Challenges for Mathematics Teacher Education

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Westminster, MD
for
AMTE Annual Meeting
Tulsa, Oklahoma
January 25, 2008

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General Issues – Teacher Education

At Issue

- Respect for teacher education
- Amount of time spent by faculty members in responsibilities beyond teaching and research.
- Budget – we are cheap, well sorta

From a research perspective

- What needs to be preserved about teacher preparation and what needs to be saved?
- How can programs provide opportunities for preservice teachers to view instruction that promotes understanding?
- How can programs provide opportunities for candidates to reason in settings fraught with challenges?

Wilson and Ball, 1996

Preparing Teachers

- *State institutions (e.g. SUNY system, PA state system) have grown up to become multi-faceted state universities
- State Universities and University Systems
- *Private Colleges

*Such institutions prepare the majority of teachers in this country.

And

- Over 52% of elementary candidates complete their mathematics at the community college level.
- Community Colleges are becoming more and more involved in preservice teacher education.
- Query – should two year colleges be more involved in AMTE? I asked this question last year too!

and, there is more…

- On-line programs, etc.

Areas we will examine:

- Admission
- Mathematics Content
- Education and Pedagogy
- Practica
- Certification and Accreditation Issues
- Goal – Thinking about AMTE in all of this (e.g. NCTQ)

Initial Decisions

- Admission to teacher education programs
  - What to do about critical shortage areas (mathematics in many states and special education)
  - What to do about surplus areas (elementary education in many states)

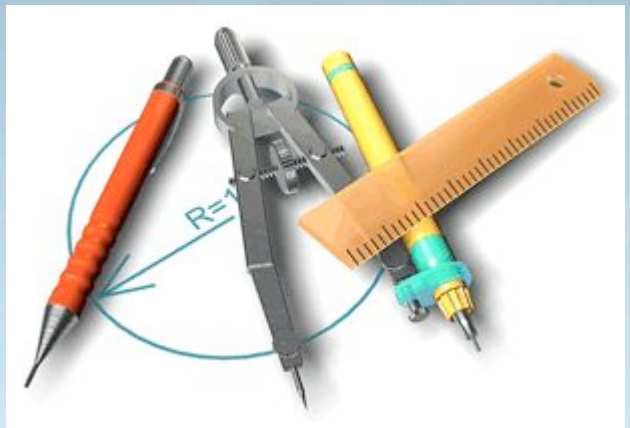
Interact A

- How does your program decides who gets in?
- What works? What needs improving – particularly given critical shortage and surplus issues?

The Role of Research

- Expectations for mathematics teachers are different than they were even 10 years ago (Rand Report, 2003).
- Teachers need to know mathematics, but know it differently than mathematicians.

Mathematics Background



Knowing the Mathematics for Teaching

- Knowing mathematics for teaching demands a kind of depth and detail that goes way beyond facility in carrying our the steps in an algorithm reliably.

Ball, Hill, Bass, 2005

Relationships…

Mathematics and Education Department, Schools, and Colleges

From a mathematician…

- "Most mathematicians view courses for teachers as remediation courses and don't realize that it is an intellectually stimulating and satisfying challenge to teach elementary arithmetic, etc. at a mathematically deep level to those who are teaching our children. This work is worthy of our attention."

Correspondence January 21, 2007

Mathematics

- What mathematics?
  - Math 100 vs. specialized courses
  - Mathematics that links to school mathematics
- How much mathematics?
- Connections and Communication with mathematics departments

What mathematics and how much?

- High School Mathematics Teachers
- Middle School Mathematics Teachers
- Elementary School Mathematics Teachers
- Early Childhood Mathematics Teachers
- Special Education Mathematics Teachers

Mathematical Education of Teachers (MET)

- **High School**
  - Prospective high school teachers…should complete the equivalent of a major in mathematics, including a 6-hour capstone course connecting their mathematics courses with high school mathematics (CBMS, 2001, p. 8).
- **Middle School**
  - Prospective middle school teachers should be complete at least 21 semester hours of mathematics, including at least 12 semester hours on fundamental ideas of school mathematics appropriate for middle grades teachers (CBMS, 2001, p. 8).

Mathematical Education of Teachers (MET)

- **Elementary School**
  - Prospective elementary teachers should be required to take at least 9 semester hours on fundamental ideas of elementary school mathematics.

How does your institution compare?

Impact of MET

- Used for NCTM's NCATE Standards for High School and Middle School mathematics.
- Used for ACEI's revision of mathematics expectations for elementary school mathematics
- Impact on Department Chairs of Mathematics?
- Impact on Deans of Education or Mathematics (Arts and Sciences)?
- National Mathematics Panel Report

NMP – to come

- Research on the relationship between teachers' mathematical knowledge and students' achievement confirms the importance of teachers' content knowledge.

NMP – to come

- Teachers cannot teach what they do not know. However, because most studies have relied on proxies for teachers' mathematical knowledge (such as teacher certification or courses taken), existing research does not reveal the specific mathematical knowledge and instructional skill needed for effective teaching, especially at the elementary and middle school level.

NMP – to come

- Direct assessments of teachers' actual mathematical knowledge provide the strongest indication of a relation between teachers' content knowledge and their students' achievement. More precise measures are needed to specify in greater detail the relationship among elementary and middle-school teachers' mathematical knowledge, their instructional skill, and students' learning.

Interact B

- What mathematics and how much mathematics?
  - Early Childhood
  - Elementary
  - Special Education
  - Middle
  - High School

- How is this determined? How does it relate to school mathematics? How is the student success in mathematics monitored?

Education

- General Education
- Mathematics Pedagogy

- We need to "orient teacher education around investigations of practices of teaching and learning instead of focusing teacher education programs on providing knowledge and skills for teaching."

Lambert and Ball, 1999

- "Methods courses need to be explicitly oriented towards learning from fieldwork."

Ebby, 2000

Pedagogy

- What happens in a methods course? (see next slide)
- How many methods courses?
- What about special education and other challenges teachers face?
- Links to field experiences?
- Links to other education courses
  - Assessment
  - Reading, etc.

AMTE Position relative to what should happen in a methods course? See the work of Bob Ronau, P. Mark Taylor, Gail Burrill…

Do these work for you?

- Selects use wide variety of math curricula;
- Concrete materials…;
- Multiple strategies…to assess students;
- Plans lessons, units, courses – local, state, and national standards, and legislative updates;
- Participates professional math organizations,…;
- Demonstrates knowledge of research results in the teaching and learning of mathematics;
- Uses knowledge of instruction in planning;
- Demonstrates ability to lead classes in problem solving, in-depth conceptual understanding,…;
- Develop lessons that use technology…

What's missing here???

Interact C

- What education courses are completed that somehow related to mathematics education?
- Are they all important?
- What is unique about your methods course(s)?

Practica

- Practicum Assignments
- Student Teaching
- The role (or not) of Professional Development Schools

Importance of Student Teaching

- Participation of prospective mathematics teachers in student teaching has declined in recent years.

- 1999 86-89%
- 2003 75-79%

Science and Engineering Indicators, 2008

Interact D

- The role of Field Experiences/practica
  - How many and how long?
  - Expectations?
  - Links from schools to teacher education programs?
  - Practicum experiences we control?
  - Professional Development Schools?

- Is there a need for a specific AMTE Position on Field Experiences?

Accreditation & Certification

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Certification Counts

- Teachers are prepared by more than 1,300 large and small, public and private colleges and universities, as well as alternative programs offered by school districts and states.
- Alternative programs often – aren't*
- ABCTE – American Board for Certification of Teacher Excellence, etc.

NMP – To come

- *Currently there are multiple pathways into teaching. Research indicates that these pathways are not significantly different from one another in terms of the impact on teachers' knowledge and effectiveness.

Certification Issues

- In field teachers have either a major or full certification in their main teaching field or both.
- All indicators showed a general pattern of unequal access to the most qualified teachers: low-minority and low-poverty schools were more likely than high-minority and high-poverty schools to have teachers with more education, better preparation, and qualifications in their field, and more experience.

Middle School	53.5%
High School	87.4%

Science and Engineering Indicators, 2008

This just in…

- Students taught by certified teachers consistently out-performed those who were taught by uncertified teachers. (This was not recognized by the NMP)
- Poor and minority students are most likely to be assigned unqualified teachers.
- Research on urban districts that recruit and retain well-qualified teachers have identified salaries, working conditions, preparation and mentoring as critical elements in building a strong, stable teaching force.

Darling-Hammond, Holtzman, Gatlin, Heilig (2005)

- Instead, the nation's teacher quality problem is one of adverse selection and allocation. Teaching disproportionately attracts less desirable candidates while losing the most desirable ones. In addition, the most qualified teachers are not necessarily in the schools where they are most needed. Seen in this light, the teacher shortage problem is easier to solve from a policy perspective. But it's much harder to address politically.

Accreditation

Accreditation - NCATE

- National Council for Accreditation of Teacher Education

Many, many institutions involved – programs nationally or state assessed.

NCATE - Unit Standards

- Conceptual Framework – The unit's shared vision for preparing teachers.
- Standard 1: *Candidate Knowledge, Skills, and Dispositions.*
- Standard 2: *Assessment System and Unit Evaluation.*
- Standard 3: *Field Experiences and Clinical Practice.*
- Standard 4: *Diversity.*
- *Standard 5: Faculty Qualifications, Performance, and Development.*
- Standard 6: *Unit Governance and Resources.*

NCATE/NCTM
Middle and High School

- Process Standards (1-7)
  1. Problem Solving
  2. Reasoning and Proof
  3. Communication
  4. Connections
  5. Representation
  6. Technology – a bit of a stretch
  7. Dispositions (loaded)
     - Equity, stimulating curricula, learning with understanding, use of assessments, use of teaching tools, including technology

NCATE/NCTM
Middle and High School

- Pedagogy Standard (8) (methods course(s))
- Content Standards (9-15) (content courses +)
  - Number and Operation
  - Different Perspectives on Algebra
  - Knowledge of Geometries
  - Knowledge of Calculus
  - Knowledge of Discrete Mathematics
  - Knowledge of Data Analysis, Statistics, and Probability
  - Knowledge of Measurement

NCATE/NCTM
Middle and High School

- Field-Based Experiences
  - Pre-student teaching – required by NCTM
  - Student teaching – required by NCTM
  - "Demonstrate the ability to increase students' knowledge of mathematics."

What about?

- Early Childhood – NCATE promotes PSSM, without any actual suggestion of courses completed, etc (NAEYC)
- Special Education – NCATE Standards for Special Education do not include any direct reference to mathematics (CEC)
- Elementary Education – NCATE Standards for Elementary Education have a section in mathematics that has been revised (ACEI)

Accreditation - TEAC

- Teacher Education Accreditation Council

Over 115 institutions involved. Relatively new, established in 1997.

Some institutions involved are:

Michigan State University
University of Michigan
University of Virginia
Colgate College
…

Alternative Certification Options

- Traditional Programs delivered in alternative format

&

- ABCTE

- On-line certification
  - University of Phoenix, etc.
- Math for America – Irwin Kra
- Teach for America…

TEACHFORAMERICA

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Accreditation - Tests

- Praxis I and Praxis II

- Praxis I or II is used in 43 of the 50 states and the District of Columbia.
- Praxis II for middle school mathematics is used in fewer states due to mixed definitions of middle school mathematics certification.
- Praxis II for secondary mathematics is used in over 30 states
- Praxis II for special education does not assess mathematics content!

Accreditation Challenges

- Cost
- Time
- Connectedness to things we value
- Opportunity and time to impact changes needed.

- What can/should AMTE say about accreditation?

Now, do you remember?

How prepared were **YOU** for your first class?

Teacher Perspective on Preparation

Teach Subject Matter	92
Assess Students	80
Use of varied instruc. materials	72
Select and adapt curriculum materials	68
Use computers in classroom instruction	58
Classroom management/discipline	54

Mathematics Teachers – middle & high school level

Based on 2003-04, NCES Data

"*I didn't call myself anything. I was more than a teacher. And less. In the high school classroom you are a drill sergeant, a rabbi, a shoulder to cry on, a disciplinarian, a singer, a scholar, a clerk, a referee, a clown, a counselor, a dress-code enforcer, a conductor, an apologist, a philosopher, a collaborator, a tap dancer, a politician, a therapist, a fool, a traffic cop, a priest, a mother-father-sister-brother-aunt-uncle, a bookkeeper, a critic, a psychologist, the last straw.*"

"Teacher Man" Frank McCourt (p.19, 2005)

Those who leave teaching are dissatisfied with their jobs because of:

- Low salaries (NMP report salary)
- Student discipline problems
- Lack of support
- Little opportunity to participate in decision making.

Ingersoll, 2003

Keeping the next generation…

- They will expect to be paid well for the important work they do.
- The will expect variety in what they do with differentiated roles and opportunities to advance.
- They will expect the opportunity to collaborate with colleagues and to work in organizations that support them – NCTM issue!.

Moore Johnson, et al, 2004

Assessment of Teachers

- How do we feel about Praxis?
- How do we feel about other teacher assessment programs?
- Position statement on such tests?

Issues which may help…

- National Mathematics Panel – Teacher Report
- NSF Science and Engineering Indicators – 2008
- America Competes?
- Competition and Coherence Issues
- Others

What AMTE must do!
or
will NCTQ do it?

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