National Math Panel Testimony
Stanford, California
November 6, 2006

Good morning. My name is Sherry Fraser and I have been involved in mathematics education for over 30 years. I have a degree in mathematics and taught high school in Buffalo, New York, Los Angeles, California, and in the San Francisco Bay Area. I am one of the developers of the Equals program and the Family Math program that originated at the Lawrence Hall of Science, University of California at Berkeley. I am also one of the developers of the Interactive Mathematics Program, a high school curriculum designed to meet the needs of all high school students. All three of these programs have spread worldwide and through these programs I've had the opportunity to visit high schools and classrooms around the world. The transcripts of the previous meetings of this panel trouble me and I want to be certain several points about school mathematics education become part of the record. That is why I am here today.

1) We have failed our kids in the past when we paid most of our attention to the list of mathematical topics that should be included in a curriculum without factoring in how students learn, without giving attention to what might be the best teaching strategies to facilitate that learning, and without giving serious attention to providing access to important mathematics for all students.

How many of you remember your high school algebra? Close your eyes and imagine your algebra class. Do you see students sitting in rows, listening to a teacher at the front of the room, writing on the chalkboard and demonstrating how to solve problems? Do you remember how boring and mindless it was? Research has shown this type of instruction to be largely ineffective. Too many mathematics classes have not prepared students to use mathematics, to be real problem-solvers, both in the math classroom and beyond as critical analyzers of their world.

Unfortunately my experience and probably most of yours is what we refer to today as the "good old days." This was when students knew what was expected of them, did exactly as they were told, and learned arithmetic and algebra through direct instruction of rules and procedures. Some of us could add, subtract, multiply, and divide quickly. But many of us just never understood when to use these algorithms, why we might want to use them, how they worked, or what they were good for. And it showed. In 1967, when U.S. mathematics students were compared to their peers in the First International Mathematics Study, the U. S. learned there was a positive correlation between student achievement at the middle school and students' view that mathematics learning is an open and inquiry-centered process. In the Second International Mathematics Study, in 1981, teachers were still using whole-class instructional techniques, relying heavily on prescribed textbooks, and rarely giving differentiated instruction on assignments. Twenty years later, the Third International Study just reinforced what we should have already known. We were doing a poor job of educating our youth in mathematics.

2) This crisis in mathematics education is at least 25 years old. I remember in the 1980's when the crisis in school mathematics became part of the national agenda with such publications as An Agenda For Action (NCTM, 1980), A Nation at Risk (National Commission of Excellence in Education, 1983), and Everybody Counts: A Report to the Nation on the Future of Mathematics Education (NRC, 1989). Those of you on the board who have been involved with mathematics education should remember these documents as well. Our country was in trouble. We were not preparing students for their future. Sure, some could remember their basic facts, but that wasn't enough. Something different needed to be done if our country was going to compete in a global economy.

It was at the end of that decade that the National Council of Teachers of Mathematics released their Curriculum and Evaluation Standards for School Mathematics (1989). Contrary to what you hear today, they were widely accepted and endorsed. This set of standards had the potential to help the American mathematics educational community begin to address the problems articulated throughout the 1980's.

Shortly after publication, the National Science Foundation began funding the development of large scale, multi-grade instructional materials in mathematics to support the realization of the NCTM Standards in the classroom. Thirteen projects were funded. Each of the projects included updates in content and in the context in which mathematics topics are presented. Each also affected the role of the teacher. Each has been through rigorous development that included design, piloting, redesign, field-testing, redesign, and publication. This amount of careful development and evaluation is rarely seen in textbook production.

3) These NSF projects were developed to address the crisis in mathematics education. They did not cause the problem; they were the solution to the problem. Their focus went beyond memorizing basic skills to include thinking and reasoning mathematically.

4) These model curriculum programs show potential for improving school mathematics education. When implemented as intended, research has shown a different picture of mathematics education to be more effective. In fact, the U.S. Dept of Education, through an act of Congress, evaluated mathematics programs, K-12, and in 1999 found five programs that deserved exemplary status. One of the criteria was that the program must have evidence that it made a measurable difference in student learning. The program had to provide evidence of gains in student understanding of mathematics, evidence of gains in inquiry, reasoning, and problem solving skills, evidence of improvements in

course enrollments, graduation rates, and post-secondary school attendance and evidence of improved attitudes towards learning. Three NSF curriculum projects met all the criteria and received exemplary awards from the U.S. Department of Education.

Another study by the American Association for the Advancement of Science (AAAS) evaluated 24 algebra textbooks for the potential to help students understand algebra and, once again, the NSF-funded curriculum programs rated at the top of the list. And in 2004 the National Academy of Sciences released a book, *On Evaluating Curricular Effectiveness: Judging the Quality of K-12 Mathematics Programs*, which looked at the evaluation studies for the thirteen NSF projects and six commercial textbooks. Based on the 147 research studies accepted it is quite clear which curriculum programs have promise to improve mathematics education in our country. They are the NSF-funded curriculum projects.

5) You might be asking yourself why hasn't mathematics education improved if we have all this promising data from these promising programs?

Let me use California as an example.

In 1997 California was developing a set of mathematics standards for K-12. A State Board member hijacked the process. She gave the standards, which had been developed through a public process, to a group of four mathematicians to fix. She wanted California's standards to address just content and content that was easily measurable by multiple-choice exams. The NCTM standards, which the original CA standards were based on, were banned and a new set of CA standards was adopted instead. This new set punished students who were in secondary integrated programs and called for Algebra 1 for all 8th grade students, even though the rest of the world, including Singapore, teaches an integrated curriculum in 8th grade and throughout high school. The four mathematicians and a few others called California's standards "world class". But saying something is world class doesn't make it so. In fact, we now have data to show these standards haven't improved mathematics education at all. Most of California's students have had all of their instruction based on these standards since they were adopted almost ten years ago. Yet, if you go to the California Department of Education's website on testing and look at the 2006 data you will find that only 23% of students are proficient in Algebra I by the end of high school, a gain of 2 points over four years. At the Algebra II level, only 45% of California's students actually take the course and only 25% of those are proficient. This is a loss of four percentage points over the last four years.
(www.cde.ca.gov/ta/tg/sr/documents/yr06rel89summ.pdf)

Three years of college preparatory mathematics is required, four recommended, for entrance into our colleges and universities, yet less than 12% of California's high school graduates now have the minimum proficiencies expected by higher institutions. And these numbers don't even take into account the 30% of California students who drop out of high school. World class? Hardly. California is one state you do not want to emulate or look to for solutions to the problems in mathematics education.

Why, then, do you read in newspapers about how terrible the mathematics programs developed in the 1990's are and how successful California is? It has to do with an organization called Mathematically Correct, whose membership and funding is secret. Their goal is to have schools, districts, and states adopt the California standards and they recommend Saxon materials as the answer to today's problems. They are radicals, out of the mainstream, who use fear to get their way.

I urge this panel to look at the data and make recommendations based on the desire to improve mathematics education for all of our students. Direct instruction of basic skills does not suffice. Moving backwards to ineffective habits does not make sense. Our children deserve more. Thank you.

Sherry Fraser
Director, Interactive Mathematics Program
Network Coordinator, COMPASS POINTS
Faculty Member, Marilyn Burns Education Associates

fraser@math.sfsu.edu