students no opportunities to figure out what sense they made of the new materials; they used the manipulatives to capture and rivet students' attention on memorizing the traditional rules and procedures. Rather than treating the materials as opportunities to help students construct and articulate their understanding of mathematics, these teachers treated the materials as another didactic agent of direct instruction, presenting traditional menus of mathematical content. Again, the new mathematics instruction was filtered through an older and much more traditional mathematical and pedagogical structure.

Hence, our case studies of how policy influences practice also are studies of how practice influences policy. For instructional policies are filtered through teachers' knowledge and beliefs about academic subjects, and through their established practices. California teachers' mathematical and pedagogical pasts shaped the mathematical future that this new policy invited them to help create. Policies that seek to change instructional practice depend upon—and are changed by—the practice and the practitioners they seek to change.

These comments highlight a key dilemma in recent demands for improved teaching: teaching for understanding or higher order thinking. On the one hand, teachers are central actors in the old school subjects: They offer a mechanical version of reading or writing or mathematics, and the result offends reformers. Often it bores students. Teachers are, in one sense, the problem that policy seeks to correct. On the other hand, teachers are the most important agents for improving things: Students' encounters with mathematics in school will not change unless teachers change them.

How can teachers teach a mathematics that they never learned, in ways that they never experienced? That is the dilemma that such reforms pose. Our cases explore it. They suggest the enormous complexity of the changes that many instructional policies imply and the great difficulties of producing such changes from a distance.

One last point: These cases are not an evaluation of California's new policy or of the teachers we portray. Such an evaluation would be entirely inappropriate, for the policy has only just begun and we visited these teachers in their first two years of using the newly revised texts. This is not another effort to pull a tender young thing up by the roots, to see if it is growing. It is only an early report from a few outposts on the front lines. We offer no conclusions about the policy's "impact." But we do offer some insights into how instructional policy and teaching practice affect each other. We think that these insights will be of interest to researchers and policymakers everywhere, at any stage in the evolution of instructional policy.

Notes

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References

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

Clune, W., White, P., & Patterson, J. (1989). *The implementation and effects of high school graduation requirements*. Princeton, NJ: Rutgers University, Center for Policy Research in Education.

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.

Cohen, D. K. (1990). *Policy and practice: The classroom impact of state and federal policy.* Unpublished manuscript, Michigan State University, East Lansing.

Cuban, L. (1990). Reforming again, again, and again. *Educational Researcher, 19,* 3–13.

Dossey, J. A., Mullis, I. V. S., Lindquist, M. M., & Chambers., D. L. (1988). *NAEP: The mathematics report card: Are we measuring up?* Princeton, NJ: Educational Testing Service.

Elmore, R. F., & McLaughlin, M. W. (1988). *Steady work: Policy, practice, and the reform of American education.* Santa Monica, CA: the RAND Corporation.

Finn, C. E. (1989). National standards: A plan for consensus. *Teachers College Report, 91,* 3–9.

Firestone, W. (1989). Educational policy as an ecology of games. *Educational Researcher, 18* (7), 18–24.

Firestone, W., Fuhrman, S., & Kirst, M. (1989). The progress of reform: An appraisal of state education initiatives. Princeton, NJ: Rutgers University, Center for Policy Research in Education.

Goodlad, J. (1984). *A place called school: Prospects for the future.* New York: McGraw Hill.

Kennedy, M., Berman, B. F., & Demaline, R. E. (1986). *The effectiveness of Chapter 1 services. (National Assessment of Chapter 1).* Washington DC: U.S. Department of Education.

Lampert, M. (1988). What can research on teacher education tell us about improving quality in mathematics education? *Teaching and Teacher Education, 4,* 157–170.

Launor, C. F. (1984). The sustaining effects study of compensatory and elementary education. *Educational Researcher, 13*(8), 4–13.

National Council of Teachers of Mathematics. (1989a). *Curriculum and evaluation standards for school mathematics.* Reston, VA: Author.

National Council of Teachers of Mathematics. (1989b). *Professional standards for teaching mathematics—Draft.* Reston, VA: Author.

National Research Council. (1989). *Everybody counts: A report to the nation on the future of mathematics education.* Washington, DC: National Academy Press.

National Research Council. (1990). *Reshaping school mathematics: A framework for curriculum.* Washington, DC: National Academy Press.

Porter, A., Floden, R., Freeman, D., Schmidt, W., & Schwille, J. (1988). Content determinants in elementary school mathematics. In D. A. Grouws, T. J. Cooney, & D. Jones (Eds.), *Effective mathematics teaching* (pp. 96–113). Reston, VA: National Council of Teachers of Mathematics.

Resnick, L. B., & Resnick, D. P. (in press). Assessing the thinking curriculum: New tools of educational reform. In D. R. Gillford & M. C. O'Connor (Eds.), *Future assessments: Changing views of aptitude, achievement, and instruction.* Boston: Kluwer Academic Publishers.

Rowan, B., & Guthrie, J. (1989). The quality of Chapter 1 instruction: Results from a study of twenty-four schools. In R. Slavin, N. L. Karweit, & N. A. Madden (Eds.) *Effective programs for students at risk* (pp. 195–219). Boston: Allyn and Bacon.

Sarason, S. (1971). *The culture of the school and the problem of change* (2nd edition). Boston: Allyn and Bacon.

Schwille, J., Porter A., Floden, R., Freeman, D., Knappen, L., Kuhs, T., & Schmidt, W. (1983). Teachers as policy brokers in the content of elementary school mathematics. In L. Shulman & G. Skykes (Eds.), *Handbook of teaching and policy* (pp. 370–391). New York: Longman.

Shanker, A. (1989). *Asking the right questions.* Washington, DC: American Federation of Teachers.

Stake, R., & Easley, J. (1978). *Case studies in science education.* Urbana, IL: University of Illinois.

Stodolsky, S. (1988). *The subject matters: Classroom activity in mathematics and social studies.* Chicago: University of Chicago.

Travers, K., & Westbury, I. (1989). *The IEA study of mathematics I: Analysis of mathematics curricula.* New York: Pergamon.

Welch, W. W. (1979). Twenty years of science curriculum development: A look back. *Review of Research in Education, 7,* 282–306.

Wilson, S. M. (1989). *The history of the California mathematics frameworks.* Unpublished manuscript, Michigan State University, East Lansing.

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