

# STEM Summit IV

Sturbridge, Massachusetts

October 17, 2007

## Panel on Elementary Mathematics: The Foundation for STEM

*“Elementary-School Mathematics is NOT Elementary”*

Moderator: Tom Fortmann  
Massachusetts Board of Education

# Regulation 603 CMR 7.06(7)(b)2

## 2. Mathematics.

- a. Basic principles and concepts important for teaching elementary-school mathematics in the following areas.
  - i. Number and operations (the foundation of areas ii-iv)
  - ii. Functions and algebra
  - iii. Geometry and measurement
  - iv. Statistics and probability
  
- b. 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*.
  
- c. The Commissioner, in consultation with the Chancellor of Higher Education, shall issue *guidelines for the scope and depth of knowledge* expected in mathematics, described above.

# Assessment

Beginning January 2009, the MTEL General Curriculum Test will include a separately scored section of 40 questions on the mathematics specified in the new regulation and guidelines.

A passing score in mathematics will be required for licensure.

# Commissioner's Guidelines

for the scope and depth of knowledge  
expected in mathematics

*Guidelines for the Mathematical  
Preparation of Elementary Teachers*

July 2007

<http://www.doe.mass.edu/mtel/MathGuidance.pdf>

# Course Expectations

Typical candidates will require “at least three to four college-level, subject-matter courses, i.e., 9–12 semester-hours, taught by mathematics faculty, potentially in partnership with education faculty.”

These courses should be “integrated with or taken prior to methods courses.”

## Recommended weightings:

i. Number & Operations	45%	iii. Geometry & Measurement	20%
ii. Functions & Algebra	25%	iv. Statistics & Probability	10%

# Mathematical Depth

Teachers must **understand**:

- Logical reasoning based on clear definitions
- Unity & coherence (it all *makes sense*)
- Habits of mathematical thinking
- Overriding importance of problem solving
- Role of abstraction

# Guide to the *Guidelines*

- The *Guidelines* are not a syllabus
- Sample problems illustrate expected depth
- Number & Operations is paramount
- Traditional math courses aren't enough
- Math/math ed collaboration is critical

# Advice to the Panel *in Absentia*

- Unless teacher preparation in mathematics is a life changing experience, it will not suffice. Teachers must have a very different view of mathematics than our current high school graduates do in order to significantly improve mathematics education.
- The sorry state of word problems in instruction is a symptom of the failure of our system. Inability to do word problems means that students cannot connect the mathematical concepts/procedures they learn with their applications in the real world. But there is very little point to math instruction if the ability to use math meaningfully is not an outcome.

—Roger Howe

Professor of Mathematics, Yale University

Member, National Academy of Sciences

Member, US Department of Education Advisory Committee on

Improving Teacher Content Knowledge in Mathematics

Thank you for attending  
Please join us for the afternoon panel:

## *The Symbiosis of Content & Pedagogy*

**The Perfect Stew:** *“The mathematics department offers us tough steak which we cannot chew and the school of education vapid soup with no meat in it.”* How do we avoid this plight highlighted by Stanford mathematician George Polya and colorfully described by one of his students? □

This workshop invites mathematicians and math educators to discard old stereotypes and lay the groundwork for robust communication, collaboration, and innovation that will enhance and integrate methods and content courses to produce a new generation of mathematically proficient and pedagogically adept elementary teachers. Bring your ideas and an open mind.

# Comments on the *Guidelines*

- Mathematics instruction should be combined with discussion of methods, since not only mathematical principles, but also substantial discussions of how these ideas can play out in the classroom at various levels, will need to be supplied.
- Team teaching, between the mathematics department and the education department, may be the most effective method of delivery. This would also have the beneficial side effect of requiring very goal-oriented dialog between the two departments.

—Roger Howe

Professor of Mathematics, Yale University

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