

## As Massachusetts Goes, So Goes the Nation?

By Donna Beers

As 2008 wound to a close, the 2007 *Trends in International Mathematics and Science Study (TIMSS)* scores were released. There was good news for Massachusetts: Its fourth and eighth grade test-takers outperformed their peers nationwide; further, the state's fourth graders ranked third internationally, while its eighth graders ranked sixth. On the other hand, news stories in mid-May revealed that some 75% of aspiring elementary school teachers in Massachusetts failed their mathematics tests.

What tests? During the 1990s, Massachusetts, along with Texas and Maryland, led the way in standards-based reform. Now the Bay State has embarked on a new era of reform, one calling for tougher mathematics licensure requirements for elementary school teachers, including a separately scored mathematics subtest. The new licensure requirements are an attempt to respond to concerns about the mathematical preparation of teachers, but they raise questions of their own.

### The National Context

For the past three years, people have worried about the mathematical preparation of teachers, driven by workforce needs, national security needs, and the mediocre performance of American students on national and international mathematics tests. For example, the National Council of Teacher Quality (NCTQ) surveyed 77 education programs. In a final report, strikingly titled *No Common Denominator: The Preparation of Elementary Teachers in Mathematics by America's Education Schools* (June, 2008), the NCTQ concludes there are no common standards in mathematics, either for admissions to or for graduation from education programs, and no common mathematics coursework is required of students.

With the goal of building teachers' deep conceptual understanding of the mathematics they will be teaching, the NCTQ recommends that teacher preparation programs follow a 3/1 framework: three mathematics courses covering the four "critical areas: numbers and operations, algebra, geometry and measurement, and data analysis and probability," and one closely aligned methods course. Echoing the *Final Report of the National Advisory Panel for Mathematics* (March, 2008), the NCTQ report urges that algebra receive greater attention: "A deeper understanding of elementary mathematics, with

more attention given to the foundations of algebra, must be the new "common denominator" of our preparation programs for elementary teachers."

The NCTQ's 3/1 course framework for pre-service elementary teachers parallels the new mathematics curriculum recommended by the Massachusetts Department of Education. The NCTQ also advises that "States need to develop strong course standards and adopt wholly new assessments... to test for these standards. ... A unique stand-alone test of elementary mathematics is the only practical way to ensure that the state's expectations are met. Only one state, Massachusetts, is on the road to creating a regulatory framework that accomplishes these goals, goals that should be shared by the entire nation."

### Standards-based Reform in Massachusetts

The 1989 publication of the NCTM's *Standards for School Mathematics* sparked a standards-based reform movement in all 50 states. For Massachusetts, this reform began under a cloud: the Supreme Judicial Court ruled that the state was violating its constitutional mandate "to provide every child with an adequate education." Until 1993, school funding was based on property taxes; plaintiffs successfully claimed that poor school districts were disadvantaged. The Massachusetts Business Alliance, made up of business, education, and civic leaders, reacted by proposing a comprehensive blueprint for educational reform, including standards for core school subjects, common assessments tied to the standards, and, very significantly, a landmark method of school funding that would provide a minimum funding level for all school districts. This plan was enacted in the 1993 Educational Reform Act.

By the end of the nineties, Massachusetts, with Texas and Maryland, earned recognition as a model of standards-based reform. Massachusetts stood out for the high quality of its common assessments, the Massachusetts Comprehensive Assessment System (MCAS). Quoting Achieve's 2002 report, *Three Paths, One Destination: Standards-Based Reform in Maryland,*

*Massachusetts, and Texas:* “Our results showed that the state has developed high-quality standards and high-quality tests, and there is tight alignment between the two ...[W]e found MCAS to be among the best tests Achieve has reviewed in the United States.”

Since 2000, state workforce needs have been a huge impetus for strengthening mathematics and science education in Massachusetts. Two companion organizations, Mass Insight Corporation and Mass Insight Education, have mobilized policy-makers and leaders from business and higher education to develop strategies for growing the state’s economy and its leadership in the global economy, and to strengthen student achievement, respectively. In 2005 Mass Insight Corporation initiated *Global Massachusetts 2015*, a multi-year agenda for making Massachusetts “a world leader in R & D,” e.g., in life sciences/medicine.

At the same time, Mass Insight Education reported a narrowing pipeline of students into STEM majors and careers. In its 2005 report, *World Class: The Massachusetts Agenda to Meet the International Challenge for Math- and Science-Educated Students*, it concluded: “Teachers’ weak content knowledge is at the heart of our national math and science problems, universally among elementary teachers but also to a disturbing degree — especially in urban areas — among middle school and secondary teachers.” To combat this problem, Mass Insight Education launched an ambitious framework for reform, “The Great Schools Campaign,” which aspires to provide Massachusetts students with a world-class education in mathematics and science.

The *World Class* report recommended “three high-leverage steps” to strengthen teacher preparation: (1) “Raise pre-service math and science course requirements for elementary school teacher candidates.” (2) “Require aspiring elementary school teachers to pass MTEL math and science tests, just as they have to pass a reading test today.” (3) “Provide intensive content training and coaching in math to current teachers in grades 3-8 at a scale that matches the need. Follow that math priority with an equivalent commitment to science training and coaching.” The new Massachusetts mathematics licensure requirements emerged against this back drop.

### New Licensure Requirements in Mathematics

In July 2007 the Massachusetts Department of Education (DOE) issued *Guidelines for the Mathematical Preparation of Elementary Teachers*, which delineated new licensure require-

## Guidelines for the Mathematical Preparation of Elementary Teachers

### 2. Mathematics.

Basic principles and concepts important for teaching elementary school mathematics in the following areas:

Number and operations  
 Functions and algebra.  
 Geometry and measurement.  
 Statistics and probability.

Candidates shall demonstrate that they possess both fundamental computation skills and comprehensive, in-depth understanding of K–8 mathematics. They must demonstrate not only that they know *how to do* elementary mathematics, but that they *understand* and can explain to students, in multiple ways, *why it makes sense...*

[Massachusetts Department of Education, July 2007, p. 1]

ments in mathematics for elementary teachers. Noting the “front line” role played by elementary school teachers in preparing children for advanced study of mathematics and for STEM careers, the *Guidelines* states that the goal of the new licensure requirements is to “strengthen the mathematical preparation of teachers at the elementary level,” and to articulate “...the scope and depth of mathematical knowledge — both skills and understanding — that are expected of elementary teachers and that will be assessed on the [state licensure] test.”

Through December 2008, candidates for elementary teaching licenses were required to pass three Massachusetts Tests for Educator Licensure (MTEL): “General Curriculum,” “Communication and Literacy Skills,” and “Foundations of Reading.” The General Curriculum Test covered Language Arts, History/Social Science, Science, Child Development, and Mathematics. Of this test’s 86 questions, 18 were on mathematics. To pass the General Curriculum Test, candidates only had to obtain an overall passing score across the five subjects. As of March, 2009, the General Curriculum MTEL Test includes a separately scored subtest of 45 mathematics

questions which candidates must pass to obtain licensure. See the sidebar on page 25 for the topics covered in the subtest.

The *Guidelines*, written for mathematics faculty as well as for licensure candidates and the coordinators and faculty of teacher preparation programs, recommend 9 to 12 semester-hours of coursework to cover the four strands of elementary school mathematics according to the following weights: Number and operations (45%); Functions and algebra (25%); Geometry and measurement (20%); and Statistics and probability (10%). The mathematics courses taken by candidates shall be “taught by mathematics faculty, potentially in partnership with education faculty,” and “these should be taken after any necessary remedial courses and either integrated with or taken prior to math methods courses.” The *Guidelines* provide sample course syllabi as well as suggestions for textbooks.

## The Recent Test Results

On May 19, 2009, the *Boston Globe* headline read: “Aspiring teachers fall short on math — nearly 75 percent fail revamped section of state licensing test.” So we learned the results of the mathematics subtest for the Massachusetts state licensure exam for elementary teachers, administered for the first time in March, 2009. Moving beyond the drama of the headline, we observe that Massachusetts is in a transitional stage: Undergraduates who were the first to take the

test were likely rising juniors when the DOE Guidelines were released in July, 2007, so the 9 to 12 credit hours of mathematics recommended by the DOE may not have been available to them. Moreover, mathematics departments in Massachusetts schools and universities are still revising their curricula to meet the needs of preservice elementary teachers.

For now, several questions need to be answered: What assistance do mathematics faculty need to revise their existing courses for elementary school teacher candidates? What assistance do mathematics departments need to win administrative support for adding new mathematics courses, given current economic constraints? What assistance do teacher candidates need to help them prepare to re-take the test? For those graduate education programs that currently do not require their students to take a mathematics course, how will they determine what mathematics their students need and how will they deliver it?

President Obama has promised 40,000 Teacher Service Scholarships to be used, in part, to recruit high quality mathematics and science degree graduates into the teaching profession. With the nation awakening to the importance of what we do, the present moment offers mathematics departments the opportunity to increase the number of mathematics majors, enrich departmental offerings, and strengthen collaboration with education programs on teacher preparation. 🍷



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