California Dreaming: Reforming Mathematics Education

Reviewed by Anthony Ralston

California Dreaming: Reforming Mathematics Education
Suzanne M. Wilson
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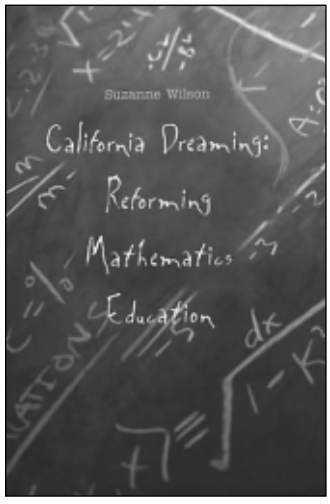
Who would you choose to write a book about the history of the Math Wars, a topic surely familiar by now to almost all readers of the *Notices* (if not, see [1])? A mathematics educator? Probably not, since most such are biased toward the progressive school of mathematics education. A mathematician? Again, probably not, since most of them are avid exponents of the traditional view of mathematics education. Neither? Worst of all, you might say, for how could a nonmathematician, nonmathematics educator ever understand the Byzantine world of California mathematics education politics? But, in fact, Suzanne Wilson's background and knowledge do qualify her to write this book.

Wilson is a professor of teacher education at Michigan State University and, therefore, suspect as a colleague of mathematics educators. But, in addition to her Ph.D. in educational psychology, she also has a master's degree in statistics, so that she is not mathematically ignorant. At any rate, she has written a book about the Math Wars in California from which not only did I, a peripheral warrior in the Math Wars, learn a lot but in which I could not detect even the whiff of bias.



Wilson is equally critical of zealots on both sides of the Math Wars. Despite having "strongly held" opinions of her own, she aims at and, I believe, hits "the middle ground". This book is then a tour de force that merits reading by anyone interested in the Math Wars, even including Californians, almost all of whom, I dare say, would learn something about math education in their state from this book.

Since 1986 Wilson has spent considerable amounts of time in California working on a variety of mathematics education projects. So, in addition to having the perspective of a non-Californian, she knows whereof she writes. The first six (of ten) chapters cover the history of twentieth-century mathematics education in California and in the U.S. until 1993, when the Math Wars began in earnest. The next two chapters deal with the Math Wars themselves and are followed by a chapter on how the California Mathematics Framework of 1999

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and the California Mathematics Content Standards of 1997 have affected—or not—classroom practice. The final chapter, "Toward a Civil, Constructive Discourse", details the author's hopes, probably overly optimistic, for a replacement of war by constructive engagement in mathematics education in California and the U.S.

California is so large, so diverse, and so important in the U.S. that what happens there is bound to have an impact throughout the nation. In particular, the diversity of California ensures that all problems in (virtually) every other state are mirrored somewhere in California. Wilson's title, *California Dreaming*, refers to the dreams of progressive educators in California in the 1970s and 1980s for reforms that would create "classrooms in which students loved mathematics" as well as to the dreams of the critics of those reforms whose wish is for "rigorous mathematics delivered to all schoolchildren." Mostly, however, I think that the title refers to the author's own dreams of an end to the Math Wars in California and elsewhere.

Although Wilson uses the labels "traditional" and "reform" (or "progressive") to identify the two sides in the Math Wars, she is careful to note that actually there were not two well-defined positions in the Math Wars, which, tongue-in-cheek, she describes as

> the Republican-Conservative-Traditionalist-Positivist-Math-as-Skills-Direct-Instruction-Social-Efficiency Camp and the Democratic-Progressive-Constructivist-Interpretivist-Math-as-Conceptual-Understanding-Child-Centered-Instruction-Democratic-Equality Camp. [p. 165]

Very few fit precisely into either camp, but those of you who have been close to the Math Wars will probably be able to think of some people—Wilson's "zealots" or "extremists"—who fit pretty well into one or the other.

Some History

If you are under fifty—or should it be sixty?—the New Math is probably something you have heard of but know little about. Following the launching of Sputnik by the Soviet Union in 1957, there was much well-founded hand-wringing about the state of American mathematics and science education that led to a number of new curricula, collectively known as the New Math. These were mainly the brainchildren of university mathematicians, although mathematics educators played a role too. In particular, these curricula emphasized the language of sets, relations, and functions much more than had been usual in elementary and secondary school classrooms. For a variety of reasons, but perhaps most notably because teachers were not prepared to teach this mathematics nor were they given adequate support, the New Math rocket went up quickly but came down almost as quickly, its trajectory spanning little more than the decade of the 1960s. Wilson suggests that another reason for the failure of the New Math was that it was led by mathematicians who were "unenlightened about the realities of schooling." An important question about the Math Wars is whether mathematicians have learned this lesson of the New Math or whether the recent victory of traditionalists in California, spearheaded by research mathematicians, is, to quote Yogi Berra, "déjà vu all over again."

At any rate, "the New Math left a disastrous legacy" that rendered suspect any subsequent proposal for major change in the school mathematics curriculum and has led critics to tar the so-called "reform" proposals of the 1980s and 1990s as the New New Math even when they bear little or no resemblance to the New Math.

The lack of discernible improvement in American education in the 1970s led to the publication of perhaps the most influential of all U.S. government reports on education, *A Nation at Risk* [2], in 1983. Two particularly trenchant quotes from this report are:

> If an unfriendly power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war.
>
> For the first time in the history of our country, the educational skills of one generation will not equal, will not even approach, those of their parents.

The publication of *A Nation at Risk* led to a flurry of activity. In California there was first the *Mathematics Framework for California Schools, K–12* [3] in 1985 and then the *1992 Framework for California Public Schools (K–12)* (the *1992 Standards*) [4], both developed by the California Department of Education with the help of various committees of (some of) the great and good in California mathematics education. In between these two frameworks, the National Council of Teachers of Mathematics (NCTM) published in 1989 the *Curriculum and Evaluation Standards for School Mathematics*, known universally as the *NCTM Standards* [5]. These three documents all reflected the progressive side of mathematics education. All were controversial. The *NCTM Standards* has been influential in changes made in the mathematics programs in many states; this document has become the bête noire of the traditional side because of its deemphasis of traditional pencil-and-paper arithmetic and its advocacy of the use of calculators in elementary and secondary school mathematics. In

Research

One of the most important and deepest disagreements between research mathematicians and mathematics educators concerns research in mathematics education. I know research mathematicians on the extremist fringe on this issue who believe that "research in mathematics education" is an oxymoron. To them "research" is a word justified only when applied to theorem-proof mathematical research or to the scientific-method paradigm of the physical sciences. Thus, essentially nothing written about education or about any of the social sciences would qualify as research. This perspective is at least consistent, if not very helpful. Work in education or the social sciences will *almost never* lead to ironclad, provable results.

A much larger number of research mathematicians appear to believe that just about everything published in mathematics education journals is, at best, second rate. But, while it would be folly to try to defend much that is published in these journals, equally it would be folly to dismiss it all out of hand. There are many very bright people working in mathematics education who are excellent scholars and who produce work worthy of the attention of the mathematics research community. As David Berliner has written [12],

> The important distinction is really not between the hard and soft sciences. Rather it is between the hard and easy sciences.

Just because definitive results are almost impossible to obtain, the problems that social scientists deal with are intrinsically harder than those that mathematicians deal with.

The question of research has been an important one in the Math Wars in California. Wilson writes:

> According to the California State Education Code, the state's framework had to "incorporate principles of instruction reflective of current and confirmed research" but no one could agree on what counted as "research". In 1997, the State Board contracted with Douglas Carnine, a professor at the University of Oregon, to review high quality research. [pp. 174–175]

Although 968 relevant articles were identified, Carnine and his collaborators ruled out of their study all but the 110 of these that discussed "experimental studies in mathematics." Thus, qualitative studies, the ones that research mathematicians are generally quickest to criticize, were not considered at all. An irony is that the single piece of research in mathematics education most praised by mathematicians in recent years is the book by Ma [13], which is, quintessentially, qualitative research. Indeed, it is almost always qualitative research that is most significant in education and the social sciences, where the scientific research paradigm is just not applicable because of the large number of variables, most of which cannot be controlled. Therefore, the application of the scientific method to make education an "evidence-based field" (one of the objectives of the No Child Left Behind Act of 2001) will remain a chimera.

Thus, the results of the so-called Carnine Report [14] were predictably equivocal and, more predictably, were controversial, being particularly criticized by progressives because of the skewed database it used and because they saw Carnine "as a political conservative".

—*A. R.*

addition, various, mostly trivial, mathematical errors in the *Standards* have been pounced on by traditionalists as evidence of a general sloppiness.

In California controversy grew rapidly after the publication of the *1992 Standards*, escalating into what is now called the Math Wars. Wilson weaves her way through the minefield of competing claims with great dexterity, while at the same time elucidating the structure of mathematics education in California and the alphabet soup of organizations involved with developing standards, choosing approved textbooks, and designing tests to be administered to all of California's children.

"Dueling Standards"

This is the title of Wilson's Chapter 8, in which she describes the escalation of the Math Wars during the development of the *1999 California Mathematics Framework* [6]. In 1995 the California State Legislature mandated the separate development of "content standards", which were to be much more explicit about the content of the mathematics to be taught in each year than the previous California frameworks or the *NCTM Standards* had been. The development of these content standards proceeded more or less in parallel with the writing of the *1999 California Mathematics Framework*. In fact, the first draft of the framework was completed before the content standards were finished, even though "by law the new framework had to align with the new state [content] standards." Complicating things further, the content standards expressed a clearly progressive stance, whereas the *Framework* had a traditional emphasis. With only two months left until the mandated December 1997 date for the completion of the content standards, the State Board of Education (SBE) asked several "highly regarded mathematicians" to revise the content standards to bring them into alignment with the *Framework*. The SBE then

accepted the revision without further "public review or discussion." The 1999 framework, which focuses on content and is, indeed, aligned with the content standards, espouses a traditionalist perspective that would have been controversial in any case but was made more so because of the inability of progressives to comment on the final content standards document before it was adopted by the SBE.

Wilson tells this complex story skillfully, weaving into it such things as the emerging poor results of American students in the Third International Mathematics and Science Study (TIMSS) in the mid-1990s and the national debate that ensued from these. There is a good section on the famous open letter [7] to then-Secretary of Education Richard Riley that appeared in the *Washington Post* on November 18, 1999. This letter, signed by over two hundred scientists, mainly research mathematicians, castigated the U.S. Department of Education for assigning the labels "exemplary" or "promising" to ten newly designed reform mathematics programs, some of which were already beginning to be widely used.

Wilson also discusses briefly the NCTM's *Principles and Standards for School Mathematics 2000* (PSSM) [8], an update of the 1989 *Standards*. Although developed with input from all the major professional societies in mathematics (see, for example, [9]), PSSM has by no means silenced the traditionalist critics of NCTM.

This chapter ends with a brief section, "A Story That Has No End", a title as apt today as when this book was published in early 2003.

Technology

If you have read this far, you will have gathered that I think Wilson has done a generally excellent job on a topic where satisfying everyone that she is impartial would have been almost impossible. But that is not to say that this book is without fault.

Wilson presents twentieth-century American mathematics education as the ebb and flow of progressive and traditional approaches to mathematics education. And so it has been. But there is one thing about the Math Wars that makes them different from anything that has preceded them and that accounts for much of their bitterness.

This difference is the impact of technology, specifically calculator technology, on mathematics education. Wilson barely mentions calculators or computers in her book, despite the fact that whether or not they should be used in elementary and secondary mathematics education has been a source of major controversy since the 1980s at least. There are two index references to calculators and some half dozen other places where calculators are mentioned. But nowhere does she grapple with the crucial issues in mathematics education that are raised by calculators and that have played important roles in the Math Wars. My intent here is not to discuss whether calculators should be used in school mathematics or whether, as mandated in the *1999 California Framework*, they should be banned from elementary classrooms. Rather, I wish to argue that calculators (and computers) have crucially changed the *nature* of the debate about, particularly, elementary school mathematics, but also, more generally, about what is important in school mathematics at the beginning of the twenty-first century.

Consider first long division. Wilson notes the criticism of the initial draft of the California content standards: "Where was long division?". But she does not put this into the context of a debate going on at least since the publication in Great Britain of the Cockcroft Report [10] in 1983, which stated, "We believe that it is not profitable for pupils to spend time practising the traditional method of setting out long division on paper, but that they should normally use a calculator." The important thing is not whether you agree with this recommendation but rather that you understand that it is a recommendation that could not have been made before calculators became ubiquitous and cheap. Before that time skill at paper-and-pencil long division was something that everyone who used arithmetic needed, so a recommendation to abandon it could not have been contemplated. Now with calculators available to almost everybody, the terms of the debate have changed. Only if you believe the argument (see [11]) that facility with the traditional long-division algorithm is necessary for the subsequent study of mathematics could you still advocate teaching it, since the skill *itself* has ceased to be useful.

A second example concerns addition and multiplication. No one except perhaps a very few lonely souls on the far edges of the progressive side of the debate has ever argued that children do not need to learn the addition and multiplication tables. But does it follow, for example, that they should also learn to add long columns of numbers by hand or to do, say, three-digit by three-digit multiplication? Neither of these skills any longer has any intrinsic value in itself. Teaching children to become adept at them can only be justified by an argument about the importance of being able to do these things for the further study of mathematics.

Wilson states that as "mathematics changes…the content of school mathematics must change," although, in fact, the content of elementary school mathematics has hardly changed at all in a century, at least not as a result of any advances in mathematics. What may have changed—and this is a major portion of the Math Wars debate—is the *importance* of various mathematics topics traditionally taught in elementary school. If such change has

occurred, then we must consider what adjustments should be made in the content and teaching of elementary school mathematics.

It is unfortunate that Wilson does not discuss these issues in her book. But, despite this criticism, Wilson's book is worth reading by research mathematicians and mathematics educators alike.

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