High Achievement in Mathematics:

Lessons from Three Los Angeles Elementary Schools

by

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Abstract. This paper describes characteristics and academic policies of three low income elementary schools in the Los Angeles area whose students are unusually successful in mathematics. Barriers to high achievement in mathematics that exist for a large number of schools in Los Angeles are also identified and discussed.

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What can elementary schools do to promote high achievement in mathematics for their students? While much knowledge has been gained in recent years about the teaching of reading, relatively little is known about what constitutes effective mathematics programs.

This paper describes characteristics and policies of three low income schools with unusually successful mathematics programs in the Los Angeles area. It should be conceded from the outset that this is not a scientific study, and any conclusions and recommendations for the establishment of successful mathematics programs in this report are necessarily speculative. The descriptions of the mathematics programs which follow are based on my conversations with the principals and some teachers at these schools, and on site visits.

This report also identifies and discusses barriers to student achievement in mathematics which exist for a great number of schools in the Los Angeles area. The observations in this regard stem from my work with the Los Angeles County Office of Education, or LACOE, between July 1, 1999 and June 30, 2000. During that year, I took a leave of absence from my normal duties as a professor of mathematics at California State University, Northridge to serve as a mathematics consultant for LACOE. My responsibilities during that time included directing eight math specialists toward increasing student achievement in mathematics in L.A. County schools and making teachers and administrators aware of the California state mathematics standards and a variety of educational resources to support them.

Three High Achieving Elementary Schools

The three high achieving elementary schools identified in this report are Bennett-Kew Elementary School, William H. Kelso Elementary School, and Robert Hill Lane Elementary School. Lane Elementary School is located in Monterey Park and is part of Los Angeles Unified School District, or LAUSD. The other two schools are part of Inglewood Unified School District, located near the Los Angeles International Airport. These schools are exceptional. Among elementary schools with 95% or more of the students tested on California's STAR exam, 25% or more of the student body categorized as Limited English Proficient (LEP), and at least 70% of the students on free or reduced lunch, Kelso ranked highest in the state in terms of the Academic Proficiency Index (API) score, Bennett-Kew was the second highest, and Robert Hill Lane Elementary was the 4th highest in California in 1999.[1] Spring 2000 SAT-9 (Stanford Achievement Test) average percentile scores by grade level are summarized in the following table:

Average SAT-9 Percentile Scores by Grade Level, Spring 2000

School(s)	Grade 2	Grade 3	Grade 4	Grade 5
Bennett-Kew	80	83	65	58
Kelso	81	82	69	73
Robert Hill Lane	64	72	64	67
LAUSD Schools	41	42	35	35
L.A. County Schools	51	51	44	44

At Robert Hill Lane, 90% of the student body is Latino or Hispanic, 36% of students are not fluent in English, and 85% qualify for free or reduced price lunch. Yet the school's performance in mathematics is typical of relatively affluent schools.

The entire Inglewood Unified School District has received national attention because of the high academic achievement of its elementary schools and the modest resources of the student population.[2] Almost 75% of Inglewood's elementary students qualify for subsidized lunches, a standard measure of poverty among schoolchildren, and 45% of the teachers hold emergency credentials. More than one-third of the students are not fluent in English, and 98% of the student population is Latino or African American. At Bennett-Kew, 51% of the student body is African American, and 48% is Latino; 77% of all students qualify for free or reduced priced lunch, and 29% are not fluent in English.

At Kelso, 44% of all students are African American and 53% are Latino; 89% of all students qualify for free or reduced priced lunch, and 34% are not fluent in English.

Bennett-Kew and Kelso are the two highest achieving schools in Inglewood, and they have led the district in implementing successful reforms. The late Superintendent of Inglewood Unified, McKinley M. Nash, organized the other elementary schools to emulate Bennett-Kew and Kelso. He pushed the district's adoption of Open Court, the reading program that Bennett-Kew and Kelso had used for many years. He also required all elementary school principals in the district to report student reading scores to him. Those reforms began to take root in the district around 1997 as test scores started to rise in Inglewood.

Bennett-Kew

Nancy Ichinaga, the principal of Bennett-Kew until she retired in June 2000, describes the beginning of her tenure as principal as follows:

> *When the scores of the first California Assessment Program at the third grade level were released in October, 1974, I had been principal at Bennett-Kew for just a little over a month. Bennett's third graders ranked at the third percentile in the state. Reacting with shock and dismay, I told the staff that the third percentile meant that: 1) 90% of our kids were retarded or 2) the Open Structure Program, in its fourth year at Bennett, was not working. The teachers admitted that their program had created a school full of illiterate children, and they were ready for a change. They agreed that they needed to teach all children to decode and encode in a structured, systematic beginning reading program. They also agreed that to make children truly literate they needed to expose them to the best of children's literature from all over the world.*

To improve mathematics instruction, Mrs. Ichinaga directed teachers first to study the major standardized tests for mathematics, then categorize and sequence the topics to develop a curriculum for the school. This process took several years, but the result was a program which elevated student test scores up to and beyond the 50th percentile on standardized tests. A key component to the mathematics program was that Mrs. Ichinaga collected and analyzed results of diagnostic tests from teachers and responded to

deficiencies in student performance. Especially significant to student success in mathematics, according to Mrs. Ichinaga, is a clearly defined curriculum. The school uses direct instruction with an emphasis on basic skills as prerequisites to problem solving. Calculators are rarely if ever used. Parents contribute to every aspect of the school, from making curriculum and budget recommendations to painting classrooms and planting flowers.

In the fall of 1998, Bennett-Kew began a pilot program using Saxon Mathematics, a K-6 curriculum which in 1999 became one of several approved by the California State Board of Education. One class at each grade level used the curriculum, and resulting increases in student performance motivated the teachers to adopt the program school-wide in the Autumn of 1999. During the first year with the pilot program in 1998, one third grade class in a Gifted and Talented Education (GATE) program scored on average at the 89th percentile using the old curriculum. Mrs. Ichinaga and the teaching staff were surprised, however, when a regular third grade class using the Saxon program scored at the 95th percentile that same year.

Although more than one in four students at Bennett-Kew do not speak English fluently, the school never practiced bilingual education during the decades of Nancy Ichinaga's tenure as principal. Instead, entering Kindergartners are immersed in English, and those who still require help beyond that year enroll in "junior first grade," where language and math skills are also bolstered in preparation for first grade. For entering students in higher grades, there are English Language Development classes and bilingual aides in classrooms to assist identified students in specific content areas. As a child, Nancy Ichinaga faced similar language barriers as her own non-English speaking students. As Mrs. Ichinaga explains, "My kids come to school much like I was, with very little English." She was raised in a Japanese-speaking home on a Hawaiian sugar cane plantation, but attended schools that taught in English. The immediate effect of this policy on mathematics instruction is that all mathematics classes are conducted in English using the same program.

Nancy Ichinaga selected her teachers carefully, and it shows. During a visit to several classrooms at Bennett-Kew, I observed clear and well organized instruction. The teachers exhibited warmth toward their students while simultaneously making no secret

of their high expectations and demands on performance. The students appeared to understand the lessons and were able to solve problems independently. In several cases, students solved problems at the white boards at the front of the class and briefly provided cogent instruction themselves to the rest of the class. The teachers were not warned in advance of my visit.

An interesting and slightly different perspective was given to me by Juliet Anekwe, a fourth grade teacher at Bennett-Kew. Ms Anekwe commented that the teachers at Bennett-Kew are really no different from teachers at other schools. When I asked her to identify factors leading to Bennett-Kew's successful mathematics program, she replied, "Perhaps a significant factor in the school's success is the fact that we work together and we are very structured as a team. All teachers use the same textbooks, and this was encouraged and enforced by Mrs. Ichinaga." Other schools allow different programs even within the same grade level, or they impose ineffective or even damaging programs on teachers.

Not all teachers can accept the kind of environment one finds at Bennett-Kew. Newly credentialled teachers from prestigious universities are sometimes turned away after a semester or two. Education college doctrine is often at odds with what works at Bennett-Kew, and Mrs. Ichinaga has found that in some cases noncredentialled teachers provide better instruction than credentialled ones.

Kelso

Marjorie Thompson was the principal at Kelso Elementary school for more than two decades until she retired in February, 2000. She and Nancy Ichinaga have been friends for many years and developed similar policies at their schools. In 1988, Nancy Ichinaga shared the curriculum developed at Bennett-Kew with Marjorie Thompson. Both started using Open Court for reading in the mid-1980's and both schools have similar policies such as "junior first grade" and close cooperation with parents in educational programs. The capable new principal at Kelso, Jacqueline Moore, was head of the Reading Alliance program sponsored by the Packard Humanities Foundation, and she spent time at Bennett-Kew. As with Bennett-Kew, there is a strong focus on basic

skills at Kelso, and calculators are rarely used. Kelso also rejected bilingual education two decades before California voters ended it through Proposition 227.

While principal, Marjorie Thompson tested all new entering non-Kindergarten students in order to place them in appropriate grade level classes. Mrs. Thompson required parents to be present during those placement sessions, and during the height of the Whole Language era, she estimates that roughly 80% of the new students were placed at a lower grade level at Kelso than they would have been if they had continued at their previous schools. Principal Jacqueline Moore continues this placement policy with parental agreement.

Kelso has some distinguishing features that undoubtedly contribute to its high test scores. More than an hour each day is devoted to mathematics instruction. Some fourth and fifth grade teachers are paid to stay an extra 45 minutes at the end of each school day to provide additional instruction. Each morning begins with 20 to 30 minutes devoted to reviewing concepts and skills in reading, math, and language. Marjorie Thompson has for years recognized the value of repeated exposure to topics in mathematics. A topic is usually reviewed during at least two of the morning sessions of the week it is presented and reviewed less frequently thereafter. In this respect, the program at Kelso is similar to the Saxon math program used at Bennett-Kew; repeated exposure and review is an important component of both mathematics programs. Kelso uses a standard curriculum from the publisher Silver-Burdett-Ginn with supplementary material from "Excel Math" of AnsMar Publishers and materials generated within the school.

Instruction at Kelso is data driven. Kelso conducts regular uniform diagnostic assessments for reading and mathematics as part of its curriculum. The effect of a strong reading program on mathematics performance is an interesting topic and one which Mrs. Thompson has considered. Mrs. Thompson suggests that language mastery facilitates the mental trial and error methods upon which solving math problems depends. Literary abilities and mastery of the language contribute to mathematical proficiency, and therefore a strong reading program aids mathematics instruction in fundamental ways. Principal Moore concurs with this point of view, and both principals firmly believe that high expectations of students are essential in order to produce high achievement in both language and mathematics.

Kelso has four year round tracks. Up to two-thirds of students in third through fifth grade attend math classes during the interim sessions, while other children on the same tracks at different schools are on vacation. Some intercession classes are devoted solely to math. Kelso teachers who are off-track work as substitute teachers at Kelso as needed and also supply instruction during the interim sessions. In this way, Kelso teachers contribute to the overall consistency and uniformity of instruction. As with Nancy Ichinaga, Marjorie Thompson was highly selective in hiring teachers for her school and found that noncredentialled teachers sometimes perform better in the classroom than credentialled teachers, even when their degrees come from prestigious universities. In several cases, newly hired credentialled teachers followed their college of education training by opposing direct instruction and not giving sufficient attention to basic skills. Those teachers left the school when it became clear that they were not meeting standards set by Principal Thompson. I asked the vice principal at Kelso, Clark Osborne, what he believed to be the most important factor in the high achievement of Kelso students in mathematics. He identified the high quality of the Kelso teachers as the single most important factor and gave full credit to Marjorie Thompson for Kelso's excellent faculty.

Robert Hill Lane

Robert Hill Lane Elementary School is the recipient of the Los Angeles Educational Excellence Award in 1999. The principal, Sue Wong, explained that for the past two years she held many meetings with teachers to find ways to improve student achievement and develop grade level pacing plans aligned to the California standards. Every teacher at the school has a copy of the California Mathematics Framework to assist in that effort.

Sue Wong provides a student handbook governing student behavior and has a student compact which includes a code of conduct listing expectations and responsibilities. Parents, students, and teachers are expected to sign this document. There is a high degree of parental involvement in the school, with 91% of students' parents attending parent teacher conferences according to Ms Wong.

About one-third of the student body is classified as Limited English Proficient, or LEP. Of these students, about 80% use "Model A" or English immersion for instruction. Instruction is in English, but clarification is given in the primary language of the students. The remaining 20% of LEP students receive instruction using "Model B," which includes instruction in English, but also includes occasional previews of lessons in Spanish.

Robert Hill Lane emphasizes systematic, direct instruction and the teaching of basic skills in mathematics. Calculators are rarely used. Like Nancy Ichinaga and Marjorie Thompson, Principal Wong conducts extensive hiring interviews for teachers, and she is very selective. She finds that sometimes noncredentialled teachers are better in the classroom than credentialled teachers. For Kindergarten through second grade, the school uses a curriculum by Scott-Foresman. In subsequent grades, teachers use a Silver-Burdett-Ginn Curriculum, but Robert Hill Lane plans to buy a California state approved supplementary math program aligned to the California mathematics standards.

Robert Hill Lane employs a school-based management system and works on a LEARN calendar, so it does not operate year round.[3] The school has an intervention program with after-school tutoring and two hours of Saturday classes with one hour for reading and one hour for math. Students in the intervention program are identified by test scores from an assessment created by the teachers and other forms of teacher evaluation. The tutors come from the Math and Engineering Club of East Los Angeles College and from Garfield High School during the high school's off-track periods.

Barriers to Mathematics Achievement in Los Angeles Schools

There are many barriers to student achievement in mathematics beyond the control of school districts. Poverty is the most debilitating. In the 80 school districts within the boundaries of Los Angeles County, there are tens of thousands of public school children who are homeless. For such children the very concept of homework is problematic, and the heart wrenching effects of their day to day plights cannot be completely compensated by the limited resources of schools. Beyond these extreme

cases, there are multitudes of other children who are not homeless, but whose sources of support are meager. Many school children have unschooled single mothers with only limited knowledge of the English language, holding down two or three low paying jobs in order to support their children. Though not commensurate with the scale of poverty in Los Angeles, the heroic efforts of legions of teachers who dedicate time, energy, and their own limited resources to helping such children should be acknowledged and honored.

Despite these barriers, schools are not powerless. Bennett-Kew, Kelso, and Robert Hill Lane, whose poverty rates range from 77% to 89%, clearly demonstrate that high levels of academic achievement for children are attainable and should be expected, regardless of their social standing and ethnicity.

There are important barriers to student achievement in mathematics which are self-imposed by school districts and which could easily be eliminated. During my conversations with them, the principals of Bennett-Kew, Kelso, and Robert Hill Lane were adamant in their insistence on holding students to high expectations. They were dismissive of excuses and highly directed toward results. This is a key factor in their academic successes and it deserves further illumination because declaring one's high expectations for all students by itself is of little value.

No one declares *low* expectations for girls or minority students. Such a pronouncement would be unthinkable for any responsible school administrator. But administrators do embrace the notion of different "learning styles" correlated with gender and ethnicity, and the result is much the same: expectations are lowered. Jack Price, a former president of the National Council of Teachers of Mathematics, or NCTM, expressed the views of many administrators and local math curriculum specialists when he stated publicly in 1996[4]:

> *What we have now is nostalgia math. It is the mathematics that we have always had, that is good for the most part for the relatively high socio-economic anglo male, and that we have a great deal of research that has been done showing that women, for example, and minority groups do not learn the same way. They have the capability, certainly, of learning, but they don't. The teaching strategies that you use with them are different from those that we have been able to use in the past when young people–*

> *we weren't expected to graduate a lot of people, and most of those who did graduate and go on to college were the anglo males.*

and

> *All of the research that has been done with gender differences or ethnic differences has been–males for example learn better deductively in a competitive environment, when–the kind of thing that we have done in the past. Where we have found with gender differences, for example, that women have a tendency to learn better in a collaborative effort when they are doing inductive reasoning.*

The view that African Americans, Latinos, and girls have "learning styles" for mathematics different from the learning style of white males (and presumably Asians of both genders) has contributed to the creation and widespread use of low quality mathematics textbooks and curricula in the U.S.—and in the Los Angeles area in particular. Many of these curricula radically de-emphasize basic skills in arithmetic and algebra, as well as deductive mathematical arguments and proofs. They tend to emphasize inductive reasoning, with a particular focus on extending patterns. Such activities have little or no mathematical significance. Extensive use of calculators is promoted at all grade levels, even at the Kindergarten level in some cases, where Kindergartners are encouraged to use calculators to learn to count.[5] Such approaches are advertised as math for *all* students, as opposed to white males, but the word *all* is a code word for minority students and/or girls and women. These curricula attempt to redefine mathematics in a way that is accessible to different "learning styles." The Federal government has actively funded the creation and distribution of these programs, sometimes referred to as *integrated math*, *reform math*, *new new math*, or *whole math*. The last designation draws an analogy to the Whole Language approach to teaching reading.

In October 1999, the U.S. Department of Education released a list of 10 integrated math programs which it designated as "exemplary" or "promising." The following month, I sent an open letter co-authored with mathematicians Richard Askey, R. James Milgram, and Hung-Hsi Wu, with more than 200 other co-signers to U. S. Education Secretary Richard Riley urging him to withdraw the Department of Education's recommendations.[6] Among the endorsers are many of the nation's most accomplished

scientists and mathematicians. Sixteen department heads, including the chairs of the math departments at Caltech, Stanford, Harvard, and Yale, along with two former presidents of the Mathematical Association of America, added their names in support. Seven Nobel laureates and winners of the Fields Medal, the highest award in mathematics, and several prominent state and national education leaders also co-signed our open letter. The open letter was well-covered in the national press and appeared as a full page ad in the Washington Post on November 18, 1999.

Among the programs criticized in the open letter is an elementary school program called "MathLand." This program is based on student discovery and has no student texts for any of the grades K through 6. It makes excessive use of calculators and does not develop the foundations of arithmetic. It does not even include instruction on the standard algorithm for multiplication. MathLand has become a target of ridicule among university mathematicians and dissatisfied parents.[7] It is not a state adopted mathematics program and it is not aligned to the California mathematics standards on which students are tested. Yet, MathLand has been heavily promoted by LAUSD math education specialists who continue to advise the Los Angeles Board of Education. Several LAUSD math education specialists have opposed the California mathematics content standards and yet they are called upon to implement those standards.[8]

The Achievement Council is a nonprofit organization in Los Angeles dedicated to improving the achievement of minority students. The Achievement Council advises the Los Angeles school board about mathematics curricula and other matters, and receives funding from LAUSD as well as from several private foundations. The Achievement Council has taken a public position in support of integrated math programs not aligned to the California Mathematics standards on the grounds that they are somehow better for minority students. The organization explicitly defends MathLand, and the LAUSD Board president, Genethia Hayes, has publicly aligned herself with the mathematics policies of the Achievement Council.[9] The 1999-2000 interim superintendent, Ramon Cortines, ordered LAUSD schools not to purchase new state adopted mathematics programs for the Fall 2000 school year, even for grades K-3, where the materials are mostly consumable. MathLand elementary schools were required to remain MathLand elementary schools for at least another year. In the Spring of 2000, the LAUSD Board

supported Cortines' mandate even in the face of contradictory advice from Nancy Ichinaga, now a member of the California State Board of Education, Barry Simon, the chair of the mathematics department at Caltech, Jaime Escalante, of *Stand and Deliver* fame, and many others. Principal Sue Wong explained to me during an interview that she was limited by the LAUSD mandate to purchasing only supplemental materials for mathematics for the Fall 2000 school year. Thus, a majority of LAUSD students are required to use inferior curricular materials, partly on the supposition that what works for white males is inappropriate for minority students. Sadly, LAUSD is not the only Los Angeles area school district that continues such misguided policies.

In addition to the use of deficient mathematics programs and curricula, there is another important barrier to student achievement in mathematics, again self-imposed by school districts. Many, and perhaps most, mathematics curriculum specialists are mathematically weak. They give bad advice, not only because they support a misguided notion of learning styles for minority students and girls, but also because they simply don't understand mathematics very well themselves, generally at a level far below that of classroom mathematics teachers in the schools they serve.[10] The mechanism leading to this paradoxical state of affairs is that the weakest math teachers are usually the first to embrace education fads and are consequently rewarded by principals and other administrators for their willingness to be innovative. Unfortunately, innovation for its own sake has a higher priority than proven effectiveness for most administrators. The result is that the least competent teachers advise senior administrators and gain authority over mathematics programs in the schools. A particularly unfortunate consequence is that the staff development programs and inservices for math teachers are typically of low quality.

The growing pressure on teachers to incorporate computers and the Internet in their daily instruction, whether it does any good or not, also interferes with effective instruction. The California Mathematics Framework warns against the overuse of technology in mathematics instruction.[11] According to an informal estimate published in the Los Angeles Times, "Sixty percent of the eighth-graders in L.A. Unified, it is estimated, do not yet know their multiplication tables."[12] Flooding classrooms with expensive, advanced technology when a substantial proportion of middle and upper grade

students in Los Angeles haven't mastered basic arithmetic may create future customers of technology, but it won't address fundamental shortcomings in mathematics education.

The Simplicity of Success

During my discussions with Nancy Ichinaga, Marjorie Thompson, and Sue Wong, I asked them in a variety of different ways why they were so successful. On more than one occasion, they each explained (separately) that they didn't think they were doing anything special. All of these outstanding principals wondered why other schools don't do better by simply using common sense.

There are three fundamental ingredients to student achievement in mathematics:
1. A clear set of high quality grade by grade standards.
2. Textbooks and curricula for teachers and students that are aligned to the standards.
3. Sufficiently high teacher knowledge of mathematics to teach to the standards.

The first ingredient is free. The California mathematics standards are clear and specific, and they are held in high regard by university mathematicians and experts on educational standards. The Fordham Foundation ranked them the best mathematics standards in the nation.[13] As for the second item, the California State Board of Education has approved specific textbooks aligned to the standards, and state funds are provided for schools to purchase those programs. Unfortunately, because of the resistance of senior administrators, making these resources available to children has been problematic. The third ingredient, increased teacher knowledge, is difficult to attain, but under California's Assembly Bill 1331, good programs and funding for professional training are available.[14] Clearly, teachers need to know more mathematics than what they expect students to learn. Here again, senior administrators and their mathematics education advisors have resisted making sound, content-oriented training available to classroom teachers, especially in LAUSD.

At the school level, leadership from the principal is essential in order for a school to implement an effective mathematics program. During my discussions with Principals Nancy Ichinaga, Marjorie Thompson, Sue Wong, and Jacqueline Moore, I was struck by their own probing inquisitiveness and interest in improving their schools' mathematics performance beyond what they had already achieved. In contrast to the defensiveness

one often encounters in principals from low achieving schools, these principals pursue new ideas, but at the same time they are decisive in their rejections of faddish programs that are not likely to promote high academic achievement.

Los Angeles County's fifth grade SAT-9 math scores rank it 50th among the 58 counties in California. LAUSD, the largest school district in California, includes slightly less than half of all students in L.A. County, and LAUSD math scores are well below the county average. With the Spring 2000 appointment of Nancy Ichinaga to the California State Board of Education, it is possible that a culture of genuinely high expectations will gain a foothold in Los Angeles schools. It is difficult to imagine an education leader more capable of moving schools beyond the mere rhetoric of high achievement and guiding them directly to its substance. However, without the support of local district school boards, little will change. School board members would do well to demand the implementation of math curricula aligned with the California standards and to dismiss administrators who cling to the empty rhetoric and dismal failures of the past decade.

Endnotes

1. I am indebted to Professor Wayne Bishop of the mathematics department at California State University, Los Angeles for the collection and analysis of this data.

2. Duke Helfand, "Inglewood Writes Book on Success," *Los Angeles Times,* April 30, 2000.

3. "LEARN" is an acronym for Los Angeles Educational Alliance for Restructuring Now.

4. This statement was made during a radio interview of NCTM President Jack Price, independent textbook publisher John Saxon, and co-founder of "Mathematically Correct," Mike McKeown on April 24, 1996. The KSDO radio show on Mathematics Education, hosted by Roger Hedgecock, was held in conjunction with the annual meeting of the National Council of Teachers of Mathematics, in San Diego that year (http://mathematicallycorrect.com/roger.htm [August 1, 2000]). For examples of "learning styles" correlated with race and gender see, David Klein, "Big Business, Race, and Gender in Mathematics Reform" in Steven Krantz, ed. and author, *How to Teach Mathematics, second edition* (American Mathematical Society, 1999). A more recent defense of differing "learning styles" and the math curricula based on them was given by Judith Sunley, Interim Assistant Director of the National Science Foundation, in the *Notices of the American Mathematical Society*, vol. 47, no. 6, June/July 2000.

5. David Klein, "Math Problems: Why the U.S. Department of Education's Recommended Math Programs Don't Add Up," *American School Board Journal*, vol. 187 (April 2000) (http://www.mathematicallycorrect.com/usnoadd.htm [August 1, 2000]).

6. "An Open Letter To United States Secretary Of Education, Richard Riley," November, 1999 (http://www.mathematicallycorrect.com/riley.htm [August 1, 2000]).

7. See, for example, Martin Scharlemann, Open Letter on MathLand, October 11, 1996 (http://mathematicallycorrect.com/ml1.htm [August 1, 2000]).

8. Michael McKeown and others, "The National Science Foundation Systemic Initiatives: How a Small Amount of Federal Money Promotes Ill-Designed Mathematics and Science Programs in K-12 and Undermines Local Control of Education," in Sandra Stotsky, ed., *What's at Stake in the K-12 Standards Wars: A Primer for Educational Policy Makers* (Peter Lang Publishing, Inc., New York, 2000).

9. David R. Baker, "Math-Teaching Issue Debated," *Los Angeles Daily News*, May 3, 2000.

10. For a partial history of the opposition from mathematics specialists and education leaders to the teaching of long division and standard arithmetic procedures in elementary school, see David Klein and R. James Milgram, "The Role of Long Division in the K-12 Curriculum"

(ftp://math.stanford.edu/pub/papers/milgram/long-division/longdivsiondone.htm [August 1, 2000])

11. "Chapter 9: The Use of Technology" in *Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve*, California Department of Education, 1999 (http://www.cde.ca.gov/cdepress/schoolbag/events.html [August 1, 2000]).

12. Quoted in Richard Colvin, "Debate Over How To Teach Math Takes Cultural Turn," *Los Angeles Times*, March 17, 2000, p. A1.

13. Ralph A. Raimi and Lawrence S. Braden, "State Mathematics Standards," Fordham Foundation Report, vol. 2, No. 3, March 1998 (http://www.edexcellence.net/standards/math.html [August 1, 2000]).

14. For example, "The Winning Equation" for grade 4-7 teachers was developed by the Curriculum and Instruction Steering Committee of the California County Superintendents Educational Service Association. As a referee, I recommended approval of this program to the California State Board of Education. The program was subsequently approved and has been widely used outside of LAUSD.